LIBRARY
Michigan State
University

PLACE IN RETURN BOX to remove this checkout from your record.
TO AVOID FINES return on or before date due.

DATE DUE	DATE DUE	DATE DUE
FEB 05 1997	05 12 04	
NOV 25 2008		

MSU Is An Affirmative Action/Equal Opportunity Institution
c:\circ\datedue.pm3-p.1

MAIZE MARKET REFORM IN ZIMBABWE: LINKAGES BETWEEN CONSUMER PREFERENCES, SMALL-SCALE ENTERPRISE DEVELOPMENT AND ALTERNATIVE MARKETING CHANNELS

By

Lawrence Michael Rubey

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1995

ABSTRACT

MAIZE MARKET REFORM IN ZIMBABWE:
LINKAGES BETWEEN CONSUMER PREFERENCES, SMALL-SCALE ENTERPRISE DEVELOPMENT AND ALTERNATIVE MARKETING CHANNELS

By

Lawrence Michael Rubey

With the initiation of economic reforms in 1991, Zimbabwe faced an increasingly acute food price dilemma: in order to offer remunerative maize producer prices and reduce government deficits, there was great pressure to increase retail maize meal prices and remove consumer maize meal subsidies. This study draws on primary survey data to investigate possible policy changes in the maize subsector that may mitigate the adverse effects of structural adjustment and the removal of consumer food subsidies. The study uses a subsector perspective and stated preference techniques to demonstrate that specific, complementary policy reforms can lead to the expansion of alternative maize marketing channels that both protect the urban poor from rising food prices and generate productive employment through small enterprise growth.

The study uses contingent valuation techniques on data from 512 households in order to estimate the potential market share of certain processed maize products largely unavailable due to policy and regulatory constraints. The analysis suggests significant unmet urban demand for inferior goods such as white straight-run meal and yellow roller meal, particularly when such products are available at a modest price discount. Stated preference data is used in a conditional logit model to predict the potential market share of new products. Predictions of market share are consistent with actual post-reform market shares prevailing in late 1993.

In addition, the study explores the implications of the choice of technique in the milling industry and identifies supply response constraints of small-scale maize millers using data from a set of firm surveys. Small-scale hammer milling firms are shown to be superior to large-scale roller mills in terms of employment generation, investment capital utilization, fixed production costs, foreign exchange utilization, and enterprise flexibility. Specific regulatory constraints, however, restrict the ability of small-scale millers to provide consumers with low priced maize meal products.

In Zimbabwe, accompanying subsidy removal with complementary policy reforms permitted the development of alternative, decentralized, and lower-cost marketing channels supplying straight-run meal, benefiting the majority of urban consumers. Evidence also suggests that there still may be unmet demand for yellow maize meal. The study concludes with an analysis of Grain Marketing Board pricing policy options in the newly liberalized maize marketing environment.

Copyright by

LAWRENCE MICHAEL RUBEY

1995

Dedicated to my parents

Raymond and Elyrae Rubey

who began my education thirty years ago

with a story about preferences for green eggs and ham

ACKNOWLEDGMENTS

This research, took place over a three-year period and involved the cooperation and contributions of many people to whom I am deeply indebted.

At Michigan State University (MSU), I was fortunate to have a dissertation committee that truly exemplified the best virtues of a life devoted to training a new generation of agricultural economists. I am extremely grateful to Dr. Michael Weber, my major professor and dissertation supervisor. Dr. Weber guided and supported this research from the very start and always approached the task of advising me with a rare combination of intellectual focus, relaxed humor and enthusiasm; Dr. Jim Shaffer provided steadfast encouragement and inspiration since I first chose to attend MSU; Dr. Don Mead was always a source of wisdom and I was especially fortunate to have the benefit of his conscientious guidance during his extended stay in Zimbabwe. Dr. Thom Jayne offered many important suggestions upon my arrival in Zimbabwe and contributed greatly to my education; Dr. Tom Reardon gave generously of his ideas and shared his expertise in modeling consumer preferences. Also, a special thanks to Dr. John Staatz, my assistantship supervisor during my academic coursework, who provided direction and counsel at critical stages in my academic program and during this research. I also wish to express my appreciation to the USAID-funded Food Security in Africa Cooperative Agreement which supported me during my coursework at MSU, during my first three months in Zimbabwe, and after my return to MSU in May 1994.

In Zimbabwe, I am grateful to several individuals at the Ministry of Lands, Agriculture, and Water Development who supported and collaborated on many aspects of this research. In particular, I would like to thank Tobias Takavarasha (Deputy Secretary for Economics and Markets), as well as Leo Sibanda, Gordon Sithole, and Nancy Zitsanza of the Farm Management Research Division. At the Grain Marketing Board, Share Jiriyengwa unselfishly devoted many hours sharing his extensive insights into Grain Marketing Board operations. Also, Charles Ndoro of the Central Statistical Office generously facilitated the random selection of sample households.

I was particularly fortunate to be able to work with an extremely capable survey staff. I would like to express my sincere thanks to Justin Mutiro, Eddington Danda, Knoledge Gwanyanya, Otilia Dikani, Charity Mushapaidzi, Emily Mutandwa, Olivia Chigovanyika, Patricia Samuriwo, Beauty Gondora, Mary Zulu, Pauline Gondora, Steven Mandigora, Elijah Dhauka, Joshua Ndlovu and Miriam Mugumbati. Mrs. Mugumbati also provided very capable and efficient data entry services. Thanks also to Audrey Balfour, Joan Bradnick, and Barbara Reed at Probe Market Research for their input and cooperation.

This research would not have been possible without funding and support from the USAID mission in Harare. I am particularly grateful to Dr. Robert Armstrong, Calisto Chihera, and Jim Harmon for their vital input in shaping the direction and content of a set of related studies from which this dissertation is derived.

At the University of Zimbabwe, I thank Godfrey Mudimu for providing an academic home and collegial support for me in the Department of Agricultural Economics and Extension. I am also grateful to Dr. Kay Muir-Leresche for both her wide-ranging

advice and generosity of spirit. Colleagues at the University of Zimbabwe, particularly Solomon Chigume, Chris Sukume and Muhamo Chisvo provided many insights from their years of experience. Dr. J.B. Wyckoff provided both encouragement and practical advice. I also benefitted greatly from discussions on Zimbabwe agricultural policy with Dr. Will Masters.

Many colleagues and fellow graduate students at Michigan State University and elsewhere provided that all too rare combination of professional advice and friendship: Frank Lupi provided valuable advice on the econometric portions of this dissertation over pizza at the Student Union; Elizabeth Bartilson and Lisa Besko endured countless interruptions as I battled formatting demons. While not in her job description, Sherry Rich always managed to boost flagging spirits. Many fellow MSU graduate students, Joseph Rusike, Jennifer Wohl, Julie Howard, Ousseynou Ndoye, Laura Geis, Nick Minot, Lisa Daniels and Cynthia Phillips among others, shared wisdom, knowledge and travails and made this journey so much more enjoyable.

I owe a great debt to the over one thousand individuals and firms that generously and patiently participated in the long series of rapid appraisals, focus groups, and lengthy survey questionnaires that comprised this research effort. Without their frank and honest cooperation, this study would not have been possible.

Most of all, thank you to Cathy Baxter, my life companion, who more than anyone has given me encouragement during adversity and multiplied the joys of life.

TABLE OF CONTENTS

CHAPTER 1: INTRODUCTION 1

1.1 Study premise 1

1.2 Background and problem statement: Zimbabwe's food price dilemma 1

1.3 Strategic questions and related research objectives 3

1.4 Scope of the study of the maize subsector 7

1.5 Chronology of research activities and major reforms: 1991-1994 8

1.6 Organization of the dissertation 13

CHAPTER 2: CONCEPTUAL FRAMEWORK: A MODIFIED SUBSECTOR APPROACH 15

2.1 Conceptual approaches to agricultural marketing 15

2.2 The subsector approach: the theoretical background 18

2.3 Applications to marketing systems in developing countries 20

2.4 The subsector approach applied to the maize marketing system in Zimbabwe 22

CHAPTER 3: OVERVIEW OF THE MAIZE SUBSECTOR 27

3.1 Maize production and marketing 27

3.1.1 Maize production trends 28

3.1.2 The maize marketing system before reform 31

3.1.3 Farmer maize marketing behavior 33

3.2 Maize processing 39

3.2.1 Maize milling industry structure before reform 39

3.2.2 Seasonality of demand for hammer milling services 40

3.2.3 Milling margins and retail pricing 43

3.2.4 Roller meal subsidies 45

3.3 Maize consumption preferences 48

3.4 Overcoming bottlenecks to improved system performance 50

CHAPTER 4: MAIZE PREFERENCES OF URBAN CONSUMERS 54

4.1 Overview of research methods for demand analysis 55

4.1.1 Approaches to the estimation of potential demand 56

4.1.2 Collecting household income data 62

4.1.3 Consumption survey design and sample selection 63

4.2 Maize consumption patterns in urban areas 67

4.2.1 Household demographic and socioeconomic overview 68

4.2.2 Maize purchasing habits 71

4.2.3 The decision to consume straight-run meal: a discrete choice model 75

4.2.4 Urban maize production and transactions 80

4.3 Estimation of potential demand for alternative maize meal products 82

4.3.1 Straight-run meal: estimates of potential demand 85

4.3.2 Yellow maize: estimates of potential demand 91

4.3.3 Preferences for alternative maize meal attributes: a conditional logit model 95

4.4 Implications for targeting consumer food subsidies 102

4.4.1 The growth of white straight-run meal consumption 105

4.4.2 Yellow roller meal and self-targeting 108

4.4.3 Yellow maize grain subsidy options 116

4.5 Implications for the administration of drought relief 122

4.5.1 Drought relief efforts during the 1991/92 season 122

4.5.2 Improving maize distribution in drought years 124

4.6 Implications of expanded consumer choice on nutritional status, agricultural productivity and food policy 128

4.6.1 Nutritional implications 129

4.6.2 Implications for agricultural policy and productivity 131

CHAPTER 5: CHOICE OF TECHNOLOGY IN THE MAIZE MILLING INDUSTRY AND THE ROLE OF SMALL-SCALE MILLING ENTERPRISES 136

5.1 Overview of research methods for choice of technology analysis 137

5.1.1 Overview of the choice of technology literature 137

5.1.2 Applications to food processing in developing countries 140

5.1.3 Survey design and sample selection for firm-level surveys 142

5.2 The evolution of the milling industry: 1991-1993 144

5.2.1 The grain market reform process: 1991-1993 145

5.2.2 The changing structure and operations of the maize milling industry 146

5.2.3 Shifts in milling throughput trends by technology type 150

5.3 Implications of technology choice in maize milling 153

5.3.1 Production cost comparisons 153

5.3.2 Employment generation 160

5.3.3 Investment capital and foreign exchange utilization 165

5.3.4 Capacity utilization in maize milling 169

5.3.5 Enterprise flexibility 173

5.3.6 Locational choice in milling 175

5.3.7 Generation of linkages 177

5.4 Supply response constraints of custom millers 181

5.4.1 Access to manufacturing inputs 181

5.4.2 Health, licensing and zoning regulations 183

5.4.3 Seasonality of demand for milling services 187

5.4.4 Access to investment and working capital 191

5.5 Supply response constraints of production millers 192

5.5.1 Marketing constraints 192

5.5.2 Technological limitations 201

5.5.3 Borrowing working capital 204

5.6 Implications of choice of technology in maize milling for development policy 205

CHAPTER 6: MAIZE MARKETING REFORM AND THE DEVELOPMENT OF ALTERNATIVE MAIZE MARKETING CHANNELS 211

6.1 Effects of the 1991-1993 maize market reforms 212

6.2 The key determinants of the evolutionary paths of alternative maize marketing channels 217

6.2.1 Opportunity cost of time, the demand for marketing services and equilibrium market shares for maize meal 217

6.2.2 The transformation of the custom milling industry 222

6.3 Facilitating investments in the development of alternative marketing channels: a role for yellow maize 227

6.4 Parastatal reform: an essential component to maize market liberalization 231

6.4.1 Market reform and the GMB financial crisis 232

6.4.2 GMB strategy options: alternative views and competing objectives 236

6.4.3 The dimensions of GMB pricing reforms 242

6.4.4 GMB stockholding policy 256

CHAPTER 7: CONCLUSIONS AND POLICY IMPLICATIONS 260

7.1 Background to the study 260

7.2 Implications of results for the maize subsector in Zimbabwe 261

7.2.1 Implications for consumers 261

7.2.2 Implications for small enterprise development 264

7.2.3 Implications for maize marketing and food security policy 266

7.2.4 Implications for GRZ macroeconomic goals 270

7.3 Methodological issues and needed research 273

7.4 Final summary 276

BIBLIOGRAPHY 277

LIST OF TABLES

Table 1: Chronology of policy reforms and research activities (First phase: January 1992 to October 1992) 10

Table 2: Chronology of policy reforms and research activities (Second phase: November 1992 to August 1993) 11

Table 3: Chronology of policy reforms and research activities (Third phase: September 1993 to June 1994) 12

Table 4: Smallholder maize marketing, 1988/89 marketing season 34

Table 5: Smallholder maize marketing, 1990/91 marketing season 35

Table 6: Smallholder maize marketing, by channel for the 1988/89 and 1990/91 seasons 37

Table 7: Timing of communal farm maize sales, 1988/89 and 1990/91 marketing seasons 38

Table 8: Commercial maize millers margins per metric ton, February 1992 to June 1993 44

Table 9: Maize grain and maize meal pricing structure: 1992/93 and 1993/94 marketing years 47

Table 10: Population and sample sizes for the consumption survey 64

Table 11: Derivation of income quintiles from per capita monthly household cash income 70

Table 12: Expenditures on foodstuffs, by income quintiles 70

Table 13: Comparison of market share of large-scale commercial and production millers 73

Table 14: Maize meal consumption by type and by income quintile 76

Table 15: Probit model of the decision to consume straight-run meal 78

Table 16: Summary of results for the probit model of the decision to consume straight-run meal 79

Table 17: Volumes of household grain inflows by source, May 1992 through June 1993 81

Table 18: Types of maize-meal produced in Zimbabwe 84

Table 19: Consumer preferences by meal type 85

Table 20: Preferences of consumers of straight-run meal for alternative types of maize meal 87

Table 21: Preferences of roller meal consumers for alternative types of maize meal 87

Table 22: Regression results of demand for straight-run conditioned on the price of roller meal 89

Table 23: Price elasticity of demand for straight-run meal 91

Table 24: Regression results of demand for yellow roller meal conditioned on the price of white roller meal 93

Table 25: Price elasticity of demand for yellow roller meal 94

Table 26: Estimates from the conditional logit model for alternative maize meal choices 98

Table 27: Actual market share of various maize meal products versus predicted market shares based on conditional logit estimates 101

Table 28: Straight-run meal consumption, consumption prevalence and quantities consumed per capita by income group, May/June 1993 . . . 106

Table 29: Percent of consumers by income quintile switching from white roller meal to yellow roller meal at a specified price: a dual-option simulation 110

Table 30: Average price at which consumers would switch from white roller meal to straight-run meal and yellow roller meal, by income quintile 110

Table 31:	Hypothetical cost of a Z$562 per ton subsidy in various agricultural marketing years	112
Table 32:	Comparison of 1994 roller meal pricing structure and roller meal pricing structure with roller meal subsidy	113
Table 33:	Roller meal pricing with a targeted subsidy on yellow roller meal of Z$170 per ton	114
Table 34:	Roller meal pricing assuming a lower yellow maize producer price to reflect yield advantages of yellow maize	115
Table 35:	Percentage of consumers choosing each type of maize meal product at specified prices in a multi-option market simulation	119
Table 36:	Rural household grain/meal purchasing preferences at specified prices	125
Table 37:	Frequency matrix according to rank order of product characteristics	130
Table 38:	Capital and labor cost comparisons for production hammer mills and roller mills (1993 estimates)	154
Table 39:	Revenue comparisons for production mills versus roller mills in 1993 (in Zimbabwe dollars)	155
Table 40:	Proto-typical annual operating budget for production miller (in Z$), low capacity utilization case	158
Table 41:	Proto-typical annual operating budget for production miller (in Z$), medium capacity utilization case	159
Table 42:	Employment levels for alternative milling technologies	162
Table 43:	Estimated employment levels resulting from the growth of small-scale production milling (factory employees only)	164
Table 44:	Investment cost comparisons for alternative milling enterprises (1992 Zimbabwe dollars)	166
Table 45:	Foreign exchange requirements of investment in alternative milling enterprises (in 1992 Zimbabwe dollars)	167
Table 46:	Average acquisition price of maize grain for production millers, July to September 1993	179

Table 47: Rural household grain/meal purchasing preferences, May 1993 190

Table 48: Urban hammer mill customers grain/meal purchase preferences, September 1993 191

Table 49: Maize grain acquisitions by urban households, April/May 1993 and September/October 1993 214

Table 50: Acquisition costs of bagged roller meal including opportunity cost of time (OCOT) 220

Table 51: Acquisition costs of straight-run meal from custom mills including opportunity cost of time (OCOT) 220

Table 52: Estimated and predicted market share of roller meal and straight-run meal based on total acquisition cost of maize meal 222

Table 53: Source of maize grain purchased by custom millers for later re-sale to mill customers, percentage of volume from source 224

Table 54: Maize balance sheet for Zimbabwe, in thousands of metric tons 243

Table 55: GMB pricing strategy options 252

LIST OF FIGURES

Figure 1: Maize production in Zimbabwe, 1979-1993 29

Figure 2: Grain Marketing Board intake, 1981-1992 32

Figure 3: Milling throughput at Harare and Chitungwiza custom hammer mills, 1991 and 1993 151

Figure 4: Monthly GMB sales of maize to large-scale commercial millers 152

Figure 5: Immediate post-reform marketing channels for hammer-milled straight-run meal, mid-1993 213

Figure 6: Urban maize marketing channels with custom and production millers: developed stage 226

Figure 7: Average maize producer price in 1980 Zimbabwe dollars, 1981-1993 244

Figure 8: GMB maize intake and ending stock levels, 1981-1993 244

LIST OF ABBREVIATIONS

CSO	Central Statistical Office (Zimbabwe)
EA	Enumeration area
ESAP	Economic Structural Adjustment Programme (Zimbabwe)
GMB	Grain Marketing Board (Zimbabwe)
GNP	Gross National Product
GRZ	Government of the Republic of Zimbabwe
ILO	International Labor Organization
OLS	Ordinary least squares
MLAWD	Ministry of Lands, Agriculture and Water Development (Zimbabwe)
MSU	Michigan State University
MT	Metric ton
NGO	non-government organization
SDA	Social Dimensions of Adjustment
US$	United States dollar
USAID	United States Agency for International Development
WTP	willingness to pay
Z$	Zimbabwe dollar

CHAPTER 1:

INTRODUCTION

1.1 Study premise

The premise of this dissertation is that policy and regulatory changes in the maize subsector in Zimbabwe may mitigate the adverse effects of structural adjustment. That is, the expansion of alternative marketing channels may lead to policy measures that: 1) lower food prices to the urban poor; and 2) generate productive employment through small enterprise growth and development in food processing. The structure of the maize marketing system in Zimbabwe has evolved in a unique institutional and regulatory environment. By systematically examining alternative arrangements at each stage of the maize marketing chain, it may be possible to identify potential changes that improve access by poor consumers to inexpensive maize meal and contribute to economic growth through small-enterprise growth.

1.2 Background and problem statement: Zimbabwe's food price dilemma

Since the early 1980's, a diverse array of market reforms have been attempted in Sub-Saharan Africa. The genesis of this reform impulse, known by the rubric "structural adjustment," reflected a growing belief that poor economic performance stemmed from a set of related policy failures (World Bank, 1981). In this view, low, often negative economic growth rates, could be remedied by policy reforms that alter the structure of the economy and provide an environment more conducive to long-term economic growth. Typically, structural adjustment reforms include measures such as: government deficit reduction, currency devaluation and other monetary reforms, privatization of state-owned enterprises, and trade liberalization. In the agricultural sector, structural adjustment reforms have focussed on producer price policy changes, elimination or alteration of the role of government marketing boards, and reduction or elimination of consumer subsidies.

In Zimbabwe, since the initiation of the Economic Structural Adjustment Programme (ESAP) in late 1990, the Government of the Republic of Zimbabwe (GRZ) has been concerned with the social costs of adjustment. In particular, at the outset there were fears that Zimbabwe would soon face an increasingly acute "food price dilemma." That is, in order to maintain remunerative maize producer prices and reduce government deficits associated with grain marketing, there was great pressure to increase government-fixed retail maize meal prices above politically acceptable levels. While in the long run, technical changes that reduce the real cost of producing food, improvements in food marketing, and income growth should alleviate the food price dilemma, the experience of other African nations indicates that the short-run effects of structural adjustment may be severe. Rising food prices and greater unemployment, the typical immediate consequences of reform, can impose significant burdens on vulnerable groups and, as a result, creates great demand for alternatives for protecting low-income groups.

In addition, the structural adjustment reforms have focussed attention on the potential for small-scale enterprises to provide employment and contribute to economic growth. In the short run, structural adjustment reforms in other nations have typically been accompanied by falling real wages, rising unemployment in the formal sector as loss-making state enterprises are privatized or streamlined, and increased local prices of imported goods due to currency devaluation. The growth of small-scale enterprises may counterbalance these adverse effects by providing employment, income, and import substituting commodities. A recent survey estimated that there are over 800,000 micro and small enterprises in Zimbabwe. However, this survey found that micro- or small enterprises involved in food processing in urban Zimbabwe accounted for a much smaller percentage of total enterprises than in many other African nations (Liedholm and Mead, 1992).

1.3 Strategic questions and related research objectives

This study of the maize subsector is built around several fundamental "strategic questions." Although these strategic questions are examined for the Zimbabwean case, the findings may have applicability to other nations. The strategic questions underlying this analysis are:

a. In what way can the development of alternative marketing channels improve household food security?

b. What is the value of *ex-ante* analysis and market simulation exercises in informing food policy?

c. What are the linkages between policy and regulatory reform and the growth of small-scale processing and marketing enterprises?

In order to answer these broader questions, specific research objectives were formulated. These objectives are comprised of three components: 1) quantifying the potential demand for various types of processed meal; 2) exploring the implications of the choice of technique in the milling industry; and 3) examining the constraints to the development of alternative maize marketing channels.

A. ***Analyze consumer maize meal preferences based on characteristics such as degree of processing, color, and price.***

Designing food polices to protect low-income households from the adverse effect of rising food prices requires an understanding of the grain preferences of the largest and most concentrated block of food deficit consumers: urban households. Yet, prior to 1992, the choices available to consumers were, for the most part, confined to refined white maize meal produced by large-scale millers. At the outset of reform, there was no empirical data to provide the basis for predicting how consumers would alter purchases either when faced with changes in prices and incomes or when offered a greater range of choices of meal. The objectives of this research were to:

i) estimate the degree to which urban consumers would substitute straight-run meal (i.e. whole meal) and yellow maize meal for refined white maize meal products at alternative price scenarios;

ii) estimate how demand for various types of maize meal varies with income levels using consumer responses from market simulations;

iii) evaluate potential mechanisms for implementing a targeted meal subsidy that reaches vulnerable groups with minimal leakage to richer households and without significant diversion of subsidized food into stockfeeds;

iv) examine the implications of consumer preferences and the structure of the maize marketing system on the design of drought relief programs;

v) examine the implications of expanding the choice of processed maize products available to consumers on the structure of agricultural production, the use of foreign exchange, and maize trade policy.

B. Explore the implications of the choice of technique in the maize milling industry.

The maize milling industry in Zimbabwe is characterized by a dual production and marketing structure. When grain market reforms began in late 1991, the industry was dominated by large-scale commercial mills using imported roller mill technology. Yet, even in 1991, small hammer mill owners had begun to carve out a market niche despite limited access to grain supplies. The growth of small-scale mills also has an effect on economic variables such as employment and foreign exchange expenditures, although the magnitude of this impact is unknown. The second component of this research programme was designed to:

i) document the evolution of the operations of small-scale hammer mills during the process of maize market reform, including estimates of annual throughput;

ii) identify the constraints to the investment in and proliferation of urban hammer mills, including the technological and institutional investments needed to facilitate the growth of the industry;

iii) analyze the effects of the present choice of technique in the maize milling industry on employment generation, capital utilization, and use of foreign exchange and other scarce resources.

C. Identify the constraints to the growth of alternative maize marketing channels.

Maize marketing restrictions can impose considerable constraints on the growth of alternative maize marketing channels. Yet in the aftermath of reform and removal of restrictions, the true effects of reform on participants in the subsector are often unclear. Furthermore, maize market liberalization, although a necessary condition, may not be a sufficient condition for the growth of alternative marketing channels and resolution of the food-price dilemma. Selected investments in technology, institutions, and other policy reforms may be needed to further facilitate the development of the alternative marketing channels. Thus, a central question is: how does the removal of maize movement restrictions affect participants in the maize subsector and what other reforms must be undertaken in order to meet performance criteria such as affordable and stable food prices, low public sector deficits and renumerative producer prices? The final component of this research will:

i) evaluate the effectiveness of market reforms in meeting food policy objectives;

ii) explore the likely "development path" of maize marketing channels given consumers' opportunity cost of time;

iii) identify the constraints to the transformation of the small-scale milling industry beyond custom-milling. The "transformation" of the industry refers to initiation of an expanded range of activities including grain trading, de-hulling, and/or packaging meal for retail sale;

iv) identify facilitative investments needed to induce further growth of alternative marketing channels;

v) examine options for parastatal reform in a liberalized maize marketing environment.

1.4 Scope of the study of the maize subsector

The potential scope of this study of the maize subsector is large. All maize growers, consumers, food processors, and retailers in Zimbabwe are affected by the structure and performance of the maize subsector. Maize producers include such diverse categories as resource-poor smallholders, large-scale commercial operation and even urban dwellers cultivating vacant urban land. Maize consumers run the gamut from deficit smallholders in low-rainfall areas to wealthy urbanites. Food processing enterprises can be classified by such disparate characteristics as size, product lines, and location.

For the purposes of defining the boundaries of this study, several decisions were made. On-farm maize production decisions are largely ignored: the focus of the study is largely on the transformation and movement of maize through the food system after the farm-gate. Obviously this dichotomy is artificial since the workings of the post-farmgate stages of the system continually feed back to affect upstream decisions. The focus of post-farmgate activities, however, reflects the necessity to pare the research down to a manageable size.

Second, the study is largely limited to issues of urban food security. For example, the examination of consumer preferences focuses upon urban consumers, even though issues such as the acceptability of yellow maize to rural consumers or growth of rural custom millers are also important research questions. Similarly, milling enterprises were included in the study based on whether they served (or had the potential to serve) urban areas.

Finally, the number of potential alternative marketing channels in Zimbabwe is large. There are also inherent difficulties in determining whether two particular channels are indeed "different." As a result, this study focuses only upon a handful of alternative marketing channels, those which either are currently the most successful and are most likely to develop as the food system evolves.

1.5 Chronology of research activities and major reforms: 1991-1994

This research, conceived in late 1991, was part of a responsive, on-going effort to inform the maize marketing reform process in Zimbabwe carried out over several years. In summarizing the findings of this research, a chronological approach is adopted: early chapters focus on the research findings during the initial stages of reform, while later chapters investigate further issues that arose as the reform process evolved. For example, Chapter 3 centers on a set of policy questions that largely pre-date any meaningful maize market reform while Chapter 6 focuses on the implications of complete maize market liberalization and subsidy removal (completed by April 1994) for the future of existing and emergent marketing channels and their participants.

Informing maize policy through subsector research was envisaged as a dynamic process with defined steps. The initial step involves *ex-ante* analysis and investigation of an original set of perceived problems or bottlenecks in the subsector. Potential policy changes that may mitigate perceived problems are investigated, estimates are made of the potential effects of alternative policy changes, and research results are disseminated to policy-makers. Next, certain policy changes may be made and/or further alterations in the policy environment occur as the effects of exogenous variables such as weather are felt. Policy changes and exogenous variables interact to create a new status quo. Finally, as the new environment gives rise to new problems or bottlenecks that hamper subsector performance, the dynamic process of identifying and elucidating policy alternatives begins again.

This dynamic, iterative approach to policy relevant research was adopted and utilized by the author and collaborators in government and donor agencies during maize market reform from late 1991 to mid-1994 in Zimbabwe. This 30 month period can roughly be divided into 3 ten-month phases of reform and research input. During the first reform phase (January 1992 to October 1992) summarized in Table 1, an initial set of relatively minor reforms was announced and an initial set of empirical surveys was undertaken. By the latter half of 1992, addressing problems created by drought eclipsed the policy reform process.

The second reform phase (November 1992 to August 1993) was dominated by drought relief and drought recovery efforts. Not until mid-1993, after a good 1992/93 harvest, were significant policy changes made in removing maize meal subsidies and ending most movement restrictions. Table 2 summarizes the key policy reforms and research activities of this period.

Table 1: Chronology of policy reforms and research activities (First phase: January 1992 to October 1992)

POLICY REFORMS AND MAJOR SUBSECTOR DEVELOPMENTS (JANUARY 1992 TO OCTOBER 1992)										
MONTH	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**
MAJOR REFORMS		(1)		(2)		(3)	(4,5)	(6)		
MAIZE SUBSECTOR DEVELOPMENTS	(a)	(b)			(c)	(d)		(e,f)		(g)
RELATED RESEARCH ACTIVITIES										
MONTH	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**	**SEP**	**OCT**
Custom mill operators survey		═══	═══							
Custom mill owners survey		═══	═══							
Consumer rapid appraisal		═══	═══							
Retailer rapid appraisal			═══							

MAJOR REFORMS:

(1) Feb 1992: Roller meal subsidy increased to $392 per ton.
(2) Apr 1992: Market liberalization in Natural Regions IV and V takes effect. GMB granted greater autonomy. Commitment to sell grain from all GMB depots affirmed.
(3) June 1992: Trade in Export Retention Scheme foreign exchange entitlements by commercial banks permitted, essentially giving private firms access to foreign exchange at market prices.
(4) July 1992: GMB announces it will phase out grain selling points.
(5) July 1992: Pre-planting maize producer price of $900 announced for 1993/93 marketing year, an increase of 1992/93 price of $550.
(6) Aug 1992: Roller meal subsidy increased to a level of $562 per ton.

MAIZE SUBSECTOR DEVELOPMENTS:

(a) Jan 1992: Record low rainfall. Very poor harvest expected due to extreme drought conditions.
(b) Feb 1992: As domestic supplies run out, maize shortages occur nationwide.
(c) May 1992: First shipments of imported yellow maize arrive.
(d) June 1992: Zimbabwe faces 1.86 million ton cereal deficit. Fear of widespread starvation.
(e) Aug 1992: Largest large-scale miller has record year in 1991/92 profits.
(f) Aug 1992: Maize imports needs revised upwards to 2.5 million tons.
(g) Oct 1992: 5.4 million people (half of population) register for drought relief.

Table 2: Chronology of policy reforms and research activities (Second phase: November 1992 to August 1993)

POLICY REFORMS AND MAJOR SUBSECTOR DEVELOPMENTS (NOVEMBER 1992 TO AUGUST 1993)										
MONTH	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**
MAJOR REFORMS								(1)	(2)	
MAIZE SUBSECTOR DEVELOPMENTS					(a)	(b)		(c)		
RELATED RESEARCH ACTIVITIES										
MONTH	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**	**JUL**	**AUG**
Consumer survey										
-focus groups		—	—							
-training					—					
-pretesting						—				
-survey							—	—	—	
-revisits								—		
Production mill survey								—	—	

MAJOR REFORMS:

(1) June 1993: Roller meal subsidies removed. Retail roller meal prices increase by 55 percent.

(2) July 1993: Redefinition of Zone A/Zone B effectively deregulates maize movement throughout the country. Large-scale millers are only users required to buy from the GMB.

MAIZE SUBSECTOR DEVELOPMENTS:

(a) Mar 1993: Bumper maize harvest of 2.1 million tons predicted

(b) Apr 1993: Maize deliveries begin to flow to GMB as first 2000 tons are delivered at the 1993/94 marketing year price of $900

(c) June 1993: Over 200,000 tones of maize delivered to GMB in first 3 months of marketing year.

Table 3: Chronology of policy reforms and research activities (Third phase: September 1993 to June 1994)

POLICY REFORMS AND MAJOR SUBSECTOR DEVELOPMENTS (SEPTEMBER 1993 TO JUNE 1994)										
MONTH	**SEP**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**
MAJOR REFORMS					(1)			(2)		
MAIZE SUBSECTOR DEVELOPMENTS		(a)					(b,c)	(d)		
RELATED RESEARCH ACTIVITIES										
MONTH	**SEP**	**OCT**	**NOV**	**DEC**	**JAN**	**FEB**	**MAR**	**APR**	**MAY**	**JUN**
Custom mill owners survey										
Custom mill operators survey										
Custom mill customers survey										
Production mill survey										

MAJOR REFORMS:

(1) Jan 1994: Major financial reforms announced including 20 percent devaluation, introduction of two-tier exchange rates, and relaxation of restrictions on access to foreign exchange

(2) Apr 1994: Maize movements completely liberalization as large-scale millers no longer required to purchase from the GMB. Maize producer price retained at $900 for 1994/95 marketing year.

MAIZE SUBSECTOR DEVELOPMENTS:

(a) Oct 1993: Largest large-scale miller announces plant closures due to falling demand.

(b) Mar 1994: Maize output set to reach 2.3 million tons.

(c) Mar 1994 Roller meal from large-scale millers available at selected shops at 11 percent discount

(d) Apr 1994: GMB losses continue to mount as purchases continue at mandated $900 per ton producer price and sales to large-scale millers fall.

The third reform phase (September 1993 to June 1994) was a time of significant changes in maize meal consumption patterns and tremendous growth of food processing enterprises. Surveys were undertaken to document the effects of second phase reforms and in early 1994 major financial reforms were announced. By the end of the third phase of reform, maize movement was deregulated throughout the entire country and no maize meal subsidies were in place. Yet even by mid-1994, the reform process was by no means complete; major concerns still persisted regarding the role of the government grain marketing parastatal, the Grain Marketing Board.

1.6 Organization of the dissertation

The next chapter presents a conceptual framework for examining maize policy and sub-sector technology options for coping with a "food-price dilemma." Based on other applications of the subsector approach to examining marketing systems in developing countries, it outlines a modified sub-sector approach for the examination of the maize marketing system in Zimbabwe. This approach permits the examination of the potential for the development of alternative maize marketing channels, based on the premise that there is need for a system that permits better articulation of consumer demand.

Chapter 3 provides an overview of the maize subsector and presents descriptive survey results of the structure of the maize milling industry.

Chapter 4 provides an empirical description of consumer maize preferences and presents an estimate of the demand for alternative maize products using survey data. The focus is on predicting how consumers will alter current maize demand patterns in response to changes in maize meal prices, household income and availability. This chapter examines the implications of these results for targeting subsidies and administering drought relief.

Chapter 5 identifies the constraints to the expansion of the small-scale milling industry and uses survey data to empirically document the economic implications of the dominance of large-scale mills in the maize milling industry.

Chapter 6 evaluates the effectiveness of the market reforms in meeting food policy objectives and identifies potential constraints to the continued expansion of alternative maize marketing channels.

Finally, Chapter 7 offers the implications of this research for on-going maize market reforms in Zimbabwe and suggests wider applications of this methodological approach.

CHAPTER 2:

CONCEPTUAL FRAMEWORK: A MODIFIED SUBSECTOR APPROACH

2.1 Conceptual approaches to agricultural marketing

In much of the developing world, vast portions of the population are heavily dependent upon on how "well" agricultural markets work. Meissner (1989) argues that ineffective food marketing systems are among the chief causes of hunger. Farmers that are net sellers, deficit rural households, and urban dwellers all depend upon the performance of agricultural markets to meet such divergent objectives as stable, renumerative producer prices or low retail food prices. Given the importance of food access for the well-being of the populace, intervention in food marketing has long been viewed as an appropriate concern of governments in sub-Saharan Africa. During the colonial era, the devices adopted by governments ranged from uncompensated seizure of foodstuffs from producers to guaranteed producer floor prices for staple foods (Jones, 1972). In the post-Independence era, many nations opted to maintain, and sometimes strengthen, parastatals or government marketing boards that controlled most, if not all, aspects of food crop marketing and distribution. Yet by the 1980's rising public sector deficits and the poor performance of many agricultural marketing parastatals led to donor-induced pressures for privatization of parastatals, greater emphasis on the role of private sector agents in crop marketing, and market determination of input and output prices.

Agricultural market reforms are based implicitly or explicitly on a model of how the economy works. Several fundamental questions are common to all nations at the outset of reform: How do agricultural markets actually work? What is the impact of the operation of the "market" for a particular commodity on the participants in that market (e.g. farmers, input suppliers, food processors, consumers, etc.)? What changes in the marketing system can be made to improve system performance? In what instances is government intervention and institutional support essential to improved performance and when is it counter-productive?

Agricultural economists have addressed these problems by adopting one of two conceptual approaches to the study of agricultural marketing (Riley and Staatz, 1981). The first approach, the "efficiency" approach, emphasizes the perfectly competitive market as the norm. Models of perfect competition tend to focus on the evaluation of technical and economic efficiency in agricultural markets. This particular approach gained much support in the immediate post-WWII era as high cost marketing functions were seen as a major problem in the United States (Trelogan, 1951). The basic premise is that improvements in efficiency can reduce marketing margins, benefiting producers, consumers or possibly both.

As Riley and Staatz (1981) have catalogued, studies of this genre have generally attempt to: 1) evaluate market efficiency by comparing price differentials through time and space with the costs of spatial and temporal arbitrage; 2) calculate net margins for various marketing functions; or 3) use correlations of prices among markets to evaluate the degree of inter-market relatedness. Other studies focussed on such issues as possibilities for increased firm operating efficiency through greater labor efficiency in packing plants, savings on transportation costs, or alternative methods of farm assembly (Farris, 1983). However, some of the tools used to measure efficiency and market performance, such as the use of correlation coefficients as an index of competitiveness and analysis of marketing margins, have been criticized as tautological constructs (Harriss, 1979). Furthermore, a limitation of the "efficiency" approach is the lack of answers to broader questions relating to organization and performance of marketing systems as a whole. Kohls (1957) and Farris (1983) have documented how research on agricultural marketing in the immediate post-WWII years consisted of "many fragmented studies" without a holistic or systems perspective. The danger was that marketing economists were unable to respond to emerging problems in food marketing in the U.S. For example, in the late 1950's rapid vertical integration in the U.S. poultry industry, while capturing public attention, caught many marketing economists by surprise (Farris, 1983). Partly in response to the limitations of the "efficiency" approach, a second approach to the study of agricultural marketing has evolved over the past three decades: the "food systems" approach. This general approach has attempted to examine "food production and distribution more as a unified system and has stressed the interdependence of activities at different levels in that system" (Riley and Staatz, 1981). The food system is broadly defined as "the entire set of actors and institutions involved in input supply, farming, and the processing and distribution of agricultural products, including their links with international trade" (Staatz and Bernsten, 1992). With a food systems approach, static allocative efficiency determination is supplanted by the concept of a dynamic, evolving system. The evolving relationships between technology, preferences, and institutions are specifically included in the analysis (Shaffer, 1973). While the research tools and methods used in food systems analysis are often similar to the efficiency approach, fundamental differences are dynamic analysis and consideration of a wider set of relevant factors such as market power, institutional design and potential coordination failures.

2.2 The subsector approach: the theoretical background

The food system approach recognizes that the food system has both horizontal and vertical dimensions. The horizontal dimension refers to participants performing particular tasks at a specific stage in the food marketing system. For example, in the food system, fertilizer manufacturers, transporters, and food processors carry out similar activities across a broad range of commodities. The vertical dimension, by contrast, considers a vertical slice of the system, examining the various stages of the production and marketing of a particular commodity (Shaffer, 1973). Holtzman (1986) defines a "subsector" as a "vertically linked set of participants which produce a related output or group of outputs." The "commodity subsector approach" focuses on examining how each participant and each inter-linkage in this vertical slice of the food system affect system performance.

The subsector approach is a natural outgrowth of industrial organization theory, typified by the familiar "structure-conduct-performance" causality, developed by Bain in his seminal 1959 book *Industrial Organization*. The subsector approach draws on industrial organization theory to posit that the performance outcomes in a particular subsector stem from the structure of ownership and the behavior of participants. Yet as Holtzman (1986) points out, the subsector approach has several characteristics which serve to differentiate it from industrial organization.

1. The traditional dichotomy of "production" and "marketing" is rejected. Rather, the subsector approach focuses on the transformation and transactions that occur as the commodity moves through the stages of the vertical system.
2. Consumer demand is viewed as the key force driving the development of the subsector. The development and growth of the subsector and opportunities for participants (input suppliers, processors, traders, etc.) are greatly affected by shifts in demand and changes in income.
3. The subsector approach emphasizes the nature of coordination between different system participants. Drawing from the transaction costs approach, it recognizes that alternative institutional arrangements, such as contracting, cooperatives, and vertical integration, arise to overcome coordination failures between economic agents.

Subsector analysis uses these concepts to assess the feasibility of intervening within the system. By analyzing inter- and intra-channel dynamics, the key bottlenecks where an intervention could affect large numbers of people can be identified (Bear, 1993). Thus subsector analysis is a diagnostic and prescriptive tool and lends itself well to applied, policy-oriented research. Although much effort is often devoted to describing the structure, conduct and performance outcomes in a particular subsector, the identification of needed facilitative interventions by government or donors is a key element. A central tenant is that the "letting markets work" is an imperfect answer to subsector coordination problems. In this view, the market mechanism may fail to provide effective coordination across vertical stages of the subsector due to bounded rationality on the part of market participants, high transaction costs, opportunistic behavior, and/or externalities (Shaffer, 1980; Riley and Staatz, 1981). Shaffer (1973) makes a useful distinction between two types of coordination: 1) exchange coordination, or coordination by competitive or non-competitive market processes; and 2) administrative coordination, characterized by intra-firm decisions or governmental authority. Facilitative investments by government can either promote greater competition by improving exchange coordination and/or improve system performance through alterations in the rules governing administrative coordination.

A natural outgrowth of this framework is that effective coordination is essentially a question of institutional design. When coordination of activities between different participants in the marketing chain breaks down, system performance can be impaired. Maintaining effective coordinating institutions and, in turn, desired system performance, depends upon the rules and incentive structures facing individual members.

Subsector analysis permits the food policy analyst to identify key constraints (or coordination failures) in a particular subsector that inhibit improved performance. It also can aid the analyst in discerning the particular points in the subsector in which specific policy or institutional changes may enhance system performance.

2.3 Applications to marketing systems in developing countries

The subsector approach to agricultural marketing has been a well-utilized method in the study of the food systems of developing countries. In the late 1960's and early 1970's, the subsector approach was applied to problems of poor performance in urban food markets in Latin America (Harrison, et al., 1987). Based upon the premise that effective food marketing systems would not necessarily evolve automatically, and in light of the traditional distaste by governments for "middlemen" and other providers of marketing services, researchers demonstrated how coordination failures between different participants in the marketing chain imposed additional costs that ultimately led to poor food system performance. For example, surveys of market participants in revealed coordination failures stemming from lack of market information, "social traps" that inhibited firm innovations, and high transactions costs (Harrison et. al., 1987).

In the mid-1980's, Morris and Newman (1989) used a subsector perspective to explore the operations of private cereal traders in Senegal. Evidence showed that illegal parallel market activities by private traders, although in violation of official marketing regulations, helped achieve important performance objectives. For example, traders in the parallel markets operated with lower marketing margins than the official state marketing agency, enabling them to purchase rice from producers above official prices and still offer consumers larger supplies at lower prices than might have otherwise prevailed (Morris, 1989).

More recent work by Boomgard, Davies, Haggblade and Mead (1992) has adopted the subsector approach to issues of small enterprise development. The subsector approach is used to examine the competitive position of small-scale firms in alternative supply channels and identify opportunities for intervention and constraints to firm growth. Unlike much research on small-scale enterprises that is descriptive, the diagnostic and prescriptive elements of the subsector approach permit research that offers an operational direction for small-scale firms (Boomgaard et al., 1992).

For example, Boomgaard (1983) used a subsector perspective to examine small-scale furniture production in Thailand. The study found that the keys to growth were the manufacture of higher value products and establishing links to expanding export markets. Competition in the raw rattan market was also deemed essential for village producers to have access to quality inputs. Haggblade's (1987) study of the sorghum beer industry in Botswana found that it would be possible to improve the competitiveness of home-brewers by facilitating their access to high-quality commercially produced sorghum malt and preventing the misapplication of retail licensing laws. Further evidence how subsector analysis has been adopted by NGO's interested in micro-enterprise development comes from a study of the silk subsector in Thailand. Subsector analysis revealed that in order to take advantage of rapidly growing tourist and export markets, traditional village-level silk producers needed to specialize in weft yarn which forms the horizontal weave in fabric made by larger weaving mills (Haggblade and Ritchie, 1992).

The subsector perspective can also be used to inform the design of agricultural research programs. Boughton (1994) has documented in Mali how technical innovation alone may not achieve all potential productivity gains within a given subsector because of inadequate coordination at different stages in the subsector. For example, improving the potential payoff of investments in farm-level maize technology research in Mali was found to hinge upon driving down the costs of pre-processed maize flour (Boughton, 1994). Institutional or policy changes could therefore help create market opportunities for consumer maize products that complemented farm-level maize technology innovation.

2.4 The subsector approach applied to the maize marketing system in Zimbabwe

This section presents a conceptual framework for examining the potential for the development of alternative grain marketing channels, emphasizing the need for a system that permits better articulation of consumer demand and supports the potential gains of "new" food processing technologies. The subsector approach is chosen since the static nature of traditional efficiency approaches necessitates a narrow focus on whether prices and costs relationships over space and time behave as might be predicted by the perfectly competitive model. More importantly, in traditional approaches to marketing efficiency, efficiency is defined by the existing system. Yet efficiency gains in the formal marketing system are not the only route to lower food prices over time in Zimbabwe. Reforms that allow consumer demand to be articulated and "new" technologies to arise may lead to the development of lower-cost alternative channels. The advantage of the subsector approach outlined here is that it permits exploration of these dynamic changes and enables an examination of key supply-side and demand-side constraints during the process of studying and informing market reform.

The structure of any marketing system for a staple food is shaped by two key factors: 1) consumer preferences; and 2) market regulation. Consumer demand essentially "pulls" the commodity through the vertical stages of transport, processing and distribution, shaping all aspects of commodity production, processing and marketing. Market regulations, the "rules of the game" also shape the development of the system since the collection of market regulations regarding land tenure, food safety, labor practices, financial and investment codes create a unique regulatory environment that affect both the end-product and the initial structure of the system.

In the case of maize in Zimbabwe, a hypothesis underlying this study is that market regulations have been the major force in shaping the development of the food system: certain rules and regulations have prevented consumer maize preferences from being fully articulated. If so, government policies that encouraged the development of a highly centralized and concentrated maize milling industry and restrict entry of new participants may explain consumers' maize meal consumption patterns.

Zimbabwe embarked on a series of agricultural reforms in late 1991 largely because the existing system, characterized by declining maize output, high food marketing costs, and food subsidies, was unsustainable from a budgetary perspective. In the long run, technical changes that reduce the real cost of producing food and broad-based income growth may contribute to a more sustainable system, yet such improvements are relatively far off. In the short run, significant gains may also be realized from the restructuring of the maize subsector through market liberalization and parastatal reform. **The challenge is to restructure in a way that relieves constraints at different stages of the maize subsector, permits "new" technologies to blossom and allows latent consumer demand to be articulated.**

Yet there is no simple way to implement reform or initiate a restructuring exercise: reform is not a "once and for all" proposition, but rather is a process of continued, sometimes incremental, change. As regulations and institutions are altered to create new opportunities for improved performance, new possible sources of obstruction arise. Furthermore, governments are often reluctant to embark on the tumultuous journey of reform when the transitional period presents new, potentially damaging, obstructions and when the ultimate benefits of reform are unclear.

The conceptual framework used for this research recognizes these potential pitfalls and augments traditional subsector analysis in two ways:

1. **The need to demonstrate the ex-ante benefits of reform is stressed.** Riley and Staatz (1981) have noted that "the systems approach lacks a well-developed methodology for *ex-ante* evaluation of the performance consequences of alternative institutional arrangements." This research is expected to help define such a method. By demonstrating the benefits of reform, by demonstrating the potential benefits a particular institutional arrangement over another with ex-ante analysis, the reluctance on the part of government officials to alter the status-quo may be overcome.

2. **Overcoming transitional dilemmas at each phase of the reform process is vital.** Reform is not a "one-shot" process of diagnosis, recommendation and implementation. In an initial phase, *ex-ante* analysis of perceived problems or bottlenecks in the subsector is undertaken. Potential policy changes that may mitigate perceived problems are investigated, estimates are made of the potential effects of alternative policy changes, and research results are disseminated to policy-makers. As policy changes are made and other exogenous factors affect the evolving policy environment, a new set of transitional dilemmas or subsector bottlenecks arise. Thus market reform is a dynamic, iterative process with the results of each phase of reform feeding into the system, creating a new reality, and then creating the impetus for a next round of reforms.

Like many previous studies of this nature, the subsector analysis presented here has a strong normative component. Constraints are identified, ways of overcoming coordination failures or bottlenecks are explored and specific interventions or facilitative investments are recommended. The resultant operational strategies are thus based on preconceived notions of what constitutes "good" system performance. As stated in Zimbabwe's Grain Marketing Act and acknowledged by GRZ policy statements, "good" performance in the food system entails Zimbabwe's agricultural institutions achieving a broad set of performance objectives including:

1. Stable, affordable food prices for consumers.
2. Enhanced smallholder welfare, particularly through renumerative, stable producer prices.
3. National food security (adequate food supplies at the national level).

The tools used in analysis of the maize subsector (multiple regression with cross sectional data, discrete choice models, and factor utilization ratios for alternative technologies) are no different from the traditional tools of economists; rather what differentiates the subsector approach from other approaches is the scope and comprehensiveness of the required research. All of the vertical relationships from the purchase of maize from the producer to the consumption of maize meal by urban households are considered.

CHAPTER 3:

OVERVIEW OF THE MAIZE SUBSECTOR

The central thesis of this dissertation is that selected policy and regulatory changes that contribute to the expansion of alternative maize marketing channels may ameliorate the adverse effects of structural adjustment. This overview of the maize subsector provides the background for further investigation of the potential gains of reforms in the maize subsector. Section 1 summarizes maize production trends and marketing behavior at the outset of the reform process. Section 2 illustrates the dualistic nature of maize processing in Zimbabwe and presents survey results from early 1992 to document the potential benefits of reform. The negative effects of maize meal subsidies are also explored. Section 3 reviews the prevailing conventional wisdom regarding the maize meal preferences of urban consumers and the results of a rapid appraisal of 300 consumers undertaken in February 1992 are analyzed. Section 4 links these exploratory findings to stated GRZ performance objectives in the maize subsector in order to identify potential bottlenecks to improve system performance and identify further the empirical needs investigated in later chapters.

3.1 Maize production and marketing

Government intervention in maize production and marketing in Zimbabwe has been a part of the agricultural policy landscape since the first European settler farms began producing surpluses at the turn of the century. This section explores the variable nature of maize production trends and the domination of parastatal maize marketing channels that have remained a part of the policy landscape in the post-Independence era.

3.1.1 Maize production trends

The structure of maize production in Zimbabwe is largely dualistic: 4000 European settler farmers (commercial farmers) and nearly one million smallholders (communal farmers) grow maize. Land distribution is highly skewed with commercial farmers retaining 33 percent of total land area and possessing an average holding size of over 3000 hectares. By contrast, communal farming lands comprise 42 percent of land area with an average holding of only 3 hectares of arable land (Bratton, 1989). Furthermore, while the majority of commercial farms lie in the best agro-ecological areas (Natural Regions I, II and III), three-quarters of communal farmers subsist in low-potential areas (Natural Regions IV and V).

Year-to-year maize output in Zimbabwe exhibits often extreme variability due to mid-season dry spells and drought. The variability of annual rain-fed maize production has been compounded by erratic producer price policies and external factors such as low world market prices and civil war. Between 1972 and 1979, as the independence war intensified, commercial maize production declined by more than 55 percent due to a 30 percent drop in yields and a 35 percent decline in hectares planted (Rohrbach, 1989). Maize output in the communal sector was essentially stagnant in aggregate terms during this period.

After Independence in 1980, maize production increased dramatically. Although drought conditions prevailed in 1983 and 1984, a series of bumper harvests were recorded. Smallholder farmers were responsible for the bulk of the increase, creating the widely-heralded Zimbabwe "success story" of the mid-1980's. As Figure 1 shows, commercial farmers, after a brief surge in 1981, reduced area planted to maize and saw a corresponding fall in output over much of the 1980's. By contrast, between 1979 and 1985, smallholder maize production more than tripled. Communal farmers were responsible for over half of all maize production and over a third of GMB intake during this period.

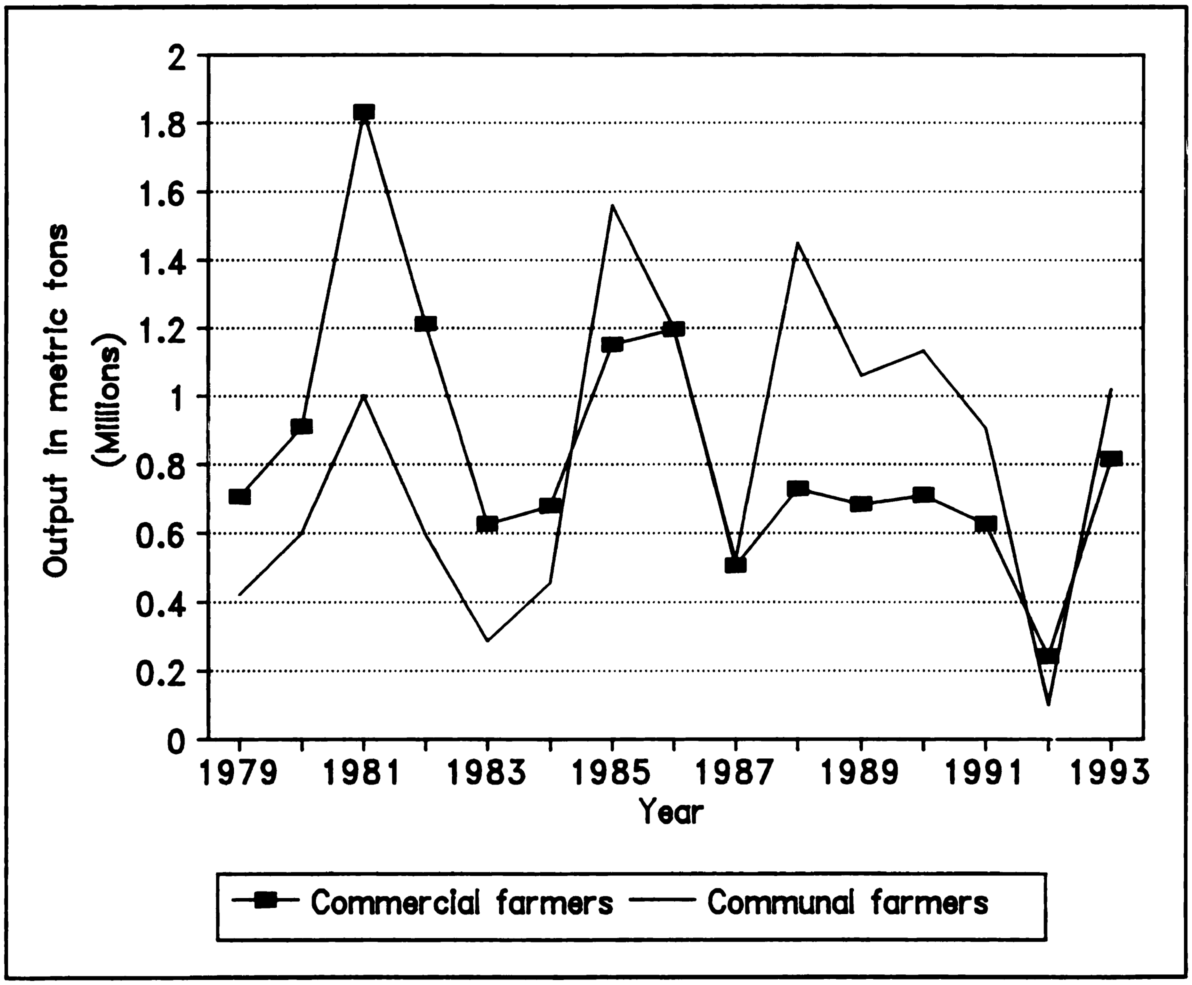


Figure 1: Maize production in Zimbabwe, 1979-1993

Rohrbach (1989) attributes the growth in smallholder production to a complementary set of changes in agricultural policies, institutions, and technologies. The changes include: 1) a dramatic rise in producer prices in the early 1980's; 2) commitment to strong research and extension support; 3) improved access to credit, input markets, and product markets; and 4) the wider availability of hybrid maize varieties.

By the late 1980's, despite continued concern about the damaging effects of maize surpluses, the maize sector was ripe for crisis. Maize production by the commercial sector had steadily declined for much of the late 1980's, primarily because of falling real producer prices. Area devoted to maize by the communal sector, after reaching a peak in 1985, declined from 1985 to 1989. By early 1992, low stock levels and drought during the 1990/91 and 1991/92 growing seasons led to massive maize shortfalls and the need for over 2 million tons of imports. With producer prices for 1993 over triple those of 1991 (in nominal terms), area planted to maize again surged and bumper harvests were registered in 1993 and 1994.

Zimbabwe's experience over the past two decades demonstrates a distinct pattern of maize price and production cycles, well-documented by Muir and Blackie (1988). In years of bumper harvests, the GMB must borrow heavily to pay out large sums to farmers. With large GMB deficits and rising stocks, there is little incentive to maintain producer prices, leading to a drop in real producer prices over time. Lower maize prices induce shifts out of maize to more profitable crops and lower production and falling stock levels persist until poor weather causes domestic shortages. Faced with high cost imports, there are pressures to increase producer prices dramatically in the following seasons. However, with one or two bumper harvests, the cycle begins again.

3.1.2 The maize marketing system before reform

Direct intervention in agricultural pricing in Zimbabwe began in 1931 with the establishment of the Maize Control Board, the predecessor to the Grain Marketing Board (GMB). The Maize Control Board was instituted in the wake of the world depression that saw a severe erosion in the profitability of maize production. During this era, producer prices for European farmers were fixed by the Maize Control Board at a base price, which was allowed to vary over time with changes in a production cost index (Muir and Takavarasha, 1989). In addition, since communal farmers were excluded from the controlled maize marketing channels, the system protected European commercial farmers against competition from smallholders.

At Independence in 1980, the new majority government embarked on a major effort to redress some of the inequities of the grain marketing system. The number of GMB depots rose from 35 to 74, with most of the new depots located near communal farm areas. In 1988/89, a good rainfall year, the GMB also operated 53 temporary collection points from which grain was purchased (Gasela, 1992). Partly as a result of this significant effort in expanding the GMB marketing infrastructure to communal farmers, GMB maize intake from the communal sector increased substantially. While between 1980 and 1985, communal farmers were responsible for a third of GMB intake, from 1989 to 1992, communal farmers accounted for over half of maize deliveries. Figure 2 shows the pattern of GMB maize intake during the post-Independence period.

At the outset of reform in 1991, the GMB had authority over a diverse collection of both "controlled" crops and "regulated" crops. The Ministry of Lands, Agriculture, and Water Development (MLAWD), in consultation with the GMB and farmers unions, set

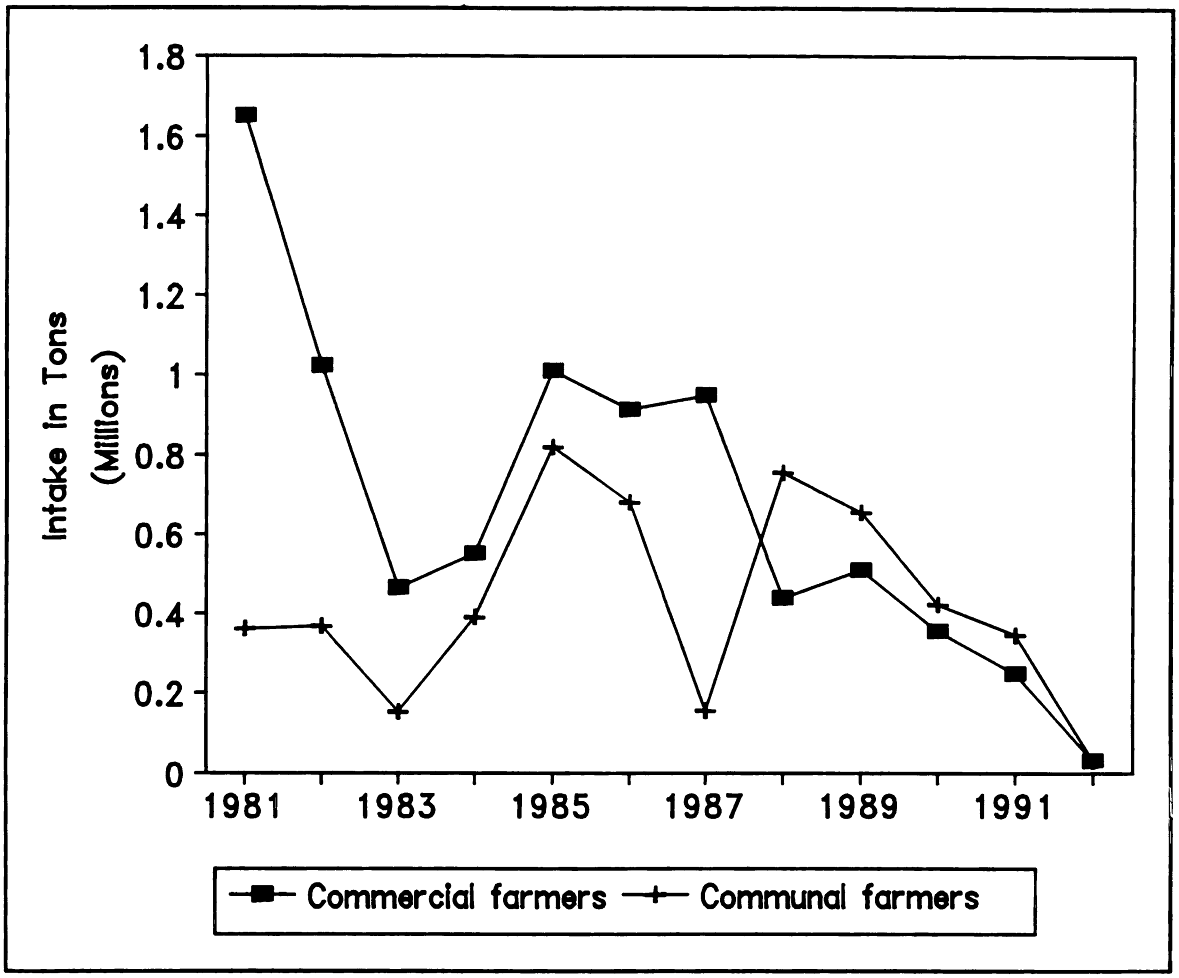


Figure 2: Grain Marketing Board intake, 1981-1992

producer prices and GMB selling prices for controlled crops each year with the GMB as the exclusive buyer. For example, during the 1992/93 marketing year, white maize, yellow maize, wheat, soybeans and sunflower were controlled crops (GRZ, 1992). Marketing and pricing of regulated crops were somewhat more flexible. In most instances, private traders were permitted to negotiate purchases of regulated products directly with producers with the GMB acting as a residual buyer by providing a floor price. In theory, the GMB floor price was set at a level for which the GMB could "break-even" on the marketing of the crop. For the 1992/93 marketing year, groundnuts, millets, and sorghum were regulated crops (GRZ, 1992). Until 1993, maximum retail prices of the processed products (maize meal, bread, and vegetable oil) were set by the Ministry of Industry and Commerce.

For decades, marketing of controlled crops was governed by movement restrictions set forth in the Grain Marketing Act. This legislation divided Zimbabwe into "Zone A" areas, which included all urban areas and large-scale commercial farming areas, and "Zone B," or smallholder communal areas. The Zone B areas were geographically scattered and were concentrated in the less favorable semi-arid regions. By 1991, there was compelling evidence that restrictions on private grain movement across zone boundaries impeded direct private trade from surplus to deficit areas, and effectively forced the bulk of marketed output in the surplus zones into the GMB system (Jayne and Chisvo, 1991). Once sold to the GMB, maize was normally transported onward to central silos and processed by large-scale millers and stockfeed manufacturers. The combination of movement controls and restrictions on access to maize basically meant that the bulk of the nation's marketed maize moves through the GMB to the large-scale millers. From 1989-1991, less than two percent of GMB's total maize intake was sold to private traders or small-scale millers (Jayne and Chisvo, 1991).

3.1.3 Farmer maize marketing behavior

In this section, data on farmer maize marketing patterns are used to provide insight into the smallholder maize marketing behavior and the functioning of rural maize markets. The data include crop sales for the years 1988 to 1991 from over 300 communal farm households in eight communal areas. The data were collected by the Farm Management Research Section of the Economics and Markets Branch, a unit of the MLAWD.

Although there has been some turnover in the survey sites over the four years of the survey, six of the eight survey sites (and sample households) have remained the same over the entire period; results for these areas are presented below. The Mutoko, Kandeya, and Chiweshe survey sites are located in "higher" potential communal areas in the north of the country. The Buhera, Nyajena, and Zvishavane survey sites are located in the semi-arid Natural Regions IV and V in the southern part of the country and can be classified as "lower" potential areas.

The first result of note is that a majority of smallholder farmers in this sample do not sell maize, even in a good year. Sales are concentrated in the high-potential areas in the north of the country, as shown by the pattern of production and sales from six communal areas after the 1988/89 harvest (Table 4).

Table 4: Smallholder maize marketing, 1988/89 marketing season

	HIGHER POTENTIAL AREAS			LOWER POTENTIAL AREAS		
	Chiweshe n=54	Mutoko n=48	Kandeya n=44	Buhera n=58	Nyajena n=60	Zvishavane n=56
Percent planting maize	100%	98%	100%	97%	100%	100%
Percent selling maize	93%	56%	89%	24%	12%	7%
Average quantity sold (90 kg bags)	58.0	12.3	57.5	8.3	1.8	2.0

Source: Calculated from MLAWD survey data.

The 1988/89 harvest was above-average to average in most parts of the country; Table 4 demonstrates that, although almost all farmers grew maize, those in low-potential areas where most communal area residents live sold very little, even after a good rainfall year. During 1988/89, in Chiweshe and Kandeya, communal farmers averaged maize sales of over 50 bags, while maize sales of two bags or less was the norm in Nyajena and Zvishavane. By contrast, the 1990/91 harvest was relatively poor, particularly in the south (Table 5). Maize sales in 1990/91 were somewhat lower in the higher potential areas, with average quantities marketed declining by up to 40 percent. Maize sales were virtually eliminated in the lower-potential areas with the average quantity sold in Nyajena and Zvishavane less than one bag.

Table 5: Smallholder maize marketing, 1990/91 marketing season

	HIGHER POTENTIAL AREAS			LOWER POTENTIAL AREAS		
	Chiweshe n=54	Mutoko n=58	Kandeya n=57	Buhera n=57	Nyajena n=58	Zvishavane n=56
Percent planting maize	93%	98%	100%	96%	93%	84%
Percent selling maize	76%	24%	72%	4%	12%	2%
Average quantity sold (90 kg bags)	42.7	7.6	37.2	8.1	0.5	0.7

Source: Calculated from MLAWD survey data.

Tables 4 and 5 seem to confirm the findings of other surveys (Hedden-Dunkhorst, 1990; Jayne and Chisvo, 1991) regarding the large number of communal producers, particularly in lower potential areas, that sell no maize and are net buyers of grain due to insufficient own-production. Yet grain pricing and marketing polices that include prohibitions on private grain movement and rely on producer prices as income transfer mechanisms appear to be largely based on the assumption that communal farming 48-end communities are either surplus producers or at least self-sufficient in grain.

Additional insight can be obtained by disaggregating farmers' sales by channel, and examining the prices received in official GMB channels and local, parallel market channels. Of farmers that do sell maize, Table 6 shows a sharp distinction between high- and low-potential areas. For producers in higher potential areas, almost 90 percent of maize sales were to the GMB. By contrast, in a good rainfall year, smallholders in lower potential areas sold a little over half of their maize to the GMB with a third sold to local farmers or shops. In a poor rainfall year, the little maize that smallholders in lower-potential areas did sell was sold through non-GMB channels. Furthermore, the reason for the difference is not necessarily, as has often been hypothesized in the past, that farmers in low-potential areas have more difficult access to GMB depots. Table 6 suggests that private, non-GMB buyers survive in low-potential markets since they offer substantially higher prices than the GMB, whereas in high-potential areas the price difference is small.

These results show that pan-territorial producer prices are largely irrelevant in the semi-arid, deficit areas in the southern part of the nation. In many instances, private, non-GMB buyers paid maize grain prices that were above the GMB selling price. For example, the average price paid by private, non-GMB buyers in the lower potential area in 1990/91 was $31.10 per 90 kg bag. This is somewhat above the government-set GMB selling price of $27.45 per 90 kg bag and far above the official GMB buying (producer) price of $20.25 per 90 kg bag.

Table 6: Smallholder maize marketing, by channel for the 1988/89 and 1990/91 seasons

	1988/89 MARKETING SEASON		1990/91 MARKETING SEASON	
	HIGHER POTENTIAL AREA	LOWER POTENTIAL AREA	HIGHER POTENTIAL AREA	LOWER POTENTIAL AREA
Percent sold to GMB	91%	57%	87%	0%
Average sale price (90 kg bag) when sold to GMB	$ 19.18	$ 19.13	$ 22.32	---
Percent selling to local farmers or local shops	1%	33%	8%	100%
Average sale price (90 kg bag) when sold to local farmer or shop	---	$ 21.66	$ 24.72	$ 31.10

Source: Calculated from MLAWD survey data.

This situation results since, as the marketing year proceeds, it becomes more difficult to buy grain from GMB depots. Although GMB depots are mandated to both buy grain from producers at the pan-territorial buying price and sell grain to consumers at the pan-territorial selling price, the GMB faces financial incentives not to satisfy consumer demand at each depot. Given the high transport costs and the GMB's fixed trading margin, there is little financial incentive for the GMB to transport grain from urban depots in the north to depots in the south, particularly given recent pressures for the GMB to reduce losses on its trading account. As a result, consumers who run out of grain during the marketing year must either depend on local grain markets or purchase commercially produced roller meal. Given the limited supplies from local production in many areas and the paucity of inter-rural trade, consumers are largely dependent upon the relatively expensive commercial roller meal (Jayne and Chisvo, 1991).

Table 7 presents additional data on the timing of sales. Most farmers sell soon after harvest; 85 percent of sales by surveyed farmers occurred in the July to September period. There was little variation in time of sale between producers in the higher potential areas and those in the lower potential areas, suggesting that on-farm storage for later sale is not attractive anywhere in the country. In fact, there were so few sales in the six months from October through March that it was not possible to observe the seasonal pattern of informal-market prices.

Table 7: Timing of communal farm maize sales, 1988/89 and 1990/91 marketing seasons

	1988/89 MARKETING SEASON	1990/91 MARKETING SEASON
Percent selling in Jan-Mar	0%	1%
Percent selling in Apr-June	4%	13%
Percent selling in July-Sept	83%	85%
Percent selling in Oct-Dec	13%	1%

Source: Calculated from MLAWD survey data.

Tables 4 through 7 show clearly that parastatal marketing services are only reaching a modest proportion of rural smallholders: namely surplus producers in higher potential areas that comprise only about 20 percent of the smallholder population. The majority of smallholders (55 percent) that live in lower potential areas market little maize, even in fairly good rainfall years. This implies that providing greater access to GMB marketing services may not improve the living standards of rural households in lower-potential areas.

3.2 Maize processing

Numerous techniques exist for grinding maize grain into flour for *sadza*, the nation's staple dish, ranging from hand pounding to modern, automated roller mills. This section describes the structure of the maize milling industry and presents survey data from early 1992 on the seasonal nature of the demand for hammer milling services. Finally, the effects of government-mandated milling margins and roller meal subsidies on maize processing are explored.

3.2.1 Maize milling industry structure before reform

At the outset of the reform in 1991, maize milling in Zimbabwe could be characterized as dualistic, with large-scale milling firms operating alongside small-scale hammer milling firms. Four large private firms dominated maize milling with the largest firm alone accounting for about 65 percent of the market for bagged maize meal. The two largest companies combined handled 85 percent of the market for bagged maize meal. The large-scale millers were the sole producers of both super refined meal and roller meal. The maize marketing system was characterized by a controlled distribution network as well as centralized storage and milling facilities. The GMB effectively served as a procurement agent for the large-scale milling industry. Millers bought maize from the GMB and sold processed maize meal to retailers at government-controlled prices. The single-channel nature of this system simplified the setting and enforcement of GRZ price controls and ensured a stable supply of a staple food for all urban dwellers at uniform prices.

Yet even in 1991, small-scale hammer millers were numerous, although the bulk operated in rural areas. An initial survey undertaken in February 1992 found 57 small-scale hammer millers operating in the Harare and Chitungwiza. In early 1992, most small-scale hammer millers specialized in "custom milling," whereby the raw material and container are provided by the customer. Due to perceived and actual restrictions, very few hammer millers sold maize grain and the sale of already-processed meal was virtually unknown. Small-scale millers used electric or diesel powered hammer mills to manufacture two products: 1) straight-run meal, or *mugayiwa*, a 98 percent extraction rate whole meal for human consumption; and 2) a coarse grain stockfeed. Straight-run meal is widely consumed in the rural areas. Another type of meal, *mudzvurwa*, was produced by a single medium-sized commercial miller. The milling process for *mudzvurwa* involves removing the bran (or hull) using a separate shelling machine before milling with a hammer mill. Similar to roller meal, *mudzvurwa* has an extraction rate of about 90 percent. Small-scale custom millers provide milling services at unregulated prices.

3.2.2 Seasonality of demand for hammer milling services

In order to examine potential institutional constraints to the expansion of the small-scale milling sector, a census of small-scale urban hammer mills was undertaken in February 1992 in Harare and Chitungwiza. The data were analyzed to determine the level and pattern of demand for straight-run meal from urban hammer mills. By systematically searching each neighborhood and inquiring from potential consumers, 57 small-scale hammer mills were located in or within walking distance of these urban centers. Information regarding milling throughput, financial aspects of the milling operation, breakdowns, milling charges, and employment patterns was elicited from mill operators. Data on monthly maize meal throughput and the proportion of throughput destined for human consumption was used to estimate the actual consumption of hammer-milled straight-run meal in these urban areas. Most millers kept daily records of actual milling throughput and it was relatively easy for respondents to distinguish between grain destined for human consumption and that for livestock because the former requires a different sieve setting and involves a higher milling fee.

The findings of this census revealed that about 20 percent of the urban millers, mainly those owned by commercial farmers on the periphery of urban boundaries, tended to focus on producing stockfeeds, while straight-run meal for human consumption was the major product processed by small-scale millers near densely populated urban areas. Based on records kept by millers and recall data, 1991 monthly milling throughput was reconstructed. In 1991, the small-scale urban mills produced over 11,000 tons of straight-run meal, or about 8 percent of the maize meal requirements of the two urban areas surveyed.

A more striking finding was the seasonal nature of demand. Demand for hammer milling services in 1991 peaked in June, July and August. This pattern coincides with the April harvest in the Harare area and the subsequent drying of maize before it may be processed by hammer mills. By October, milling throughput had fallen off considerably and reached its lowest point in February, at just over a quarter of peak levels.

This seasonal pattern observed for 1991 would be consistent with two alternative explanations: a) either there was seasonal demand for straight-run meal; or b) there was a seasonal demand for milling services given restrictions on the availability of maize grain at certain times of the year. The former explanation does not appear consistent with the consumption patterns of urban or rural households in Zimbabwe; when available and accessible, maize meal appears to be the dominant staple food during all times of the year. The other explanation, that maize grain was not accessible in urban areas after local urban production is depleted, was supported by the survey of urban millers. When asked about the availability of maize grain, 90 percent of millers said maize grain was "readily available" in April-June and none said it was "not available." Conversely, in January-March, 35 percent said maize grain was not available while only 2 percent said it was readily available. Restrictions on private grain movement into urban areas appeared to impede the development of small-scale mills and the availability of straight-run meal in urban areas after urban and peri-urban maize production is depleted, leading to the observed seasonal pattern of consumption.

While straight-run meal consumption may have only been 8 percent of total, a potential consumption figure can be extrapolated assuming that the seasonal peak is maintained for the whole year. Based on the results of the census of millers, if consumers had access to maize grain year-round and maintained post-harvest levels of straight-run meal consumption for the entire year, total straight-run meal consumption would be over 17,000 tons, or 13 percent of yearly maize meal consumption.

Yet this rough calculation probably still understated the true potential demand for straight-run meal. During the post-harvest period of peak demand for hammer milling services and straight-run meal consumption, access to maize grain is still constrained by the production potential of urban households. Maize cultivation usually takes place on extremely small garden plots between houses or on vacant municipal land. During 1990 and 1991, there was a campaign by municipal authorities to end cultivation on public lands and these prohibitions were matched by enforcement activities including slashing maize before it reached maturity.

Thus, this census suggests that there was considerable unmet demand for the products of small-scale hammer mills in 1991. However, the institutional constraints created by a restrictive maize marketing policy conferred a *de facto* monopoly to large-scale millers, even though their margins were judged two to three times higher than those of small-scale millers. With the lack of any major threat of competition from informal millers during much of the year, the large-scale millers were able to operate a higher-cost system without losing market share.

3.2.3 Milling margins and retail pricing

Until price decontrol on June 1, 1993, retail maize meal prices were determined by the application of a set "cost-plus" formula to the GMB maize selling price. Application of the formula involved several steps. First, all "direct factory costs" were reported and added to the GMB selling price. An allowance was made for the loss of revenue due to the sale of by-products at a price below that of the maize meal. Second, a flat percentage mark-up, varying according to bag size, was applied to the cost of maize and the direct factory costs incurred. A distribution allowance was also added on. Finally, the retailer received a flat mark-up of 9 percent.

The problems with such a system are easily apparent; every time the GMB selling price rose, the flat percentage mark-up the large-scale millers received rose as well. Thus, an increase in the GMB selling price due to drought and high import costs could create

Table 8: **Commercial maize millers margins per metric ton, February 1992 to June 1993**

	Feb-Aug 1992	Aug 92-June 93
Approximate maize price C.I.F. Harare	$1300.00	$1300.00
less "import subsidy"	610.00	230.00
GMB selling price (February-August 1992)	690.00	1070.00
bags	19.62	19.62
transport	4.00	4.00
electricity and water	1.51	1.51
industrial wages	2.23	2.23
loss on sale of 10% by-product as feed	79.30	102.84
packing	58.27	58.27
"Total factory cost"	854.91	1258.47
plus "mark-up" of 21.63 or 22.70 percent	184.92	285.67
plus distribution allowance (per ton)	50.00	62.00
Maximum price delivered to retailers (without subsidy)	1089.83	1605.94
less subsidy from Ministry of Industry and Commerce	392.00	562.00
Maximum price delivered to retailers (with subsidy)	697.00	1044.00
plus retailers margin of 9 percent	63.00	96.00
Maximum (subsidized) retail selling price	760.00	1140.00

windfall benefits for large-scale millers. Unfortunately, without accurate cost data, it would be difficult to demonstrate *ex-ante* that large-scale millers received a windfall benefit. Large-scale millers have maintained that increased mark-ups in 1991 and 1992 (in absolute, not percentage terms) were justified because of their rapidly rising costs. Citing rising interest rates and increased replacement costs due to devaluation, the large-scale millers argue that they did not receive a windfall gain from increases in the GMB selling price. Because analysts must rely on millers' reported costs (not actual costs), demonstrating empirically that there was such a windfall would be difficult. Despite the lack of conclusive evidence, many GRZ officials suspected that large-scale millers did receive windfall benefits during the 1992/93 marketing year, citing the record profits received by the largest milling firm.

3.2.4 Roller meal subsidies

In order to reduce maize meal prices to consumers, subsidies have been implemented at various times over the past decade. In August 1992, a subsidy on roller meal of $392 per ton was increased to $562 per ton of roller meal produced by registered millers. The roller meal subsidy was administered by providing funds for the GMB to credit the monthly accounts of "gazetted" maize millers (mostly large-scale millers until late in the scheme) $562 for every ton of roller meal produced. The effect was to reduce the retail price of roller meal substantially below that which it would be without the subsidy and, as a result, a 50 kg bag of processed roller meal was slightly cheaper than the price of a 50 kg bag of maize grain purchased by an individual from the GMB.

The principal objective of the roller meal subsidy was to ensure that consumers had access to low-cost maize-meal, especially during a time of severe drought. However, the roller meal subsidy had a detrimental effect on custom hammer millers who had begun to carve out a market niche by providing consumers with straight-run meal, a lower-cost maize meal product. The large subsidy on roller meal eliminated any incentive for custom millers, traders or consumers to purchase maize from the GMB for eventual processing at existing small-scale hammer mills and severely restricted the development of alternative, and more competitive, maize marketing channels.

Table 9 presents a summary of the 1992/1993 and 1993/94 maize pricing structure. It is important to distinguish between the two types of subsidies which existed during the 1992/1993 marketing year. The difference between the GMB buying price of maize (Line 1) and the GMB selling price (Line 3) can be thought of as the subsidy to the GMB (Line 5). This explicit GMB subsidy does not necessarily reflect parastatal inefficiencies, rather it may simply reflect a mandated GMB selling price that is insufficient to cover GMB acquisition and operating costs (i.e. the break-even selling price). By contrast, the roller meal subsidy was a direct payment to registered millers for the production of roller meal (Line 8). Although consumers do receive some of the welfare benefits of the roller meal subsidy, this subsidy can be thought of as a subsidy to registered millers for the production of roller meal.

However, large subsidies on consumer food prices do not necessarily mean that prices are lower than they would be in a restructured market. Market regulations or inefficiencies at certain stages of the system may impose additional marketing costs that overwhelm the effect of direct government subsidies. The roller meal subsidy of $562 effectively reduced the margin within which private traders and small-scale millers could

Table 9: Maize grain and maize meal pricing structure: 1992/93 and 1993/94 marketing years[1]

	1992/93 Price Structure	1993/94 Price Structure
1. GMB buying price	$1200	$900
2. Estimate of GMB operating costs	170	200
3. GMB selling price	1070	1070
4. GMB break-even selling price (1+2)	1370	1100
5. Subsidy required by GMB to balance trading account (4-3)	300	30
6. Large-scale millers margin	536	516
a. Factory costs	188	na
b. Mark-up (.2270% of 5+6a)	286	na
c. Distribution allowance	62	na
7. Ex-mill price delivered to retailer (3+6)	1606	1586
8. Subsidy to large-scale millers for production of roller meal	562	0
9. Total subsidies to maize sector (5+8)	862	30
10. Ex-mill price with millers' subsidy (7-8)	1044	1586
11. Retailers' margin (a percentage mark-up on the ex-mill price)	96	159
12. Final maximum retail selling rice of maize meal (10+11)	1140	1745
13. Effective operating margin for small-scale millers (12-3)	240	681

Source: Calculated from miller's submissions to Ministry of Industry and Commerce

[1] All prices in Zimbabwe dollars per metric ton. Retail price calculations based on consumer purchase of 10 kg. bag. GMB buying price of $1200 for 1992/93 marketing year reflects import cost of maize.

profitably operate (Line 13). The maximum retail price of roller meal ($1140 per ton) was only $70 more than the official GMB selling price of $1070. In fact, informal buyers faced an effective GMB selling price that was actually higher than the roller meal retail price because of a "non-refundable deposit" on grain bags. In August 1992, GMB selling points sold a 50 kg bag of maize grain for $56.10 (inclusive of bag), while the maximum retail price of 50 kg of roller meal was $54.47.

Finally, the budgetary consequences of the roller mill subsidy on losses attributed to the maize sector during 1992/93 were enormous (Line 9). The monthly cost of the roller meal subsidy was estimated by the Ministry of Industry and Commerce to be over $44 million. Thus, the elimination of the roller meal subsidy was a necessary condition for marketing reforms to generate tangible benefits in terms of (a) stimulation of a more competitive and efficient maize marketing and trading system, and (b) reduction in Government budget deficits attributed to the maize sector.

3.3 Maize consumption preferences

Maize meal is the staple food of most Zimbabweans. Four types of maize meal are produced in Zimbabwe, differing primarily in degree of processing: super refined, roller meal, *mudzvurwa,* and straight-run meal. It has become somewhat of a truism in Southern Africa that urban consumers have a strong preference for the highly-refined maize meals traditionally produced by large-scale millers. Large-scale millers ceased production of straight-run meal in convenient bag sizes in 1979, contending that demand was negligible. If true, low demand for the products of small-scale mills such as straight-run would explain why the small-scale milling industry failed to develop during the 1980's despite possible technological advantages.

However, results from a census of hammer millers and a rapid appraisal of consumers undertaken in February 1992 call into question the conventional wisdom regarding consumer preferences for refined maize meal. As presented in Section 3.2.2, straight-run meal processed by urban hammer mills accounted for 8 percent of urban consumers' maize meal consumption requirements. Furthermore, a rapid appraisal of 301 urban consumers waiting in maize meal queues in Harare and Chitungwiza offers preliminary evidence for latent demand for straight-run maize meal. Respondents were presented with a simulated series of choices between whole meal and roller meal at various price differentials. For example, consumers were asked "if both roller meal and whole meal were available at this store right now, which would you buy: 10 kg of roller meal at $7.60 (the current retail price at the time) or 10 kg of straight-run meal at $7.00." Four choice scenarios between roller meal and whole meal were addressed orally and with the aid of a printed card. Over two-thirds of the respondents chose straight-run meal when it was offered at an 8 percent price discount to roller meal. Of those who chose roller meal, over 80 percent cited the lower price as their reason for selecting straight-run meal. This rapid appraisal supports an earlier one conducted in 1991 which indicated that 35 percent of urban consumers would prefer to buy straight-run meal if it were 8 percent cheaper than roller meal (Jayne et al., 1991).

These rapid appraisals provided initial evidence for the potential demand for straight-run meal. Yet, given GRZ fears about altering a marketing system that had supplied urban consumers with maize meal for decades, a more comprehensive survey of maize meal preferences of urban households in Zimbabwe was undertaken. The contributions of a more comprehensive survey to the reform process were expected to be: 1) it would permit the collection of income and other household demographic variables in order that effects on different income groups could be analyzed; 2) a true random survey would enable analysts make inferences applicable to the entire urban population; and 3) more exact responses to a wider range of products (i.e. yellow maize meal) could be collected.

3.4 Overcoming bottlenecks to improved system performance

Zimbabwe's single-channel maize marketing system was designed, and was refined in the post-Independence era, to achieve a broad set of objectives. These objectives are either stated in the Grain Marketing Act or regularly acknowledged as a key component of government maize policy in MLAWD annual policy statements. The objectives include:

1. **Price stabilization.** The need to protect consumers and producers from large price fluctuations inherent in agricultural production has made price stabilization a key objective. Combatting the price swings that would necessarily accompany market determination of grain prices is one of the primary reasons for GMB intervention in agricultural markets. In recent years, the government has also pursued a cheap food policy for the urban industrial wage earning groups (Jiriyengwa, 1991).

2. **National food self-security.** Given the importance of maize and the often extreme variability in national grain output, inter-annual stockholding is viewed as a major GMB function. The GMB defines food security as "ensuring adequate food supply at the national level and meeting food production goals" (Jiriyengwa, 1991).

Stiff resistance exists within the GMB to expanding the definition of food security to the household or individual level. In contrast, the World Bank (1986) defines food security as "access by all people at all times to enough food for an active and healthy life."

3. **Improving the welfare of smallholders.** In the post-Independence era, the government has made considerable efforts to improve the welfare of communal farmers, most of whom are in the drier, more remote areas of the country. The desire of government to aid smallholders in the provision of marketing outlets is evidenced by the growth in the GMB depot network as well as improved government research and extension support. Improving smallholder welfare is continually acknowledged as a key component of agricultural policy in annual policy statements by MLAWD.

The direction of agricultural policy and the current reform program was initially outlined, in general terms, in late 1990 with the initiation of the Economic Structural Adjustment Program. The particular objectives of grain pricing and marketing reform were further elucidated in MLAWD agricultural policy statements in 1991 and early 1992. In essence, pricing and marketing arrangements for grain products were to be reformed to meet the twin goals of deficit reduction and improved marketing efficiency.

For a number of years, the GMB has been plagued by large deficits. According to the GMB, the expansion of the depot network has increased the GMB's unit transport costs (GMB, 1991). As a result, deficits have arisen because the margins between the GMB buying price and the GMB selling price have not been sufficient to cover its operating costs. The reform program calls for the GMB to be operating on a break-even basis by

1995.

A second, broader goal of grain marketing reform has been improved efficiency in crop marketing. Government policy statements affirmed the government's desire to expand the role of private traders in providing marketing services to producers in communal, resettlement, and small-scale commercial areas (GRZ, 1992). The high marketing margins of the formal sector and the desire to expand options for both buyers and sellers in smallholder areas were the primary reasons for this policy initiative (GRZ, 1992).

By early 1992, evidence presented in Section 3.3 suggested that select grain marketing policy reforms might create opportunities for the growth of alternative grain marketing channels, namely the establishment linkages between emergent private traders, small-scale millers, and retailers and consumers of hammer-milled maize in urban areas. Yet since for over 60 years the Grain Marketing Act had enshrined in law the pre-dominant, if not exclusive, role of the GMB in purchasing maize from producers, transporting maize to central silos, storing maize at the wholesale level, and selling maize to end-users, the foundation of an informal or parallel maize marketing channel, where participants (namely first handlers, wholesalers, traders/transporters, processors, and retailers) perform specialized functions, was virtually non-existent, particularly in urban areas.

In addition, market failures, opportunistic behavior, and transaction costs in maize marketing could hamper the development of potentially lower-cost marketing channels. With the initiation of reform measures, select institutional investments are often required to overcome subsector coordination problems.

By July 1992, discussions within GRZ were underway regarding several proposed maize marketing reforms, including: 1) reduction or elimination of the roller meal subsidy; and 2) elimination of maize movement restrictions across zones. Although such reforms were seen as having the potential for lowering food prices for the urban poor and generating employment as small-scale mills blossomed, there was uncertainty as to the eventual effects due to the lack of empirical evidence.

A collaborative research program, the results of which are presented in the next three chapters, was initiated to address these concerns by quantifying the potential demand for various types of processed meal, comparing technology options in the milling industry, and identifying constraints to the expansion of alternative marketing channels.

CHAPTER 4:

MAIZE PREFERENCES OF URBAN CONSUMERS

Designing food polices to protect low-income households from the adverse effects of rising food prices requires an understanding of the grain preferences of urban consumers, the most concentrated block of food deficit consumers. This chapter presents an empirical analysis of household-level maize preferences based on product attributes such as color, price, and degree of processing. The first section presents an overview of the research methods used, followed by a summary of household maize consumption patterns in Section 2. Section 3 offers estimates from market simulations of the degree to which urban consumers would substitute straight-run meal and yellow maize meal for refined white maize meal products. Demand for white straight-run meal and yellow roller meal are estimated and eventual market shares are forecast. Section 4 uses information on how demand for various types of maize meal varies with income levels to evaluate potential mechanisms for implementing a targeted meal subsidy. Section 5 examines the implications of revealed consumer preferences for the design of drought relief programs. The final section explores the implications of expanding the choice of processed maize products available to consumers on the structure of agricultural production, the use of foreign exchange, and maize trade policy.

4.1 Overview of research methods for demand analysis

One of the major hypotheses underlying this research is that a combination of policy and regulatory constraints have effectively restricted consumer access to alternative maize meal products, creating the perception that urban consumers prefer the white, relatively refined maize meal products that dominate urban food markets in Zimbabwe. To evaluate the potential outcomes of reform, *ex-antè* indications of the potential demand for alternative maize meal types are required.

Food demand analysis, studying how consumers respond to changes in prices and incomes, has long been recognized as a key element of efforts to improve the performance of agricultural markets (Timmer et al., 1983). Given the paucity of time-series data on consumption levels and food prices in developing countries, economists have made extensive use of income and expenditure surveys to draw conclusions about consumer demand. Although often originally collected to establish weights for Consumer Price Index calculations, cross-sectional household survey data from income and expenditure surveys is frequently used to estimate demand parameters. However, since price differences from cross-sectional data reflect spatial rather than temporal variations and derivation of unit values obtained by dividing recorded expenditures by recorded quantities may mask quality differences, spurious correlations are likely and more complex methods must be sought to overcome these problems (Deaton, 1987).

Traditional demand estimation techniques fail when the product for which demand is to be estimated does not exist in the marketplace. With the prevalence of this problem in diverse fields such as firm-level product marketing and resource economics, an entire literature has arisen concerning the estimation of potential demand.

4.1.1 Approaches to the estimation of potential demand

Lacking actual market data, there are at least three approaches for estimating the potential demand for commodity: the travel cost method, approaches based upon attribute theory, and contingent valuation techniques. All approaches have received their widest application in resource economics in the valuation of non-market goods. All but the travel cost method can be applied to market goods (such as maize meal) that do not exist in the marketplace. The travel-cost approach is largely confined to estimating the demand for a good such as a public park or recreation site with no admission fee. Travel costs and travel time incurred by the individual are used as proxies for market prices in a regression predicting visitation rates and Marshallian surplus is then calculated.

A second approach, based upon attribute theory, reflects a more general theory of demand and permits the use of several different econometric tools and algorithms. Attribute theory is derived directly from Lancaster's (1971) "New Theory of Consumer Demand" which deviates from traditional notions of consumer behavior by arguing that people choose to consume a particular good because of the attributes of that good rather than the good itself. When consumers buy a particular good, they essentially buy a bundle of attributes. Thus the choice to consume maize meal can be viewed as based on a complex set of product attributes, including product price, acquisition time and costs, grain color, processing technique, and packaging and presentation of the product. Lancaster suggests that the "demand for a new good could, in principle, be predicted from the observed behavior with respect to existing goods, provided the new good possesses the same characteristics (although in a different combination) as those existing" (Lancaster, 1971). The attribute approach essentially measures the price differences that arise due to attribute differences across similar goods. The objective is to estimate the implicit values associated with implicit exchanges among attributes (Hoehn and Krieger, 1988). Either actual market data exhibiting observations of variations in prices and attribute levels or ranked preference data from consumer experiments can be used to derive implicit prices of attributes.

Depending upon data availability, there are a variety of estimation tools based upon attribute theory that can be used including: construction of hedonic prices indices, conjoint analysis, goal hierarchy tests, and discrete choice models. Hedonic approaches usually rely on actual data on price and quality variations across a given market to estimate a hedonic price index. The value of different attributes, the hedonic prices, can then be derived from this index. Conjoint analysis is another popular method for predicting consumer preferences for multi-attribute options (Green and Srinivasan, 1978). It has been widely used by private firms seeking to gauge consumer response to new products. The first step is to record consumers' global judgements about a complex set of alternatives. The original rankings are then decomposed into separate and compatible utility scales by which judgements involving new combinations of attributes can be reconstituted (Green and Wind, 1975). A simplified approach to summarizing ranked qualitative preference data involves goal hierarchy tests. In a study of the consumer preferences for different types of grain in Senegal, Ross (1979) used a goal hierarchy test to investigate the most important characteristics in consumers' preferences toward rice. He found that "volume after cooking" and "oil absorption" were the most important characteristics to consumers of rice, while preparation time was less important. Finally, a diverse group of discrete choice models have been developed within the past decade to forecast consumer demand for goods which ha

Hausman

defining a

they wer

C

is the mo

value da

Survey d

of consu

In the ca

reference

valuation

WTP, f

[illegible]

I

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

which have not yet appeared on the market. In a seminal article, Beggs, Cardell and Hausman (1981) developed an ordered logit model for use on ranked preference data. By defining a good such as a car as a bundle of attributes and estimating attribute coefficients, they were able to estimate the potential demand for electric cars.

Contingent valuation techniques, a third approach to estimating potential demand, is the most straight-forward approach, at least theoretically. Contingent valuation elicits value data directly from individuals affected by a policy change (Hoehn and Krieger, 1988). Survey design consists of a series of market simulations in which a representative sample of consumers are asked to make decisions among alternative goods at varying price levels. In the case of estimation of potential demand for a new commodity, the new product is referenced against an existing product that the consumer does purchase. Contingent valuation techniques have been used for years by economists to value willingness to pay (WTP) for non-market goods such as environmental assets (i.e. "clean water" or pollution reduction), but have not been widely applied to market goods.

However, in the limited studies that have been done on market goods, data gathered from contingent valuation techniques and used to estimate potential demand have been shown to provide fairly accurate estimates of actual demand. In a study of the demand for fresh strawberries in Wyoming, Dickie, Fisher, and Gerking (1987) compared the estimation of demand functions based on actual transactions versus the demand estimation from hypothetical contingent valuation bids. They found that there was no statistical difference between the demand function estimated from a sample that was based on actual data and a consumer sample that reflected hypothetical contingent valuation responses.

An extensive literature has developed on the potential biases of contingent valuation

techniques. Some of the possible biases of this approach and the methods adopted in this study to overcome these biases are presented here.

1. **Product definition.** In many contingent valuation studies concerned with environmental assessment, defining the item to be valued in a uniform way for each respondent is difficult, if not impossible. For example, it may be difficult to define improvements in water quality simply by using the percentage reduction in pollutants. Consumers may also have difficulty attaching values to commodities with which they are unfamiliar. However, for contingent valuation of alternative maize meals, most urban consumers are very familiar with the products in question. Thus, the potential pitfalls of failing to uniformly define the good to be valued seem to be much lower for a market good, such as maize meal, than for an environmental asset. Problems also arise when the respondent is uninformed about relevant market conditions. For example, when homeowners are asked to value their home, they are often uniformed about current conditions in the market for residential property and the values named exhibit a great degree of variation. Contingent valuation for durable goods that are purchased infrequently would face similar problems. For maize meal valuations, since urban consumers make frequent purchases of maize meal and since maize meal is a significant budgetary expenditure, such problems are greatly lessened.

2. **Payment vehicle bias.** In contingent valuation of environmental assets such as air quality or recreational value, attempts are made to make the stated

mechanism for (hypothetical) payment as realistic as possible. Thus, in survey questionnaires WTP for air quality is often expressed in terms of tax increases or, alternatively, WTP for recreation may be expressed in terms of park entrance fees. Further difficulties can arise if respondents believe that any additional revenues (i.e. for pollution reduction programs) will be diverted to other programs. This problem is largely avoided with a market good such as maize meal when payment is expressed as savings or additions to amounts spent by the consumer on maize meal.

3. **Starting point bias**. Any contingent valuation study requires a bid elicitation procedure to obtain the needed values. Numerous bid elicitation procedures exist and, as Hoehn and Krieger (1988) demonstrate, such procedures have at least three dimensions. First, the elicited value response can be either the individuals maximum WTP or an accept-reject response to a pair-wise comparison. Second, the elicitation procedure can rely on a single response or it can be an iterative process. Iterative processes, where feasible, are usually preferred since they provide more precise information of actual maximum WTP rather than just acceptance or rejection at a particular price level. Third, the initial starting point is either sought from the respondent in an open-ended question or provided by the enumerator. When valuing market goods, the disadvantage of starting points elicited from an open-ended question is that it leads to wider variation in WTP than may actually exist due to lack of information possessed by the respondent about the actual relative prices of options. Also, many respondents, once

having stated their "maximum willingness to pay" in a single-response question, are reluctant to engage in the upward bidding of an iterative procedure. Yet anchoring responses to the range of feasible price options with a posed starting point does have disadvantages. When the starting point is suggested by the enumerator, the final value selected may be influenced by the starting point.

4. **Strategic bias**. In a contingent valuation experiment, the respondent may surmise that the results of the survey will influence the actual price of a particular market good, creating incentives to under-estimate WTP for the good. Alternatively, in environmental assessment scenarios, there may be incentives to over-estimate actual WTP for a good. In the case of maize meal valuation in Zimbabwe, since retail prices are often administratively determined, respondents may engage in strategic behavior if they believe that the simulation results may influence government-set retail maize meal prices. Another potential strategic problem with any bidding procedure is that consumers are often conditioned to conceal their maximum WTP. Even though respondents are not actually purchasing the offered product, they may begin to engage in "marketplace haggling." Careful explanation may help reduce this natural reluctance on the part of respondents to reveal their maximum WTP for a product, but parameters may still be under-estimated.

5. **Biases arising from the hypothetical context**. Finally, biases can arise from the reliance on a hypothetical rather than actual market context. Bishop and Heberlein (1980) found that contingent valuation led to

4.1.2

are ine

variabl

problem

respons

and inf

data en

significant underestimates of the maximum WTP for non-market goods due to divergences between people's expressed attitudes and actual behavior. If such underestimates held for market goods, estimated price elasticities would be higher than actual elasticity values. Respondents may also be confused with the format of a particular hypothetical simulation and provide inaccurate responses.

4.1.2 Collecting household income data

Any survey effort is imperfect in that both sampling errors and non-sampling errors are inevitable to some degree. Sampling errors, errors which result from the inherent variability of individual samples of a population, are generally thought to be less of a problem than non-sampling errors. Non-sampling errors (namely non-response, erroneous response, observation and measurement mistakes, etc.) can only be minimized by careful and informed pre-testing, questionnaire design, enumerator supervision, post-coding, and data entry.

One of the most common problems with household surveys is eliciting income information from respondents, especially in single-interview surveys. Not surprisingly, respondents often view questions about income level as intrusive or may unintentionally provide inaccurate responses about income levels of other members.

Due to fears that income data would be difficult to elicit from respondents, in addition to requesting income information for each household member, the consumption survey questionnaire also made wide use of income "proxies." In the absence of income data, the substitution of a proxy variable that is closely correlated with a limited number of obser

to other

owners

income

upon

income

in pred

rent. (

food e

owner

years

4.1.3

of observed values for actual income can permit inferences about the relationship of income to other variables. Several proxies were selected using socioeconomic variables and asset ownership characteristics. In spite of fears regarding non-responses to income questions, income data was obtained for the vast majority of respondents, eliminating the need to rely upon income proxies. Yet comparing the actual reported income with several possible income proxies can provide an indication of the relative value of alternative income proxies in predicting income in urban Zimbabwe. The best income proxy was "amount of rent per month" with a correlation coefficient of 0.67, although only half the sample actually paid rent. Otherwise, the best correlation coefficient was the respondent's estimate of monthly food expenditures for the previous month (0.57). A rather arbitrary 12-point scale of ownership of household durables (refrigerators, radios, stove with oven, etc.) proved to be a relatively good proxy with a 0.41 correlation coefficient. Various measures of education (years of education for each household head, all wage earners, or all household adults), which some studies have suggested as a good proxy for total household income or income per adult-equivalent in surveys undertaken in developing countries, only had a maximum correlation coefficient of 0.37.

4.1.3 Consumption survey design and sample selection

Easing the food-price dilemma in Zimbabwe through the development of alternative lower-cost grain marketing channels depends upon the potential demand for alternative maize meal products. By 1992, although preliminary work had demonstrated latent demand for less refined maize meals, there was little empirical basis for predicting how consumers would alter purchases when faced with changes in prices and incomes or when offered a greater

consum

centers

the tota

sites an

Table 1

greater range of maize products. In order to answer these critical questions, this study of consumer grain preferences was conceived and carried out.

The consumption survey was carried out in June and July of 1993. Three urban centers, representing 75 percent of the Zimbabwean urban population (and 20 percent of the total population) were chosen. Population estimates from the 1992 census and sample sizes are presented in Table 10:

Table 10: Population and sample sizes for the consumption survey

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

The design of the consumption survey was preceded by a set of consumer focus group meetings in January and February. The focus group meetings aided the design of the consumption questionnaire by clarifying attitudes towards different types of maize meal, types of purchasing patterns and hypothetical price relationships. In late February and early March, the questionnaire underwent three rounds of pretesting with the eight Harare enumerators. A special questionnaire was also designed during the pre-testing stage in March to test whether urban households regularly chose to consume a mix of maize meal types in a given month. This test questionnaire found that the demand for narrowly defined types of meal (i.e. straight-run versus roller meal) is discontinuous. That is, for a particular household, the demand for straight-run is zero at certain higher prices, then as the pri

to cov

of a m

househ

month

Howev

survey

meal p

differe

differ

of serv

mentio

survey

data u

prices

premi

desig

a mix

199

othe

fina

the price falls below some threshold, quantity demanded jumps (or switches) to an amount to cover household needs. Pre-testing showed that, for a particular household, the choice of a narrowly defined maize meal type is an "all or nothing proposition." All forty households surveyed limited themselves to one type of maize-meal during a particular month. Of course there may be seasonal variations in the type of maize meal consumed. However, due the lack of domestically-produced grain during the 1991/92 drought, this survey was not able to investigate the seasonality of maize meal consumption.

There are several reasons for the switching behavior of households: first, maize meal preparation is very time and fuel consuming, which often precludes preparation of two different types. Exceptions might only be made if household members had strongly differing preferences. Second, although households may buy a higher quality maize meal to serve to guests, pretesting revealed this type of behavior to be rare. Rice was commonly mentioned as the "status cereal" of choice. Thus the contingent valuation portions of the survey instrument were designed based upon the reasonable and empirically-based premise that urban consumers will generally consume one type of maize-meal at a certain range of prices and then, when a certain price threshold is reached, switch to another product. This premise of switching behavior was also supported by findings from the final consumption questionnaire. Less than 3 percent of households, when given a hypothetical choice, chose a mix of different maize meal types.

The individual households selected for the survey were randomly selected from 1992 census data stored at the Central Statistical Office (CSO). The selection procedure utilized a clustered random sampling procedure; each urban household had an equal probability of being selected for the survey. For ease of enumeration, it was determined that each

question

T

of 300 w

into two o

equally;

numbers

between

then link

through

5,072 h

househo

and 139

clusters

5; finall

househo

could no

househo

The sur

that each "cluster" would comprise four households as this was judged the number of questionnaires that could be administered by an enumerator in one day.

The selection procedure proceeded as follows, using Harare where a sample size of 300 was selected, as an illustrative example; 1) the 44 wards in the city were divided into two groups, representing low-density and high-density wards, with each ward weighted equally; 2) with the population of each ward known from the 1992 census, 75 random numbers (based on desired sample size of 300 divided by cluster size of 4) were selected between 1 and 296,478 (the Harare household population); 3) each random number was then linked to a particular ward. For example, suppose a cumulative total of Wards 1 through 20 showed a population of 134,131 households. If Ward 21 had population of 5,072 households, Wards 1 through 21 would naturally have a population of 139,203 households. Thus, for each of the 75 random numbers generated that fell between 134,131 and 139,203, the Ward 21 would be assigned a cluster; 4) depending upon the number of clusters assigned to each ward, 75 EA's were randomly selected from among the 44 wards; 5) finally, six households were selected from each of the 75 EA's: four original sample households and two replacements in the event that one or two of the original households could not be located after three visits. An identical procedure was used to randomly select households from Chitungwiza and Bulawayo, providing a total sample of 512 households. The survey questionnaire had five components. Information was sought on:

* Household demographic, socioeconomic, and income data.
* Household purchasing, production and food preparation behavior.
* Current grain preferences of household as expressed by household's primary food purchaser.

after co

pricing

the GR

would c

all 70 b

of July,

to urba

compri

custom

will ev

custom

spend

second

4.3

and fo

* The household's willingness to pay for alternative types of maize meal.
* Ranked preferences for specially designed showcards.

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

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

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

4.2 Maize consumption patterns in urban areas

After a brief overview of the demographic and socioeconomic status of the survey households, this section presents a detailed look at urban household purchasing, production and food preparation behavior for maize products. The factors influencing a particular househo

of urba

4.2.1 I

overvie

samplin

present

of the S

individ

househ

error o

group (

household's decision to consume straight-run meal are analyzed. Finally, the importance of urban maize production and maize grain transactions are examined.

4.2.1 Household demographic and socioeconomic overview

The purpose of this section is to provide a brief demographic and socioeconomic overview of the 512 households in the first sample. Since this survey used random sampling techniques and relied on CSO census data, the results can be aggregated to present an accurate representation of the demographic and socioeconomic characteristics of the 505,385 households (with over 2 million members) in the three largest urban centers.

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

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

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

experi

Only 18

year.

purchas

for less

income

income

househ

perhap

househ

househ

househ

size, o

as pr

househ

of per

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

As might be expected given the diversity of urban areas, reported household cash incomes exhibited a tremendous degree of variation. Average monthly household cash income was Z$865 per month. However, the distribution is right-skewed: relatively few households with very high incomes raise the average considerably. Due to this skewness, perhaps a better measure of central tendency is the median. The median monthly household cash income was Z$550 per month. Complete income data was obtained for 422 households, with 90 households unwilling or unable to provide complete information on household income.

To facilitate analysis, the sample households were divided into five groups of equal size, or quintiles, according to per capita household income. The income quintiles derived are presented in Table 11. Average monthly expenditures on foodstuffs were Z$281 per month, with a standard deviation of Z$206. The average food share for all urban households was 35 percent of income. However, per capita food expenditures as a percent of per capita household income vary according to income group. Table 12 shows how significant this difference is. The bottom 20 percent (in terms of income) of the urban population spent over half their income on food, while the top 20 percent spent only 23 percent of their income on food.

Table 11: Derivation of income quintiles from per capita monthly household cash income

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

Source: Survey data

Table 12: Expenditures on foodstuffs, by income quintiles

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

Source: Survey data

Only 4 percent of household heads were described as "unemployed." Although this figure appears very low, previous studies of the informal sector in Zimbabwe have shown that most urban dwellers cannot "afford" unemployment and therefore, if no other options are available, obtain low-paid and/or part-time jobs in the informal sector are sought. Average educational level of household head was 8.1 years, about equivalent to completing Form 1. The "primary food purchaser" (often a different person than the household head) had a educational level of 7.9 years.

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

4.2.2 Maize purchasing habits

All households selected in the survey sample were asked a screening question as to whether the household regularly purchased maize-meal for itself. Just over 3 percent of households did not regularly buy maize meal and replacements were randomly selected. Average household maize meal requirements for households that buy maize meal, as determined by the household, are 30.5 kgs per month. With an average household size of 4.4 members, this translates to 7 kgs per household member. Since this survey covered about 75 percent of the urban population (505,385 households) and since 3 percent of the urban population bought no maize meal, the total annual maize meal requirement of this portion of the urban population (i.e. Harare, Chitungwiza, and Bulawayo) is 179,420 tons. If the survey results are assumed to be representative of the remaining 25 percent of the urban population (i.e. residents of cities that were not covered in this survey), total annual

maize meal requirements are 240,820 tons. If this annual maize meal requirement is consumed as roller meal, the roller meal extraction rate of 85 percent implies that 283,320 tons of maize grain are required to meet total urban annual requirements.

Naturally, these figures only represent maize meal requirements consumed within the households. Household members very often consume maize meal outside the home, from urban "lunchtime" vendors, at school and at workplace canteens. Due to the great difficulties in quantifying maize meal outside the home, usually purchased in prepared form, this survey only examined in-home consumption.

At the time of the survey (June/July 1993), roller meal remained the dominant type of maize meal consumed in urban areas, with two-thirds of all households consuming it. Yet the consumption of straight-run has grown dramatically since early 1992. As presented in the previous chapter, in early 1992, it was estimated that from 5 to 8 percent of urban consumption needs were met by straight-run meal. However, 18 months later, in June/July 1993, this survey found that 27 percent of urban households were consuming straight-run meal. Over 93 percent of those consuming straight-run in mid-1993 cited "cheaper/saves money" as the primary reason for consuming it. The removal of roller meal subsidies in June 1993 caused a significant change in relative prices between roller meal and hammer milled straight-run meal, inducing many consumers to switch to straight-run meal. Also, since real incomes have fallen over the past two years, more consumers are investigating cheaper ways of procuring maize meal, such as procuring maize grain and having it milled for a fee at a local urban hammer mill.

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

The two largest companies have a very large market share of the purchased maize meal market. As Table 13 shows, 92 percent of maize meal purchases were of products of these two companies. Only 4 percent of purchases of bagged maize meal were from small-scale production millers. This indicates that despite the increasing growth and expansion of small-scale millers, production millers have not yet gained a significant share of the purchased maize meal market.[1]

Table 13: Comparison of market share of large-scale commercial and production millers

Company	Market Share
Company A (large-scale miller)	57
Company B (large-scale miller)	35
Company C (large-scale miller)	4
All production millers	4

Source: Survey data

Large supermarkets near home were cited by 44 percent of respondents as the type of shop where maize meal was purchased during the previous month. Small grocery stores near home accounted for 43 percent of purchases. Just over 9 percent purchased their maize meal from tuck shops.[2] When asked their reason for buying at a particular shop,

---

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

[2] Tuck shops are small vendors occupying semi-permanent structures very close, and often adjacent, to residential homes. They are largely unlicensed and offer a limited range of food staples and snacks.

about 8

of lowe

respond

less cor

service

21 minu

or taxis

at the s

percent

satisfac

I

250 cus

urban p

bagged

bags mo

favored

size ava

14 perc

they w

usually p

high-den

about 81 percent cited "near home." A further 8 percent chose a particular shop because of lower prices, while 5 percent chose the shop because of service provided (i.e. delivery).

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

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

Finally, most consumers tend to prefer to buy maize meal in larger bag sizes. Of 250 customers interviewed at urban hammer mills (a group with lower incomes than the urban population as a whole), 50 percent said that they bought 20 kg bags when purchasing bagged maize meal from a retail shop. A further 34 percent said that they bought 50 kg bags most often, with 13 percent buying 10 kg packages most frequently. Only 3 percent favored 5 kg bags the majority of the time. Until early 1994, 5 kg bags were the smallest size available from large-scale millers. Although 2 kg bags were introduced in 1994, only 12 percent of hammer mill customers interviewed in 1993 stated that there were times when they wished to buy a smaller amount of maize meal than 5 kgs.[3]

---

[3] A small production miller, seeking a niche market among very low-income household in certain high-density suburbs, was the first to introduce 1 and 2 kg bag sizes in October 1993.

4.2.3 T

S

meal in

meal is

of maize

The pric

with the

average

straight-

the large

course, a

grain, br

case of p

6.

S

in mai

popular

of the ri

cost of

preferab

income

nature

are mor

4.2.3 The decision to consume straight-run meal: a discrete choice model

Survey data shows that 27 percent of urban households were consuming straight-run meal in June/July 1993. The low price of straight-run meal relative to store-bought roller meal is cited by 93 percent of respondents for the reason for this choice. An 18 kg bucket of maize grain can be purchased from informal vendors at many locations in urban areas. The price of a bucket of maize purchased from such vendors ranges from Z$15 to Z$20, with the lower price tending to prevail in June/July (immediately after harvest). With average milling charges of roughly Z$2.00 per bucket, the acquisition cost of 20 kg of straight-run meal ranges from Z$18.90 to Z$24.45. With a 20 kg bag of roller meal from the large-scale millers selling for Z$34.65, households can realize substantial savings. Of course, a true cost-accounting would have to incorporate the value of the time to procure grain, bring it to the mill, and the wait in the queue at the hammer mill versus the relative ease of purchasing roller meal at a local shop. Such calculations are presented in Chapter 6.

Survey data revealed that greater proportions of poorer consumers consume straight-run maize meal. About a third of the households in the bottom 40 percent of the population in terms of per capita income were consuming straight-run. Only 17 percent of the richest 20 percent were consuming straight-run. Table 14 presents a complete break-down of the type of maize meal consumed by income grouping. The cross-sectional data presented in Table 14 supports the hypothesis that straight-run maize meal has a negative income elasticity of demand, while other more refined types of meal have a positive income elasticity of demand. As incomes rise, urban consumers tend to consume less straight-run and more refined types of maize meal such as roller meal and super-refined meal.

Table 1-

Quinti
Quinti
Quinti
Quinti
Quinti
All con

Source:
* less th

decision

model

to cons

functio

genera

where

consta

simp

com

chan

Table 14: Maize meal consumption by type and by income quintile

Income Quintile	Type of maize meal consumed (percentage of households)			
	Super-refined	Mudzvurwa	Roller meal	Straight-run
Quintile 1 (bottom 20%)	0	0	68	32
Quintile 2	1	0	66	33
Quintile 3	7	*	69	25
Quintile 4	6	*	73	21
Quintile 5 (top 20%)	13	0	70	17
All consumers	5	1	67	27

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

In order to quantify the importance of factors affecting an urban household's decision to consume straight-run meal, a discrete choice model was estimated. In the probit model specified here, the dependent variable reflects the binary choice to consume or not to consume straight-run meal. The probit model uses the cumulative normal distribution function, an S-shaped curve that satisfies dichotomous choice probability models. The general specification of the model is:

$$P(Y_i=1) = \Phi(\alpha+\beta X_i)$$

where $P(Y_i=1)$ is the probability the dependent variable Y equals one for case i, α is a constant, β are the parameter estimates for each of the X_i explanatory variables. The Φ is simply the standard normal cumulative distribution function.

The specification of the model includes four explanatory variables: household income, household size, distance in minutes to the nearest hammer mill, and the degree of urbanization of the household represented by the number of months the primary food purchaser has lived in a large urban area. In initial specifications of this model, a variable for "amount of maize grown on urban plots" was included as an explanatory variable. However, two concerns subsequently arose: either (1) there was the possibility that urban maize production was endogenous to the model, which would lead to biased parameter estimates and (2) in a broader sense, there were persuasive arguments that urban maize production was not an appropriate explanatory variable for straight-run meal consumption. To test for endogeneity of urban maize production the testing procedure outlined in Rivers and Vuong (1988) and Blundell and Smith (1989) was carried out. The null hypothesis that urban maize production was endogenous to the model was rejected. There are further intuitive reasons to reject the inclusion of urban maize production in the model all together. First, 99 percent of straight-run meal is ground on a service milling basis: urban consumers bring grain to a hammer mill and pay a fee for it to be ground. There are a number of sources for maize grain including own-production on urban plots, maize inflows from rural family plots, gifts or purchases from neighbors, or purchases from urban vendors. Thus obtaining maize grain is ultimately almost perfectly correlated with consuming straight-run meal and an incorrect explanatory variable. The final model did not include urban maize production. The results of the model are shown in Table 15.

Table 15: Probit model of the decision to consume straight-run meal

Dependent Variable (Y) = "DOES HOUSEHOLD CURRENTLY CONSUME STRAIGHT-RUN MAIZE MEAL" (0=no, 1=yes)			
Explanatory Variables		**Coefficient**	**T-statistic**
C	Constant	-0.4547059	2.65
INCOME	Household income (in dollars)	-0.0002146	2.28**
HHSIZE	Household size (number of members)	+0.0807391	2.66**
DIST	Distance to nearest hammer mill (minutes)	-0.0050134	1.90*
URBAN	Years lived in urban area	-0.0010289	2.15**

Log likelihood = -225.17
Cases where Y=0 is 298
Cases where Y=1 is 107

** denotes significant at 5 percent level
* denotes significant at 10 percent level

The likelihood ratio statistic for the null hypothesis that $\beta=0$ is 17.35. The χ^2 critical value for 4 degrees of freedom and $\alpha=.01$ is 13.28. Therefore the likelihood ratio test rejects the hypothesis that $\beta=0$ and the model parameters are retained.

The coefficient on household income (INCOME) is negative as expected with a significant coefficient at the .05 level. As income goes up, the probability of consuming straight-run meal declines. This result provides additional support for the hypothesis that straight-run meal has a negative income elasticity of demand. The sign on household size (HHSIZE) is positive and the coefficient at the .05 level. The positive sign on household size corresponds to the hypothesis that larger households are more likely to have a member that has time available to visit a hammer mill and wait in line to have their grain milled. An alternative model with income expressed in per capita terms yielded a significant negative parameter estimate for income, although HHSIZE became insignificant. Distance to the nearest hammer mill (DIST) also has the expected sign: the greater the distance to the nearest mill, the less likely the household is to consume straight-run meal. However, DIST is only significant at the .10 level. Distance to mill, by offering the time costs associated with hammer milling, provides a good proxy of the relative ease of access to straight-run meal of each household. The ideal proxy for access would be the difference in time between procuring packaged refined meal from a shop and having own-grain hammer milled. Unfortunately, the consumption survey only elicited distance to local shop for households that had actually purchased packaged refined meal, whereas "distance to nearest hammer mill" were collected for all respondents.

The coefficients derived from this model can be used to predict the decision of a household to consume straight-run meal given the household income, size, and distance to mill. A summary of the predictive ability of the model is presented in Table 16.

Table 16: Summary of results for the probit model of the decision to consume straight-run meal

		PREDICTED VALUES		
		$Y_i = 0$	$Y_i = 1$	Total
ACTUAL VALUES	$Y_i = 0$	220	78	298
	$Y_i = 1$	67	40	107
	Total	287	118	405

Although such summaries are one measure of goodness of fit, care should be taken in inferring poor performance when comparing predictions of the estimated model with the naive model (Y_i=0). Greene (1990) reminds us that the maximum likelihood estimator is not chosen in order to maximize a fitting criterion based on prediction of Y as in the classical regression model, rather obtaining good parameter estimates may be a preferable estimation criterion.

In some dichotomous choice models, the presence of sample selection bias can suggest further refinements to the model. For example, Heckman's two-step estimation procedure or double-hurdle models can be used to correct for sample selection problems. However, since the survey from which this data was derived occurred after major policy changes in mid-1993 which decontrolled maize movement into urban areas, access to maize meal was no longer restricted by law and, therefore, no sample selection problem exists. Of course, access to straight-run meal may have differed across individual respondents as distance maize grain or hammer mills varied across the sample. To account to differential access based upon travel time, the explanatory variable on "distance to a hammer mill" was included in the probit model. Data for this variable was available for all respondents.

4.2.4 Urban maize production and transactions

Urban maize production and rural-urban maize transactions are an important component of urban food security. By all accounts, maize production on small urban plots grew dramatically from 1990/91 to 1992/93. Although many residents grow maize in small, backyard plots, the bulk of urban-produced dried maize grain comes from maize grown on vacant land (often owned by the municipality) within urban areas. Prior to 1992, municipal authorities discouraged maize growing on municipal land and engaged in active campaigns to destroy urban maize plots. Open-land maize cultivation in urban areas was said to lead to silting of dams, especially when maize was planted near stream banks, and some city authorities claimed urban maize fields provided a refuge for illegal activities. Drakakis-Smith (1991) argues that informal cultivation is often inconsistent with the image of a modern city that authorities in developing nations wish to convey to the outside world. Whatever the case, with the drought-induced nationwide failure of the 1991/92 maize crop, attitudes of municipal authorities shifted and, under most circumstances, urban maize cultivation was allowed through the 1993/1994 growing season. Some municipalities publicized informal guidelines regarding urban maize plots on vacant land. For the 1993/94 growing season, virtually all suitable vacant land in areas adjacent to high-density suburbs was planted with maize. Obtaining maize from own household or relatives' plots in rural areas was also an increasingly widespread practice after the 1992 drought.

According to the survey data, 47 percent of all households received maize grain inflows during the May 1992-June 1993 period. Grain inflows came from a number of sources. As Table 17 shows, over half of grain inflows by volume were from urban household production.

Table 17: **Volumes of household grain inflows by source, May 1992 through June 1993**

Source	Percent of total volume of inflows
Own household urban production	57
Gift from rural person(s)	15
Purchased in urban areas	12
Own household rural production	10
Purchased in rural areas	4
Gift from urban person(s)	2

Source: Survey data

Thirty-five percent of urban households said that they grew maize in urban areas during the 1992/93 growing season. Of these, 38 percent exclusively harvested fresh maize on the cob (green mealies) and did not dry grain for later milling. Of households that grew maize on urban plots, dried maize grain for later milling and were able to estimate their total production, the average urban maize grain production was 154 kilograms. For the typical household of 4.4 individuals, this translates to slightly over five months' supply of straight-run meal.

Interestingly, of those households consuming straight-run meal, only about 40 percent said they grew maize on urban plots. The rest relied on inflows from rural areas, gifts, or rural or urban purchases. Non-commercial rural-urban maize transactions are a significant source of maize for straight-run meal, accounting for 25 percent of all inflows. Only 16 percent of transactions were outright purchases.

Due to the paucity of grain during the 1992/1993 drought months, 73 percent of maize inflows occurred in the four month period March to June 1993. Over 80 percent of urban market transactions (purchases in urban areas) occurred during this three month period. Furthermore, the amount of maize purchased from urban traders in May 1993 was more than in the previous 12 months combined. Although total amounts of maize purchased from vendors in urban areas was still small in mid-1993, urban maize markets had begun to develop where none had existed before.

4.3 Estimation of potential demand for alternative maize meal products

An analysis of the consumer preferences for different types of maize meal is presented in this section. The analysis centers on the willingness of consumers to substitute

either white straight-run meal or yellow roller meal for white roller meal, the dominant product in the market in mid-1993. The section ends with an investigation into the relative values consumers attach to different characteristics of maize products.

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

In 1992, when these surveys were first proposed, the widespread preference for refined maize meal was thought to be particularly strong in urban areas. The Commercial Millers' Association, in a 1992 press statement on maize meal pricing noted that "straight-run meal is an unsophisticated, unrefined product which normally sells at a price lower than that for roller meal ... as this product has never been popular its demise is no great loss ..." Clearly, roller meal was the dominant product on the market. In late 1991, roller meal had 83 percent of the purchased maize meal market, with super-refined maize meal estimated to have the remaining 17 percent (Liddell, 1992). A negligible amount of straight-run meal was produced by commercial millers in 1991. By February 1992, with the trebling of the roller meal subsidy, straight-run meal production by commercial millers stopped completely. A complete description of the maize meal products produced in Zimbabwe is presented in Table 18.

Yet even in 1991, a number of urban consumers consumed straight-run meal, primarily by bringing their own maize to urban hammer mills and having it ground for a fee. Surveys of small-scale urban hammer mills in Harare in early 1992 presented in the previous chapter revealed that 8 percent of the city's maize meal requirements were being processed by custom mills. Thus, a plausible hypothesis is that straight-run meal consumption was constrained by grain movement restrictions which limited urban households' access to maize grain. Due to movement restrictions, the only source of maize grain for milling was urban production or illegal inflows from rural areas.

Table 18: Types of maize-meal produced in Zimbabwe[a]

Type of meal	Description	Extraction rate	Produced by	1993 Selling price per ton (Z$/mt)
Super-refined	The bran (hull) and germ are completely removed; meal ground from the endosperm.	65%	Large-scale and production millers	Z$ 2427
Roller meal	Most of the bran and germ are removed; meal ground mostly from the endosperm.	85% (large-scale) to 92% (production)	Large-scale and production millers	Z$1498-1751
Mudzvurwa	The bran is removed before being milled; the germ and endosperm are retained.	90%	One production miller	Z$1751
Straight-run	Meal processed from the whole maize kernel; the bran, germ, and endosperm are retained.	98%	Custom millers	GMB selling price of Z$1106 plus Z$120 milling fee = Z$1226

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

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

4.3.1 Straight-run meal: estimates of potential demand

The prevailing "conventional wisdom" about consumer maize meal preferences, that consumers strongly prefer the more refined white maize meals, has persisted because it does have some factual basis. The majority of consumers do prefer refined white maize meal if price is explicitly excluded as a factor in the decision-making process as shown in Table 19.

Table 19: Consumers preferences by meal type[a]

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

Source: Survey data
[a] Assuming all prices are equal and all products are packaged in plastic

For example, when respondents were asked what type of maize meal they would buy to meet household needs if all prices were the same and all products were packed in plastic, a total of 69 percent of consumers said they would buy one of the more refined types of maize meal.

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

In the previous section, survey results were presented to show that 27 percent of consumers were consuming straight-run meal in mid-1993. When these consumers were asked about their preferences by type of maize meal, only 35 percent said that they actually prefer straight-run. The rest of the respondents said they would, if possible, prefer to eat a more refined type of maize meal. Thus, many households appear to be consuming straight-run meal because of its price advantages, not because it is most preferred. Lower income consumers of straight-run meal are less likely to say that they prefer to eat straight-run rather than other types of meal, while higher income consumers of straight-run are more likely to prefer straight-run meal. Table 20 shows the preferences of straight-run consumers broken out by income quintiles.

Similar questions were asked of roller meal consumers. Table 21 shows the preferences of consumers that currently eat roller meal. Over half both eat and prefer roller meal. Twenty-two percent consume roller meal but would prefer super-refined. Surprisingly, 15 percent of roller meal consumers actually prefer straight-run. It is possible that this group of consumers did not consume straight-run meal because the cash outlays

Table 20: Preferences of consumers of straight-run meal for alternative types of maize meal

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

Source: Survey data

Table 21: Preferences of roller meal consumers for alternative types of maize meal

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

Source: Survey data

and opportunity cost of time involved in procuring grain and visiting a hammer mill was higher than the cost of purchasing roller meal in urban shops.

Yet a true analysis of the prevailing conventional wisdom must consider that straight-run, if available as a comparably bagged product at an urban shop, would sell for less than roller meal. That is, although consumers prefer the more refined types of maize meals, a more relevant question is the potential demand for straight-run meal when available at a certain specified price discount. Consumer preferences may be exogenous, but actual consumer choices depend upon relative prices and the consumers' income. One can distinguish between a "preference" for one commodity over another versus a consumer's "choice" when faced with a set of relative prices and a budget constraint. Although two-thirds of consumers prefer the more refined maize meals, a more relevant policy question is the demand for straight-run at a specified price differential between straight-run and roller meal. The survey sought information on potential demand at different prices to answer this question.

The potential demand for straight-run meal was estimated using contingent valuation techniques. The 512 respondents to the consumption survey were given a hypothetical scenario and asked if they would purchase a specified "target" commodity at a particular price. In this market simulation, the target commodities under investigation (such as straight-run meal or yellow roller meal) were referenced against the existing uniform product prices of white roller meal or white super-refined. The target commodity was offered to consumers in an iterative bidding process with pair-wise comparisons. If the target commodity offered to the respondent in the pair-wise comparison was refused, the price of the target commodity was lowered until the respondent stated they would purchase it. If the respondent agreed to purchase the target product at the first price, the price was raised until the respondent refused to purchase it. In either case, the maximum WTP by the respondent was obtained for the target commodity. In all cases, it was explained that both products were packed in plastic and available at the same shop.

Determining how quantity demanded changes with price is analogous to deriving a demand curve for a product. The responses to the WTP questions are treated as consumption decisions under different market prices. To derive a market demand curve for straight-run meal, the sample data was aggregated using 1992 CSO population data. An OLS regression equation was then estimated with the hypothetical market demand data. Quantity of straight-run meal demanded was expressed as a function of the price difference between roller meal and straight-run and a constant. Since the price of roller meal is fixed, the resulting equation is the demand function for straight-run conditioned on the existing uniform price of roller meal.

Table 22: Regression results of demand for straight-run conditioned on the price of roller meal

QUANTSR = 70.517 + 335.721 PDIFF

T-statistics significant at .01 level
Adjusted R-squared = .88

where:

QUANTSR	=	The quantity of straight-run meal demanded by all urban consumers (in thousands of metric tons per year)
PDIFF	=	The price difference expressed in percentage terms white roller meal and white straight-run meal = ((roller price-straight-run price)/roller price).

This demand equation implies that a one percent increase in the price differential between a 10 kg bag of roller and straight-run will result in an increase in urban demand for straight run of about 3,350 tons. Therefore, the equation can be used to calculate the amount of straight-run demanded at any price differential. For example, if straight-run meal were sold at Z$15.00 per 10 kg bag, while roller meal continued to sell for Z$17.45, the price difference in percentage terms would be 14 percent. Using the demand function estimated here, straight-run meal demand would be 117,650 tons, or 49 percent of total urban maize meal demand.

Of course, this model does make two important assumptions. First, the model may be inaccurate for extremely large price changes. Second, since the respondent was limited to choosing between packaged straight-run or packaged roller meal from a shop, actual purchases of pre-packaged straight-run might not be as high as implied here. Naturally, a proportion of consumers might continue to procure their own grain and have it hammer milled rather than buy straight-run from the shops, even if packaged straight-run were available. Such consumers would be consuming straight-run, but might not enter the market for purchased and bagged straight-run meal. Yet the model does offer evidence that, if the market price of packaged straight-run meal or effective price of hammer-milled straight-run from own-grain (i.e. the price of straight-run after factoring the opportunity cost of time involved in hammer milling) is below that of roller meal, demand for straight-run is large.

Lastly, an OLS regression was run with a log-log specification to attempt to estimate the price elasticity of demand for straight-run maize meal. Unlike most elasticity estimates, since this estimation used the price-quantity relationships generated from responses to hypothetical price scenarios, it does not represent observed changes in demand. Rather it represents expected changes in consumer demand at various price levels based on the market simulations. The results are presented in Table 23.

Table 23: Price elasticity of demand for straight-run meal

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

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

4.3.2 Yellow maize: estimates of potential demand

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

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

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

The same method used to measure the potential demand for straight-run was applied to yellow maize. Consumers were given a hypothetical scenario and asked if they would switch from white roller meal to yellow roller meal at a particular price differential. Prices were altered until the maximum WTP to pay was located. After converting the survey data to price-quantity relationships for the entire population, a hypothetical demand curve was estimated. The demand for yellow roller meal was expressed as a function of the price difference between white and yellow roller meal. The resulting equation was:

Table 24: Regression results of demand for yellow roller meal conditioned on the price of white roller meal

QUANTYEL = 31.543 + 294.290 PDIFF

T-statistics significant at .01 level
Adjusted R-squared = .93

where:

QUANTYEL	=	The quantity of yellow roller meal demanded by all urban consumers (in thousands of metric tons per year)
PDIFF	=	The price difference expressed in percentage terms white roller meal and yellow roller meal = ((white price-yellow price)/white price).

The results indicate that a one percent increase in the price differential between white roller meal and yellow roller meal will result in an increase in quantity demanded of yellow roller meal of about 2,943 tons. Within a given price differential (and within the range of sample prices), the equation can be used to calculate the amount of yellow maize meal demanded. For example, if yellow roller meal were introduced at a retail price of Z$15.70, given a pair-wise choice, 25 percent of consumers would switch to yellow roller meal. A comparison of this equation with the one derived for straight-run meal reveals that consumers are less sensitive to the degree to which the meal is refined (i.e. roller versus straight-run meal) than to changes in the color of the meal. That is, consumers are willing to switch from white roller meal to white straight-run at a relatively lower price differential compared to the switch from white roller meal to yellow roller meal. By looking at the intercepts, one can see that if there was no price differential, over twice as much straight-run would be demanded than yellow roller meal in pair-wise comparison with white roller meal.

Finally, a similar OLS regression to the one for straight-run meal was used to attempt to estimate the price elasticity of demand for yellow roller meal. Again, unlike most elasticity estimates, this estimation does not use observed changes in demand, but instead uses expected changes in consumer demand at various price levels based on the market simulations. As expected, demand for yellow roller meal is also somewhat price elastic, since there are close substitutes for yellow roller meal. The results are presented in Table 25.

Table 25: Price elasticity of demand for yellow roller meal

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

The price elasticity of demand was estimated to be -1.8 which implies that a one percent decrease in the price of yellow roller meal will increase consumption by 1.8 percent. Again, high elasticity estimates may merely reflect the number of close substitutes for yellow roller meal. However, the caveat of Bishop and Heberlein (1980) is worth repeating. They found significant underestimates of the maximum WTP for non-market goods due to divergences between people's expressed attitudes and actual behavior. If such underestimates held for a market good such a yellow roller meal, the price elasticities estimated here might be higher than actual elasticity values.

4.3.3 Preferences for alternative maize meal attributes: a conditional logit model

Economic theory usually takes tastes as given; consumers possess static preferences and simply allocate budgetary resources to purchase goods which provide the greatest satisfaction. According to the traditional notions of consumer behavior, consumers receive utility from goods and their choices represent the implicit ranking of alternative goods. Some modern theories of consumer behavior deviate from traditional notions of consumer behavior. For example, Lancaster (1971) argues that people choose to consume a particular good because of the attributes of that good rather than the good itself. In this case, the choice to consume a particular type of maize meal can be viewed as based on a complex set of product characteristics, including product price, acquisition time, grain color, degree of "refinedness," and packaging and presentation.

In the marketing and resource economics literature, several techniques have been used to quantify product attributes, including conjoint analysis, goal hierarchy tests and discrete choice models. For this analysis, a conditional logit model is specified to analyze potential consumer demand for alternative maize meal products. This approach is similar to the one used by Beggs, Cardell and Hausman (1981) to gauge the potential demand for electric cars. By defining maize meal products as a bundle of underlying attributes, a discrete choice model can be used to estimate consumer valuations of these attributes. The potential demand for a new good can also be forecast using the estimated coefficients.

Following Greene (1990), the standard multiple choice model is based on the *i*th consumer faced with *J* choices of maize meal. The vector of attributes for each element in the consumer's choice set is denoted by x_{ij}. The utility of choice *j* is represented by:

Faced v

U_k is th

choice

evalua

used.

terms

McFad

expres

which

proba

mode

prod

requ

thus

simu

set.

$$U_{ij}=\beta x_{ij}+\epsilon_{ij}$$

Faced with J choices, if the consumer chooses a particular alternative, say choice k, then U_{ik} is the maximum among the J utilities. The model then depends on the probability that choice k is made:

$$\text{Prob } (U_{ik} > U_{ij}) \text{ for all other } j \neq k$$

The next step is to choose the distribution of the error term. To avoid the evaluation of multiple integrals dictated by a probit specification, the logit specification is used. If Y_i is a random variable indicating the choice made by individual i and the J error terms are independently and identically distributed with Weibull distribution, then following McFadden (1973) and Greene (1990), the probability of the choice made being k can be expressed as:

$$Probability[Y_i=j]=\frac{e^{\beta x_{ij}}}{\Sigma_j^8 e^{\beta x_{ij}}}$$

which is the conditional logit model. The estimated model will provide a set of probabilities for each of the maize meal choices based on attributes x_{ij}.

To overcome the lack of actual market data and to estimate the conditional logit model presented above, hypothetical ranked preference data for alternative maize meal products were collected during the consumption survey. Such a data collection exercise required: (1) a set of maize meal choices with the attributes of each choice described and illustrated on a showcard; and (2) the alternative chosen by each respondent in the simulation or, as an extension, the complete rank ordering of all alternatives in the choice set. In this experiment, five different attributes of maize meal were tested. The five attributes and their levels were: 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), distance traveled (two levels, 5 minutes and 30 minutes), and packaging of the product (two levels, packaged and not packaged).

In order to limit the necessary number of showcards, an orthogonal main-effect plan described by Addelman (1962) and Green (1974) was selected. Orthogonal main effect plans were developed for making uncorrelated estimates of main effects during asymmetrical factorial experiments. An orthogonal design assumes that there are no interactions among the attributes, meaning that a consumer's utility from walking a short distance to get maize meal is independent of the color of the maize grain. In this experiment, the asymmetry arises since the attributes (factors) do not all have the same number of levels; instead the attributes and levels form a $4 \text{ X } 2^4$ factorial design. Thus, an orthogonal design overcomes the problem of needing 64 showcards to investigate the five attributes in the $4 \text{ X } 2^4$ factorial design. With an orthogonal design only 8 showcards were required.

The basic data collection strategy was to offer consumers eight different possible choices of maize meal. The showcards detailing the eight choices, based on an orthogonal design, appear in the Appendix. Each of the eight choices has a particular level of one of the five attributes. Consumers first rated the eight choices from 1 to 7, with a rating of 7 denoting the most preferred. Any showcards which received an identical rating were presented again and the respondent was asked to further rank the identical showcards. These choices were then coded from 1 to 8 to provide a complete ordered ranking for each respondent. In the simplest version of the model, the highest ranked choice of each respondent was coded 1 and the seven remaining card choice were coded 0 to obtain the binary dependent variable. Each of the five maize meal attributes were included as explanatory variables. The results of the conditional logit model are presented in Table 26.

Table 26: Estimates from the conditional logit model for alternative maize meal choices

Dependent Variable (Y) = Alternative maize meal choices (J) represented by showcards			
Variables		**Coefficient estimates**	**Normalized coefficient estimates**
PRICE	Price of 10 kg of maize meal (Z$)	-0.15452 (9.19)*	-1
DIST	Distance travelled (in minutes)	-0.013807 (2.36)*	-0.089
COLOR	Color of the meal (0=yellow, 1=white)	1.2410 (8.48)*	8.031
PACK	Dummy variable for whether product is packaged (0=no, 1=yes)	0.72321 (4.94)*	4.680
SUPER	Dummy variable for super-refined meal (0=no, 1=yes)	-0.17533 (0.87)	-1.135
ROLLER	Dummy variable for roller meal (0=no, 1=yes)	0.20272 (1.03)	1.312
MUDZ	Dummy variable for mudzvurwa (0=no, 1=yes)	-0.42176 (2.21)*	-2.729
Log likelihood = -779.27 Number of observations = 490 * denotes significant coefficient at .05 level			

Table 26 shows the estimated probability associated with the different attributes and can be further used to predict the probability of consuming a particular type of maize meal. As they are presented here, however, the coefficient estimates are weights associated with the attributes presented in the choices. To obtain a standard of comparisons and draw policy interpretations, all coefficient estimates were normalized on the price coefficient by dividing each coefficient estimate by the price coefficient. Dividing by the price coefficient essentially transforms the coefficient into a marginal implicit price.

The sign on PRICE is negative as expected. Since PRICE is used as the numeraire, there is no normalized coefficient estimate. DIST, the distance travelled in minutes to purchase maize meal, is negative as expected and significant at the .05 level. The normalized coefficient of 0.089 per minute of travel translates to a per hour figure of 5.36. This implies that the consumer is willing to give up Z$5.36 to avoid one hour of travel time. This figure can be viewed as an estimate of the opportunity cost of time of procuring maize meal. In Chapter 6, this figure and other estimates of consumers' opportunity cost of time are used to inform the continuing development of alternative maize marketing channels. The variable COLOR shows a significant, positive and strong effect. To the typical consumer, a switch from yellow to white is "worth" Z$8.03 per 10 kg bag. Analysis is presented later in this chapter regarding variations in consumer demand for yellow maize across different income groups. The parameter on PACK also shows a significant and positive effect of considerable magnitude. Given a choice between purchasing already ground maize meal that is unpackaged and packaged maize meal, the packaged alternative is valued Z$4.68 more than the unpackaged variety. However, in actuality, most consumers that consume straight-run do not purchase already milled maize. Rather they procure maize through own-production or purchase and have it milled on a service basis. Of the dummy variables for the various types of maize meal, only MUDZ was significant. MUDZ shows a significant negative sign, suggesting that *mudzvurwa* is a less preferred product than straight-run meal. ROLLER has the expected sign, indicating that roller meal is more preferred than straight-run meal. Of interest is the negative coefficient on SUPER. However, the extremely low standard error show the estimate not significantly different than zero.

Since the probability of a particular choice being made was earlier shown to be:

$$Probability[Y_i=j]=\frac{e^{\beta x_{ij}}}{\Sigma_j^8 e^{\beta x_{ij}}}$$

it is possible, based on the *ex-ante* valuations of consumer rankings, to predict the market share of alternative maize meal products. In this example, consumer responses from mid-1993 are used to predict the eventual market share for straight-run meal following the removal of roller meal subsidies and maize movement decontrol. In the "before" situation, the assumption is made that only two maize meal products exist: white roller meal and white super-refined meal, selling at government-set prices of Z$11.40 and Z$24.27 respectively. The "after" situation assumes that a new product, white straight-meal, is available with specified attributes. The predicted market share is estimated and then compared with the actual market share of straight-run meal in December 1993. Such an exercise provides an indication of the predictive power of the model, as well as having numerous policy applications.

Several assumptions were made about the attributes of the "new" straight-run meal product. First, based upon survey data, the average distance (in minutes) to make the trip to and from the mill and wait line at the mill is 74.35 minutes. This contrasts with the average distance to and from a retail shop to purchase packaged maize meal and time spent purchasing of 30.52 minutes. Second, the average price of straight-run meal was calculated as the sum of the acquisition price of grain plus the hammer milling costs. The acquisition price of grain reflected a composite of the average price paid for grain in urban markets and the opportunity cost of home-grown grain (the GMB buying price of Z$900 per ton). Finally, since the straight-run meal product was neither packaged nor sold loosely in bulk, an *ad-hoc* decision to use a packaging value of 0.5 was made. Although *ad-hoc*, this essentially values service milling of own-grain (where quality characteristics are known or can be monitored by the consumer) as mid-way between plastic packaging and bulk sales of loose meal. Such an assumption seems plausible since none of custom hammer mills that sell grain sell pre-ground meal, despite possible gains in milling efficiency: consumers appear to have a strong dislike for pre-ground, unbagged meal. Table 27 presents the predicted and actual market shares of the three types of maize meal, all available in late 1993, that were considered in this model.

Table 27: Actual market share of various maize meal products versus predicted market shares based on conditional logit estimates

Maize meal product	Actual market share (December 1993)[a]	Predicted market share from logit estimates
White roller meal	41 percent	48 percent
White straight-run	53 percent	41 percent
White super-refined	5 percent	11 percent

[a]Data on actual market shares from household survey data (Minot, 1994)

Using data from the expressed consumer preferences for the eight different showcards, the logit model predicts a market share of 41 percent, somewhat underestimating the actual December 1993 figure of 53 percent. While predicted demand for both types of refined maize meal are over-estimated, the error on super-refined is considerably larger. The general conclusion for this application is that the conditional logit model provides a relatively close, although not exact, estimate of potential demand. The advantage of such models is the relative ease of data collection. None of the maximum WTP questions inherent in contingent valuation approaches are required. Instead, all that need be done is for the enumerator to record respondents' relative preferences for various showcards. The estimation results can provide a good general indication of preferences for a group of similar products. Empirical evidence regarding consumer preferences can then often provide a counter-point to the prevailing conventional wisdom, helping to ensure that policy development is "market-driven" and reflects the demands of consumers.

4.4 Implications for targeting consumer food subsidies

Zimbabwe is faced with what Timmer et al. (1983) have termed a "food-price dilemma." That is, the GRZ is caught between the need to offer producers remunerative prices and the desire to assure both urban and rural consumers affordable food prices. Over the longer-term, as the effects of the removal of movement restrictions in June 1993 is felt, a network of private grain traders and small-scale hammer millers who can provide low-income consumers with a less expensive maize meal product should continue to develop.

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

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

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

1. Continue to encourage the consumption of white straight-run meal custom-milled at hammer mills.
2. Implement a "self-targeted" subsidy on yellow roller meal.
3. Implement a "self targeted" subsidy on yellow maize grain intended for custom-milling at hammer mills.

By excluding some portion of non-needy households, targeting improves the cost-effectiveness of subsidy schemes by reducing the degree of "leakage," ideally without sacrificing coverage to needy groups. However, the administrative costs of targeting increase as the targeting efforts to further reduce leakage intensifies. At some point, the increased administrative costs are greater than the cost savings from reducing benefit leakage to non-needy households. Identifying vulnerable households requires obtaining significant amounts of data on the economic and/or nutritional status of individual households as well as the administrative capacity to carry out the scheme. A general consensus exists that many nations lack these prerequisites for the continual collection of highly disaggregated information and the effective administration targeting of food subsidies (Rogers, 1989).

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

For effective self-targeting, there must be some degree of product differentiation so there is the possibility for significant diversity in the consumption patterns of different income groups. With only white maize meal products, product differentiation is limited. Availability of both yellow and white maize meal would effectively double the available options. Furthermore, at least one stage of the marketing system must be sufficiently centralized to allow a place to "attach" the subsidy. Yet subsidies are not always required to ensure that low-income consumers have access to an inexpensive maize meal product. As the next section demonstrates, select market liberalization measures can lead to the expansion of lower cost marketing channels and permit urban households to procure household maize meal needs at lower cost than in the "formal" system.

4.4.1 The growth of white straight-run meal consumption

On June 1, 1993, the removal of the roller meal subsidy boosted the retail price of roller meal 53 percent overnight. Yet six months later, many of the poorest urban consumers were, in effect, cushioned from the full impact of this price increase. To avoid paying high prices for store-bought roller meal, many consumers were able to procure their own white maize grain and bring it to one of many urban hammer mills for custom milling. The previous section describes the economic rationale for the growth of this behavior. In June/July 1993, when this survey was undertaken, 27 percent of urban consumers were consuming straight-run meal. Table 28 further demonstrates that consumption of straight-run meal was more prevalent in the lower income quintiles. About a third of the poorest 40 percent of urban population were eating straight-run versus only 18 percent of the richest 20 percent.

Table 28: Straight-run meal consumption, consumption prevalence and quantities consumed per capita by income group, May/June 1993

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

Source: Survey data

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

The growing reliance of the urban population on less-expensive straight-run meal only became a possible option with the removal of movement restrictions that limited access

[4] The Sentinel Surveillance Survey for SDA Monitoring

to maize grain in urban areas. In April 1993, following a good 1992/93 growing season, trading restrictions on white maize were effectively lifted throughout the entire country (GRZ, 1993). Anyone was permitted to buy and sell white maize without restrictions, with the exception of five major milling firms who were still required to purchase from the GMB. The GMB continued to operate as a residual buyer in all areas by defending the mandated floor and ceiling prices for white maize (GRZ, 1993).

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

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

The "success story" of straight-run meal consumption in urban areas in offering an alternative to higher roller prices has induced many observers to explore methods of further reducing the price of straight-run meal through some form of targeted subsidy. Table 28 demonstrates that straight-run meal is an inferior good-- as household income goes up, consumption of straight-run meal declines. When subsidies are considered, inferior staple foods are often good candidates since richer consumers voluntarily exclude themselves from the subsidy. Yet the major problem with implementing a subsidy on straight-run meal is determining where to attach the subsidy. If the subsidy were directed to the major large-scale millers and a handful of production millers only, the current producers of straight-run meal (small-scale custom mills) would be severely affected.

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

4.4.2 Yellow roller meal and self-targeting

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

The conventional wisdom is that there are strong consumer preferences for white maize meal products among all segments of the population. Indeed, survey results show that almost 89 percent of the urban population "strongly prefer" white maize meal to yellow maize meal. Yet an analysis of the price sensitivity of lower income consumers to the differential between white roller meal and yellow roller meal suggests that the conventional wisdom regarding yellow maize is too simplistic. In particular, at a given price differential, a significant proportion of consumers say they would switch from white to yellow roller meal in a "dual-option" simulation.

Given that households have the option of buying a 10 kg bag of white roller meal at Z$17.40, Table 29 shows the proportion of households in each income quintile that would shift from white roller meal to yellow roller meal at two hypothetical prices for a 10 kg bag: Z$15.10 (a 13 percent discount) and Z$12.85 (a 26 percent discount). As shown by Table 29, consumers in the lowest income quintile are much more likely to switch from white to yellow roller meal at a specified differential. When yellow roller meal is 13 percent lower than white roller meal, 32 percent of the poorest fifth would switch, while only 20 percent of the richest fifth would switch. This suggests that yellow roller meal has the characteristics of an inferior good.

Table 29: Percent of consumers by income quintile switching from white roller meal to yellow roller meal at a specified price: a dual-option simulation

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

Source: Survey data

Table 30: Average price at which consumers would switch from white roller meal to straight-run meal and yellow roller meal, by income quintile

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

Source: Survey data

This trend is further explored in Table 30 which summarizes the average prices at which consumers in the five income groups said they would switch. Lower income consumers are likely to switch with a smaller price differential than higher income consumers. Table 30 also provides a comparison between white straight-run and yellow roller meal. It is clear from the table that yellow roller meal is less preferred than white straight-run. Consumers need less of a price discount to induce them to switch from white roller meal to straight-run than to switch to yellow roller meal.

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

During the first five months of 1993, the Z$562 per ton roller meal subsidy cost Z$134.1 million, or at least Z$322 million on an annualized basis. Naturally the level of the subsidy depends on the quality of the harvest; with a poor harvest substantially more rural consumers buy roller meal. Table 31 shows what the annual cost of a roller meal subsidy of Z$562 would have been in previous years, had it been in operation. For example, assuming a good rainfall year (i.e. 1989/90), total roller meal sales of 326,199 tons in conjunction with a roller meal subsidy of Z$562 per ton results in budgetary outlays of Z$183 million per year.

Table 31 shows that national demand purchased maize meal varies from year to year depending on rural demand which is in turn dependent on harvest levels. However, urban demand for purchased roller meal is relatively constant; it is only in the past six months that straight-run meal from hammer mills has become widespread (i.e. 27 percent of consumption in June 1993). Based on survey data, total urban household maize meal requirements are estimated to be 240,820 tons. Assuming that 85 percent of consumers consume roller meal, the treasury costs of the urban portion of the roller meal subsidy would be roughly Z$115 million per year.

Table 31: Hypothetical cost of a Z$562 per ton subsidy in various agricultural marketing years

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

Source: Figures on maize sales to millers from GMB files

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

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

Although the GRZ policy of controlling retail maize meal prices ended in June 1993, the four large-scale millers have agreed on a set of recommended retail maize meal prices and have been relatively successful in maintaining these prices at the retail level. The August 1992 to May 1993 roller meal pricing structure and the current pricing structure are presented in Table 32. With a subsidy of Z$562, the final retail price of roller meal was Z$1140 per ton. With the subsidy lifted, treasury costs are currently zero, but consumers have seen a 53 percent increase in the price of roller meal.

Table 32: Comparison of 1994 roller meal pricing structure and roller meal pricing structure with roller meal subsidy[a]

	August 1992 to May 1993 (Z$)	June 93 to September 1994 (Z$)
GMB selling price per ton (a)	1070	1070
Maize milling costs (large-scale)		
Factory costs (b)	188	188
Mark-up (.2270 percent of a+b)	286	286
Distribution allowance	62	62
Ex-mill price (delivered to retailer)	1606	1606
(minus subsidy to large-scale millers)	(562)	---
Ex-mill price (delivered to retailer)	1044	1606
Retailer's margin (9 percent)	96	145
Final retail selling price (per ton)	1140	1751

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

Currently yellow maize is not being milled for human consumption. When domestic production of white maize became available in April and May 1993, some yellow maize meal was sold at a price discount. However, large-scale and production millers quickly switched completely to white maize for maize meal manufacture. There was little support from major millers for continuing to offer a yellow maize meal product at a price discount. One commonly cited problem was the very poor quality of the yellow maize that was available in the early months of 1993. Eventually most GMB yellow maize stocks were disposed of through: (1) swaps with commercial farmers of 1.16 tons of imported yellow maize for one ton of white maize; (2) sales to livestock producers and feed manufacturers at Z$880 per ton; or (3) re-exports of yellow maize at large losses.

The analysis presented here suggests, however, that a subsidy on yellow roller meal could be a much more cost-effective mechanism for protecting the poor than a blanket subsidy on white roller meal. Table 33 presents a pricing structure with a targeted subsidy on yellow roller meal. This example assumes a producer price of yellow maize of Z$720 per ton. Without any subsidy, the GMB selling price would be Z$890, reflecting a operating margin of Z$170. In this example, a subsidy of Z$170 is assumed, equal to the GMB margin. Therefore the GMB selling price for yellow maize would be Z$720.

Table 33: Roller meal pricing with a targeted subsidy on yellow roller meal of Z$170 per ton[a]

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

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

At a price of Z$15.10 for a 10 kg bag of yellow roller meal, Table 29 shows that about 23 percent of the population would switch to yellow roller meal when their other option is white roller meal at Z$17.40. The total cost to the GRZ would depend upon rural demand for purchased maize meal. However, the urban portion of the subsidy would amount to Z$20.9 million. This is far below the Z$115 million the urban portion of the white roller meal cost the GRZ.

Yet, even in the absence of a targeted subsidy, a lower producer price for yellow maize could also result in cost savings to consumers. Yellow maize producer prices might be lower than that of white maize either because of GMB pricing actions or deregulation of yellow maize pricing altogether. In either case, since historically yellow maize has yielded higher than white maize on commercial farms, the GRZ would not need to apply a subsidy, and there would be no treasury losses.

Table 34: Roller meal pricing assuming a lower yellow maize producer price to reflect yield advantages of yellow maize

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

The effects of a lower yellow maize producer price to reflect the yield differential on consumer prices is analyzed in Table 34. In this example, the 25 percent higher yields of yellow maize over white maize are assumed to lead to a lower producer price for yellow maize. With a producer price that reflected a 25 percent yield advantage of yellow maize, the GMB selling price for yellow maize would be Z$720. With a GMB margin of Z$170, the GMB selling price would be Z$890 (see Table 34). When given two options, Table 29 shows that about 23 percent of urban consumers would switch from white roller meal at Z$17.40 to yellow roller meal at the cheaper price of Z$15.10 per 10 kg bag. In this case, there is no subsidy and thus treasury losses are zero. The lower retail price of maize meal results from higher yellow maize yields and a lower producer price.

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

4.4.3 Yellow maize grain subsidy options

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

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

As discussed earlier, excluding the opportunity cost of time spent travelling and queuing, the cash price of 20 kg of straight-run meal ranges from Z$18.90 to Z$24.45[5] versus Z$34.65 for a 20 kg bag of roller meal manufactured by large-scale millers. For many households, the actual cash costs of maize grain are even lower. About a third of hammer mill customers planted maize on urban plots; maize grain was thus harvested and available for hammer milling with a minimum cash outlay. Also, 25 percent of respondents at hammer mills said that the maize grain that was brought to the hammer mill was from rural production or was a gift from rural relatives. Almost 79 percent of urban households receiving gifts of maize grain from rural relatives said that they had supplied these same rural relatives with maize grain or meal during the 1992 drought. Clearly, rural-urban and urban-rural transfers are an important part of both rural and urban household food security strategies.

The bottom line is that many urban consumers are obtaining white straight-run meal with relatively low cash outlay. Because of the growth of this low-cost option over the last

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

six months, the initiation of a yellow roller meal subsidy may not induce the proportions of consumers predicted in Section 4.3 to switch to yellow roller meal. Even at a subsidized price of Z$12.82 for a 10 kg bag, yellow roller meal may still be more expensive than the cash price of straight-run meal (i.e. the cost of buying maize grain from urban vendors and having it milled).

To test this possibility, the responses of consumers to 10 different maize meal options is presented in Table 35. Consumers were shown a card with 10 different products and their prices and asked to pick the product they would buy most often. Since not all of the 10 products on the card were available to consumers in June/July 1993, estimates were made of what the price would be if the product were manufactured.

As Table 35 shows, with white straight-run maize meal available at a shop (for Z$15.50) or hammer mill (for Z$13.75), relatively few consumers (7 percent) would be willing to pay slightly more (Z$15.70) for yellow roller meal when it is one of 10 options. That is, even though yellow roller meal is cheaper than white roller meal, consumers opt for one of the white straight-run meal products that are even cheaper.

The results from this multi-option simulation presented in Table 35 contrast somewhat with the results from the dual-option simulation presented in Table 29. Looking back to Table 29, when given a choice of only two options, one of which was white roller meal at Z$17.40, 23 percent of respondents said they would switch to yellow roller meal if it were 13 percent cheaper. Apparently, the inclusion of straight run meal at lower prices (Z$13.75 and Z$15.50) has drawn consumers away from yellow roller meal.

Table 35: Percentage of consumers choosing each type of maize meal product at specified prices in a multi-option market simulation

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

In Table 35, a total of 34 percent of respondents chose one of the white straight-run meal products. Therefore, the question is "how many of these respondents would switch to yellow roller meal if it were cheaper than white roller meal and white straight-run meal and they had multiple options?" That is, how does the dual-option simulation in Table 29 compare with the multi-option simulation when the price of 10 kg of yellow roller meal is 26 percent cheaper than white roller meal (i.e Z$12.82 not Z$15.70 per 10 kg bag) and the respondents have the other options (i.e straight-run meal).

Further market simulations along the lines of Table 35 with the same sample yielded an answer. In the multi-option simulation, when the price of yellow roller meal fell to Z$12.82, 42 percent of consumers said they would switch to yellow roller meal. When combined with the 7 percent of respondents that had already chosen yellow roller meal at

Z$15.70, the multi-option simulation predicts that 49 percent of consumers would purchase yellow roller meal if the price fell to Z$12.82. Therefore, at low prices, the multi-option simulation yielded the same results as the dual option simulation (49 percent versus 50 percent).

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

As a result, a third targeting option may be subsidizing the GMB selling price of yellow maize grain intended for human consumption. As Table 35 shows, when given multiple options, 7 percent of consumers chose the cheapest product: yellow straight-run at Z$12.25 per 10 kg bag. Simulation results show that at lower prices, even more consumers would switch to yellow straight-run.

However, as alluded to in Section 4.2, the highly decentralized nature of the straight-run meal production and marketing system would complicate the use of yellow maize grain as a self-targeted staple food. Again, given the highly decentralized nature of small-scale custom milling, allowing certain buyers to purchase yellow maize grain for milling as straight-run at a price discount could mean large leakages as grain is diverted to animal feeds.

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

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

In good rainfall years, abundant supplies of white maize may mean that demand for yellow maize grain is very low. Demand for low-priced yellow maize grain would most probably also vary seasonally, peaking when own or relatives' production is exhausted. Yet, in the event of a poor harvest, a yellow maize grain subsidy, albeit imperfect, is one low-cost way of protecting vulnerable households. Ultimately, any subsidy is vulnerable to leakage to non-needy groups. Even accounting for leakage to animal feed, a small yellow maize grain subsidy would cost less than the former roller meal subsidy. The previous analysis has shown that, at a price discount, some consumers (particularly low-income consumers) would be willing to purchase yellow maize meal. In the event that the subsidized price of yellow maize grain is still "too high" relative to white maize meal, the end result would be low consumer purchases, hardly a major policy failure.

4.5 Implications for the administration of drought relief

Empirical information on maize preferences can provide insights to improved management of food relief activities during periods of drought. This section provides an examination of the implications of consumer preferences and the structure of the grain marketing system on the design of drought relief programs.

4.5.1 Drought relief efforts during the 1991/92 season

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

Although drought relief and child feeding programs are an integral part of strategies to provide rural households with access to grain during drought years, not all eligible households which apply for drought relief supplies can be accommodated in the program due to fiscal constraints. In 1992, the number of households registering for drought relief but not receiving any allocations was quite substantial. In May 1992, only 46 percent of those registered for food relief were actually fed (Herald, 1992). Of those receiving drought relief, allocations were limited to 5 kg per person per month from September 1992 onwards. An earlier section established that average maize meal needs in urban areas, where presumably diets are more diversified and less-maize dependent than in rural areas, were about 7 kgs per person. As a result, many rural households found market purchases of maize a necessity. Despite drought-induced crop failure, rural households had access to cash income from sources such as remittances and non-farm income. Also many households resorted to sales of assets for cash to buy grain.

During the 1991/92 drought, for the large number of households dependent to some degree upon commercial purchases of maize-meal, the only source of purchased maize was roller meal. That is, with low production, little or no maize was marketed by producers, either through the GMB or through informal channels; virtually all output was retained on-farm. There was little or no whole maize being marketed in smallholder or peri-urban areas. Roller meal (and super-refined meal), manufactured from imported maize obtained from the GMB, was virtually the only form in which maize was available for purchase. From February 1992 to June 1993, a period which covers the time when the effects of drought were most severe, the GRZ greatly increased the subsidy on roller meal. As a result, a 50 kg bag of processed roller meal was cheaper than the price of a 50 kg bag of maize grain purchased by an individual from the GMB. The principal objective of the subsidy was to ensure that consumers had access to a low-cost source of maize-meal. However, the subsidy had two drawbacks:

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

2. The budgetary ramifications of the roller mill subsidy were enormous. As Section 4.4 explained, the roller meal subsidy cost the GRZ Z$464 million for the 17 months from January 1992 to May 1993.

4.5.2 Improving maize distribution in drought years

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

Evidence presented earlier in this chapter has shown the willingness of urban consumers to substitute straight-run meal for roller meal. Similarly, survey results show that many rural households would prefer to purchase either whole grain (which could be brought to a local hammer mill for custom-milling) or locally-milled straight-run meal from a retail shop, rather than buy roller meal. In May 1993, 300 rural households in five different provinces were asked what they would prefer to purchase if they ran out of their own production. Table 36 shows that 60 percent would purchase 10 kg of maize grain at Z$12 and have it milled at their local hammer mill. Only 12 percent said they would prefer to purchase roller meal at Z$17.50 per 10 kg when maize grain was available at Z$12.

Table 36: Rural household grain/meal purchasing preferences at specified prices

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

Source: Survey data/Probe Market Research

Interestingly, respondents under the age of 25 were twice as likely to prefer roller meal (20 percent) than were respondents over 25 years (only 10 percent). Since many consumers prefer straight-run meal which can be processed at low cost by small-scale hammer millers, one option for providing a low cost maize meal to low-income consumers without a subsidy would be to encourage the sale of maize grain, rather than roller meal.

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

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

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

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

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

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

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

have saved over Z$280 million.

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

Finally, contrary to statements by the large-scale millers, small-scale custom millers have the capacity to meet urban demand for maize meal under virtually all policy reform and weather scenarios. Surveys of custom millers in Harare and Chitungwiza have revealed that during the peak month of operation at each mill in 1993, the mean throughput of maize was 90 tons per month. If all 81 hammer mills were operating at their peak, 7,287 tons of maize meal per month could be processed.

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

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

4.6 Implications of expanded choice on nutritional status, agricultural productivity and food policy

The lower relative prices of straight-run and yellow maize meal can mean significant gains for consumers. Some of these gains are explored in Chapter 6. Yet the increased choices available to consumers occasioned by the introduction of new products also has implications for nutritional status of individuals, agricultural productivity, and resolution of certain food policy dilemmas.

4.6.1 Nutritional implications

By all measures, straight-run meal has greater nutritional value than roller meal or super-refined. All milling techniques used in the manufacture of refined maize meal remove much of the pericarp and germ, which are considerably higher in protein content than the endosperm. Straight-run meal contains 8 percent more protein, 17 percent more thiamin, 62 percent more riboflavin, 25 percent more iron, and 71 percent more calcium than moderately refined maize meal (i.e. roller meal). The nutritional differences between straight-run and super-refined meal are even more pronounced. Straight-run meal contains 20 percent more protein, 150 percent more thiamin, 100 percent more riboflavin, 127 percent more iron, and 100 percent more calcium than super-refined meal (West et al., 1987). Such evidence supports arguments that the deficiency of de-germed meal in a number of essential nutrients "could have serious repercussions on the diet of low-income groups in developing countries" (IL0, 1984). Furthermore, this survey provides some evidence that urban consumers place high value on maize meal products with "high nutrition." However, measuring the value consumers place on the commodity "nutrition" is inherently difficult: unlike "price" or "travel distance," there are no measures of nutrition levels that have a similar ease of comprehension. Consumers are much more likely to accurately assess the value to themselves of a 20 percent lower price, than a 20 percent higher thiamin content.

In order to provide a rough indication of such preferences, this survey used a "goal hierarchy" format in an attempt to gauge consumer preferences for different characteristics. Harmon et al. (1972) used this technique to evaluate the multiple "goals" (increase profits, increase leisure time etc.) that a farmer may seek. Six different characteristics were evaluated. The respondent was offered pair-wise comparisons and then selected which of the two characteristics was more important to them. The six different characteristics tested were: 1) white (not yellow) color; 2) high nutrition; 3) how refined the meal is; 4) low price, namely a 20 percent discount; 5) hygienic packaging; and 6) short distance to shop, namely a 10 minute travel time. From the survey results a frequency matrix was derived. The frequency matrix describes the proportion that chose a particular characteristic over another in a pair-wise comparison. Although the characteristics are somewhat qualitative, such comparisons can give a rough indication of the characteristics valued by consumers.

Table 37: Frequency matrix according to rank order of product characteristics

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

Source: Survey data

Table 37 suggests that of the six characteristics tested, two can be considered most important to maize meal consumers: high nutrition and low price. For example, from the table it is apparent that 61 percent of the population would prefer the characteristic "high nutrition" over the characteristic of white grain. Similarly, 69 percent of the population would prefer low price (20 percent discount) to "how refined" the meal is.

It is important not to draw too much from such qualitative comparisons. With a lack of uniform measures, "high nutrition" may be interpreted very differently by each respondent. Without quantitative measures of "fuzzy" characteristics such as nutrition, precise statements are impossible. What is clear, however, is that consumers do value nutrition as a characteristic and many may be willing to trade off other characteristics in order to get a nutritional maize meal product.

The preference for "high nutrition" in this simplified experiment must be contrasted against consumers' actual nutritional knowledge. The consumption survey revealed that exactly half of all consumers did not know that straight-run meal has more nutrition than roller meal or super-refined. Interestingly, knowledge of the nutritional advantages of straight-run meal was not correlated with radio ownership or educational level. However, consumers of straight-run meal were more likely to know of the nutritional advantages of straight-run meal than consumers of roller meal or super-refined.

Given the value consumers place on nutritional characteristics suggested by the frequency matrix, more widespread knowledge of the nutritional superiority of straight-run might significantly boost consumption, leading to at least a marginal improvement in nutritional status. This suggests that even wider acceptance of straight-run meal may be facilitated by a public relations campaign extolling the nutritional virtues of straight-run maize meal.

4.6.2 Implications for agricultural policy and productivity

Given potential consumer demand for yellow maize when offered at a price discount, there is scope for the resolution of two agricultural policy dilemmas exacerbated by the perceived preference for white maize. First, since during the past 7 years commercial plantings of yellow maize have had significantly higher yields than white maize, increased acceptance of yellow maize for human consumption could lead to productivity gains. Essentially, it would free resources currently allocated to white maize to the production of alternative crops. Second, the belief that consumers' would not choose to consume yellow maize even when available at a price discount leads the GRZ to pursue a food self-sufficiency policy at all costs. An emphasis on food self-sufficiency may lead to inefficient allocation of productive resources. Consumer acceptance of yellow maize at a price discount could provide the GRZ with greater flexibility in the pursuit of its food policy objectives.

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

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

Naturally, if research efforts on improved white maize hybrids lead to the development of white maize varieties that can out-perform existing yellow maize varieties, any efficiency gains will be transitory. However, even with such developments, there may still be scope for yellow maize as a subsidized self-targeted staple grain should the GRZ find the reintroduction of consumer maize meal subsidies a necessity.

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

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

In essence, the large differential between export parity and import parity helps create these policy dilemmas. Surplus maize production places a strain on GRZ fiscal resources due to limited export opportunities. High transport costs to overseas markets and protectionist agricultural policies in Europe and North America limit the scope for overseas exports. Regional markets in white maize are limited since the occurrence of bumper harvests generally tends to coincide in the region. When maize producers in Zimbabwe experience good harvests, most producers in neighboring countries do as well. Limited consumer acceptance of yellow maize would provide the GRZ with greater flexibility in the pursuit of its food policy objectives. Rather than relying on a food self-sufficiency policy, a policy of food self-reliance would permit maize imports when the total costs of imported maize was below domestic production and storage costs. However, the existence of demand for yellow maize, at a given price discount, does not ensure that the demand will be met. Complementary actions may be required in promoting the availability of yellow maize. The potential role of yellow maize in alternative marketing channels is explored further in Chapter 6.

CHAPTER 5:

CHOICE OF TECHNOLOGY IN THE MAIZE MILLING INDUSTRY AND THE ROLE OF SMALL-SCALE MILLING ENTERPRISES

For decades, the maize milling industry in Zimbabwe was dominated by large-scale mills using imported roller mill technology. Although plentiful in rural areas, small-scale urban hammer mills had very little market share prior to 1993. Grain market reforms undertaken in 1993, namely the removal of movement restrictions and the ending of subsidies for roller meal, have meant a much greater role for small-scale hammer mills in urban areas. The purpose of this chapter is to explore the implications of the choice of technology in the maize milling industry. Section 1 begins with an overview of research methods, survey techniques, and a summary of the choice of technology literature. Section 2 documents the evolution of the operations of small-scale hammer mills during the process of maize market reform from 1991 to 1994. Estimates are made of annual throughput from survey data. Section 3 compares manufacturing production costs and analyzes the effects of choice of technology in the maize milling industry on employment generation, capital utilization, and use of foreign exchange and other scarce resources. Based on the findings in Section 3, Sections 4 and 5 seek to identify the constraints to the investment in and proliferation of more appropriate technologies, including both custom hammer mills in urban areas and production hammer millers throughout the nation. Special note is made of particular technological and institutional investments required to facilitate the productive growth of the small-scale maize milling industry. Finally, this chapter concludes with a discussion integrating the findings of this study of the maize milling industry with some of the broader questions as to why particular technology choices are made.

5.1 Overview of research methods for choice of technology analysis

This study of choice of technology in the maize milling industry and constraints to more appropriate technologies relies on a series of firm-level surveys of milling enterprises undertaken in 1992 and 1993. This section presents a review of the choice of technology literature, including applications to food processing enterprises in developing countries. The survey design and sample selection techniques for the firm-level surveys are then described in detail.

5.1.1 Overview of the choice of technology literature

When defined most loosely, technology is nothing more than a well-defined method for performing a particular task, whether it be a method for producing steel or training teachers. For the purposes of this discussion, a technology is defined as a distinct and well-defined method for the physical transformation and production of a particular good.

In any society, the evolution of technology is the result of a seemingly infinite number of choices made by individuals, firms and institutions. Neo-classical economists treat technology choice as an economic decision regarding which of many possible combinations of capital and labor should be used to produce a particular good. With information on relative factor prices, the optimum technology is the one where the relative marginal productivity ratios are proportional to wage/capital rental ratios.

According to the stylized neo-classical view, technological innovation occurs when more efficient, better-suited technologies replace inferior ones. Such views treat the process by which technology change is generated as exogenous to the economic system, with technological evolution the product of continual autonomous advances in scientific and technical knowledge. Theories of "induced innovation" are an attempt to overcome the inadequacies of the earlier approaches by interpreting technological innovation as endogenous to the economic system. Hayami and Ruttan (1985) have identified two distinct approaches to describing technological evolution and innovation: (1) the Hicksian tradition which focuses on technology changes in the private sector (expressed as changes in factor proportions) as responses to changes in relative factor prices which, in turn, reflect relative resource scarcities; and (2) the Schmookler-Griliches approach focuses on the influence of market demand forces on technology innovation. Hayami and Ruttan further build on the Hicksian tradition to develop a theory of induced innovation based on the critical role of the public-sector in inducing innovative behavior and technical change (Hayami and Ruttan, 1985).

The mechanics of technology choice in manufacturing becomes somewhat more ambiguous in the case of developing countries that have only embarked on widespread industrialization strategies in the past half century. One school of thought, based upon assumptions of fixed factor proportions, gained ground in the 1970's with arguments that developing countries had little in the way of meaningful choices. According to this view, often a particular product can only be produced with a unique technology for which factor proportions are rigidly specified (Eckaus, 1955). Thus, there are no efficient alternatives to the capital-intensive techniques of Western industrialized nations and drastic, non-market solutions are the only hope for the employment and growth problems of developing countries (White, 1978).

While fixed factor proportions theorists have lost favor in recent years, a variant of their premise still survives. According to this variant, private or public-sector decision-makers in developing countries face difficulties as there are often several technologies available "off-the-shelf" for the production of a particular good. In such instances, neo-classical theory implies that firms and government select the "best" technology for a particular task based on a rational calculus of benefits and costs given local conditions. Yet because existing technologies have often evolved in radically different environments than those in developing countries, "off-the-shelf" technologies from industrialized countries may not be appropriate for developing nations. The "best" technology (in neo-classical terms) may simply be the best of a number of poor options.

Because of this problem, an entire literature has developed on the issue of "appropriate technology" for developing nations. A common theme throughout this literature is the over-reliance on capital-intensive or skill-intensive technologies that are inappropriate to nations with a labor-rich, capital-scarce resource base or that lack a well-developed coterie of skilled technicians (Sen, 1957, Morawetz, 1974). The dependence upon capital-intensive technologies during the 1950's and 1960's contributed to the wide-spread realization that development strategies had not produced the expected benefits such as rising employment levels (Edwards, 1974). A major focus of the appropriate technology movement therefore became identifying whether an efficient technology with appropriate characteristics existed (Stewart and Ranis, 1990). If investigation revealed that an appropriate technology did not exist, project-based interventions were often designed to introduce and encourage the growth of appropriate technologies.

Much of the current interest in the employment-generating potential of small-scale enterprises stems from the appropriate technology movement, now two decades old. Studies of the dynamics of small firms have provided insights into the feasible patterns of growth in manufacturing output and employment and have offered more equitable and efficient alternatives to reliance on large-scale, capital-intensive firms (Liedholm and Parker, 1989). Recognizing the strategic role of small-scale enterprises, much attention is currently focussed on identifying constraints to growth of small-scale enterprises in particular subsectors, understanding the critical determinants of whether certain enterprises fail or grow, and measuring the effects of enterprise growth on key macroeconomic variables such as employment generation and GNP.

5.1.2 Applications to food processing in developing countries

Given the importance that most governments attach to ensuring adequate food supplies at affordable prices, substantial research has been conducted on choice of technology issues in food processing. Most studies have generally found that simple mechanical technologies that still retain the attributes of small-scale, labor-intensity, and relatively low investment cost are often superior to both large-scale, capital-intensive, imported technologies and traditional, non-mechanized techniques. Several of the more relevant studies of choice of technique in grain processing are summarized here.

In a study of choice of technology in rice milling in Indonesia, Timmer (1973) found that labor-intensive mechanical rice processing was preferable in economic terms to either traditional hand pounding or capital-intensive processing technologies. An important observation, however, was the degree to which the employment effects of a particular technology choice depended upon key parameters, such as interest rates and rice price policy, that were under the control of government.

In Kenya, Stewart (1977) found that roller mills were "technically inferior" to hammer mills, requiring more capital, labor and foreign exchange in relation to output. Roller mills required over 200 times as much investment per worker as labor-intensive hand mills and nearly five times as much as hammer mills. The labor productivity (output per hour of labor) of the roller mill was also inferior to the hammer mills, although it was superior to hand mills and water mills. If the output of each technology was considered uniform (i.e. ignoring the additional value of the more refined maize meal products), Stewart concluded that hammer mills were the preferred technology on the grounds of investment cost, employment generation, rural-urban balance, income distribution, nutritional consequences, and use of locally produced machinery. However, despite the apparent advantages of hammer mills, when the value of output was weighted according to its monetary value, the relative productivity of hammer mills vis-a-vis roller mills fell substantially. As a result, roller mills were found to be the most profitable technology given what Stewart termed "consumer preference" for the more refined meal. Stewart argued that the apparent consumer preference for refined maize meal actually reflected the influence of advertising and the skewed demand created by an unequal distribution of income (Stewart, 1977).

A comprehensive study by Bagachwa (1991) of grain milling in Tanzania found that small-scale mills offered greater potential for employment generation, more effective use of capital, and the production of more appropriate food products than did large-scale commercial mills. Yet despite the demonstrated advantages of small-scale mills, the Tanzanian government made the decision to expand milling capacity with investments in large-scale mills.

In the Gambia, Nath (1985) found that small-scale flour grinding mills for coarse grains were often too large for village requirements. Rural consumers tended to bring only small lots for processing at the mills. Since customers were unwilling to pool their grains for common milling (most likely due to a desire to control the quality of the output), processing small batches was necessary. But small batch processing was judged to put greater stress on machinery and was ultimately uneconomical.

5.1.3 Survey design and sample selection for firm-level surveys

Data collection of mill operations, including both custom mills and production mills, required the design and administration of a set of firm-level surveys. For the purposes of this study, three distinct technology types were defined based both upon type of machinery and services performed: (1) custom mills, namely firms providing hammer milling services on a fee-for-service basis; (2) production mills, characterized by production of a bagged and branded product using hammer mills and dehullers; and (3) large-scale mills, typified by their reliance on imported roller mills.

The urban custom mill surveys were carried out twice: the first time in February and March 1992 (before any meaningful reforms) and then 18 months later in September and October 1993 (after substantial reforms). A survey was also administered to customers of urban custom mills in September and October 1993. Finally, a survey of 11 production millers throughout the country was undertaken in October 1993.

The specific surveys were:

1. **Urban custom mill survey**. The first round of this survey took place in February/March 1992 when all 57 urban custom mills in Harare and Chitungwiza were visited and questionnaires were administered to mill operators and mill owners. In the second round (September/October 1993), a sample of one-third of all urban custom mills was selected, stratified by start-up date. Of 57 urban mills that existed 18 months earlier, 20 were randomly selected for this survey. Furthermore, of 17 mills that had opened since 1992, 5 were selected. Two different questionnaires were used to obtain information from urban custom mills: (1) a questionnaire directed at mill operators at mill locations; and (2) a questionnaire specifically for mill owners. Information collected varied from the 1992 survey to the 1993 survey but generally included: mill purchase price, other fixed investment costs, imported components, availability of and access to credit, repayment rate, variable costs (raw material, labor, electric, and other operating costs), milling throughput, revenue levels, milling capacity, number of employees, pattern of demand, recent investments in the milling enterprise, employment levels, plans for expansion, and any perceived constraints. Responses on investment costs and estimated throughput were confirmed with interviews with local manufacturers of hammer mill machinery.

2. **Survey of customers at urban hammer mills.** In conjunction with the second round of the urban custom mill questionnaire, 10 customers at each of the 25 mills selected were interviewed on a random basis about grain production, purchasing and grain processing habits.

3. **Production millers census.** Of the 13 production millers in existence in Zimbabwe in mid-1993, 11 of the mill owners were visited and interviewed about all aspects of their production milling enterprise. Information required included: start-up costs, import component, credit availability, costs of production, revenues, milling throughput, milling capacity, employment levels, expansion plans, constraints to expansion, perceived constraints to the operation, and marketing arrangements and constraints.

4. **Interviews with large-scale millers.** An open-ended questionnaire was used to interview officials of the two largest large-scale millers regarding investment costs, milling throughput, milling capacity, employment levels, foreign exchange requirements, expansion plans, and constraints in the deregulated environment. A former employee of a major milling firm also provided information about large-scale milling techniques and constraints.

5.2 The evolution of the milling industry: 1991-1993

Policy reforms in 1993 resulted in the blossoming of alternative maize marketing channels. These channels offer a lower-cost option for procuring maize meal than the former single-channel marketing system dominated by the GMB and large-scale millers. This section provides a review of the evolution of the maize milling industry and alternative marketing channels during the market reform process. In particular, this section presents a summary of the 1991-1993 maize market reforms, an overview of the changing structure and operations of the maize milling industry, and an analysis of milling throughput trends before and after reform.

5.2.1 The grain market reform process: 1991-1993

In 1992, the Minister of Lands, Agriculture and Water Development presented a first set of reforms designed to introduce more competition to agricultural marketing (GRZ, 1992). For all crops other than white maize and wheat, the marketing board's legal monopoly/monopsony in "Zone A" was lifted: these became "regulated" instead of "controlled" products, with the GMB continuing to offer floor prices for all "regulated" crops based on expected sales realizations and private trade was freely permitted.

For white maize and wheat, marketing remained "controlled" in urban areas and most commercial farming areas ("Zone A"), but private trading was allowed across zone lines in Natural Regions IV and V, the driest parts of the country. The GMB also reaffirmed and publicized its commitment to sell maize from any GMB depot to any buyer in any quantity greater than one bag. Finally, steps were also taken to ensure greater GMB autonomy in decision-making. However, due to extreme drought in the 1991/92 growing season, there was very little domestically-produced grain available in the 1992/93 marketing year other than food aid and imports that moved through the formal GMB/large-scale miller marketing channel. As a result, the 1992 reforms did not have much, if any, immediate effect on maize marketing.

In July 1993, following a good 1992/93 growing season, a second phase of grain market reforms was announced. Movement restrictions on white maize were effectively lifted throughout the entire country (GRZ, 1993). Thus anyone was permitted to buy and sell white maize without restrictions, with the exception of "designated Zone A firms" (five large-scale milling firms) who were still required to purchase from the GMB. Although the legal instrument that removed maize sales restrictions was not gazetted until November 1993, in actual practice, sales to all entities other than the five large-scale milling firms were permitted for most of 1993. By April 1994, maize movements were completely liberalized with large-scale millers (designated Zone A firms) no longer required to purchase maize supplies from the GMB. The GMB continued to operate as a residual buyer in all areas by defending the mandated floor and ceiling prices for white maize.

5.2.2 The changing structure and operations of the maize milling industry

With the maize market reforms that occurred in 1993, the milling industry has diversified considerably with the expansion of small- and medium-scale milling enterprises using hammer mill technology. By mid-1993, the milling industry was comprised of three distinct technology types based upon both the machinery mix and services performed:

1. Large-scale millers.
2. Production (medium-scale) millers.
3. Custom (small-scale) millers.

Large-scale millers use imported roller mill technology to produce two types of refined, bagged maize meal products: super-refined meal (65 percent extraction rate) and roller meal (90 percent extraction rate). Prior to June 1, 1993, the large-scale millers sold maize meal to retailers at government-controlled prices with milling margins based on cost of production data supplied by millers. However, on June 1, 1993, retail maize meal prices were decontrolled and no formal restrictions remain on retail pricing. This did not lead to competitive pricing since, with the removal price controls, the large-scale millers through an industry Miller's Association adopted a cartel-like price setting procedure. All of the four large-scale millers agreed to sell maize meal at the same price. Major retailers also agreed on a uniform mark-up of 10 percent.

Production (medium-scale) millers use hammer mill technology in conjunction with a dehuller to produce a range of branded, bagged products that are sold directly to consumers or to retailers. These new entrants produce a refined roller meal-like product, marked under the name "roller meal," with an extraction rate of 85 to 95 percent. The production of a roller meal from a hammer mill involves removing the bran (or hull) using a separate shelling machine (or dehuller) before milling with a hammer mill. Production millers also often produce a more refined meal (often called *extra fine*). One production miller has recently begun producing a bagged straight-run meal. Finally, one production miller also produces *mudzvurwa*: a refined "roller meal" type product that is soaked briefly and milled wet. By wetting the maize, the subsequent heat of the dehuller supposedly "roasts" the maize, giving the final product a better taste. However, the *mudzvurwa* produced by this method is distinct from traditional *mudzvurwa*. Traditionally, *mudzvurwa* is made by hand-pounding maize grain to remove the hull and soaking the remaining endosperm in water for a few days. The grain is then processed into meal through hand-pounding or hammer milling. The soaking stage induces initial fermentation giving traditional *mudzvurwa* a distinctive sour taste.

Although one production miller had been operating since 1988, relying on quasiillegal supplies of grain, new production millers began to emerge in mid-1992 during the drought. In essence, during this period a number of production millers recognized the large, drought-induced demand for maize meal in rural areas and, at the same time, were successful in petitioning the Ministry of Industry and Commerce for the same level of subsidy for the production of roller meal that applied to large-scale millers. With access to grain supplies and widespread rural demand, production millers were able to operate at near capacity levels almost from inception.

Production milling firms are a heterogeneous group; firm size varies from the smallest production miller using one hammer mill and one dehuller in a small building behind a rural grocery shop to the largest production miller using 6 hammer mills, 6 dehullers, and operating in a new multi-million dollar factory building. As of February 1994, 14 production millers were in operation throughout the country.

Custom millers provide hammer milling services to customers who bring their own grain. Custom millers use electric or diesel powered hammer mills to manufacture (on a service basis) two products: 1) straight-run meal, or *mugayiwa*, a 98 percent extraction rate whole meal for human consumption; and 2) a coarse grain stockfeed. No packaged maize meal products are sold. A few custom millers in Harare/Chitungwiza (about 12 percent) have recently purchased dehullers and can also produce a more refined roller meal-like product on a fee-for-service basis.

Custom millers are numerous and continue to operate in both rural and urban areas. Within the past two years, there has been significant growth in hammer mill enterprises in urban areas. In February 1992, a census of hammer mills in the Harare-Chitungwiza area located 57 hammer mills in operation. By October 1993, the number of hammer mills in

Harare-Chitungwiza had risen to at least 74, an increase of 30 percent. Although 44 percent of custom millers said they had sold maize grain at their mill during 1993, the majority of custom millers simply provide a milling service, with the raw material and container provided by the customer.

The growth in the number of urban custom hammer mills has paralleled the rapid growth in the consumption of straight-run meal since early 1993. In early 1992, from 5 to 8 percent of urban consumption needs were met by straight-run meal. However, 18 months later, in May/June 1993, 27 percent of urban households were consuming straight-run meal. The percentage of consumers eating straight-run meal has continued to grow. Results from December 1993 survey show that about half of the Harare area population was consuming straight-run meal at the time of the survey.[6] This household-level evidence is supported by estimates of monthly throughput at Harare and Chitungwiza custom mills that demonstrate that 48 percent of maize meal requirements were being processed at custom hammer mills.

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

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

5.2.3 Shifts in milling throughput trends by technology type

Until very recently large-scale millers dominated the maize milling industry. In late 1991, there were only two production millers in the entire country. Custom millers, particularly those in urban areas, experienced sharp seasonal cycles in the demand for their services. Due to maize movement restrictions, urban supplies of maize for custom milling were limited to urban production and informal inflows from rural areas.

Based on surveys of urban custom millers in early 1992, maize processing by custom mills in Harare and Chitungwiza during 1991 peaked at 1,480 tons per month in June, about 13 percent of total urban demand. By December 1991, total throughput at these custom mills fell to 628 tons. During 1991, about 8 percent of total urban demand (Harare/Chitungwiza) for maize meal was met by hammer-milled straight-run maize.

The experience of 1991 contrasts sharply with the situation in 1993, following major grain market reforms. By mid-1993, the number of production mills had grown to 13. During periods of peak demand, primarily in the period before harvest (January and February), production mills were manufacturing an average of 519 tons of maize meal per month. However, by August/September 1993, output at production mills averaged about a quarter of peak output levels, about 123 tons per month average per mill.

The removal of maize movement restrictions has also helped contribute to a great increase in the percent of urban consumers utilizing the services of custom mills. Survey data from October 1993 shows that the growth in throughput at urban custom mills (and consumption of straight-run meal) has been phenomenal.

As shown in Figure 3, maize throughput at custom mills in Harare and Chitungwiza peaked in June 1993 with total throughput of 5,076 tons, about three and a half times the peak amount in June 1991. With monthly demand for maize meal in Harare and Chitungwiza estimated to be 10,635 tons, by mid-1993, monthly throughput figures show that about 48 percent of urban maize meal requirements were met by maize meal processed by custom mills.

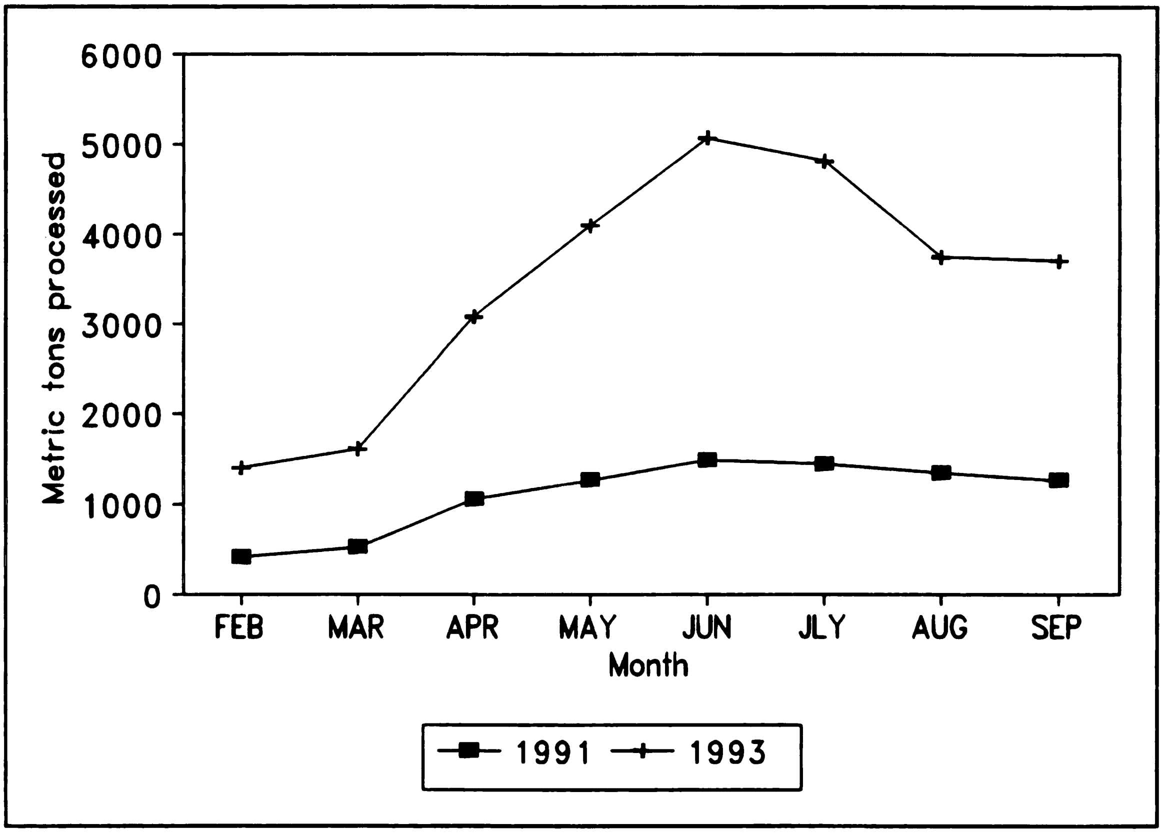


Figure 3: Milling throughput at Harare and Chitungwiza custom hammer mills, 1991 and 1993

At the same time, maize meal sales by large-scale millers have fallen drastically. Although maize meal sales figures of large-scale millers are not public information, a good proxy for actual sales of maize meal by large-scale millers is GMB sales of maize grain to large-scale millers. Unlike production millers, large-scale millers were required to purchase all maize requirement from the GMB until April 1994. Figure 4 shows how drastically GMB sales to large-scale millers fell in 1993 compared to 1991.

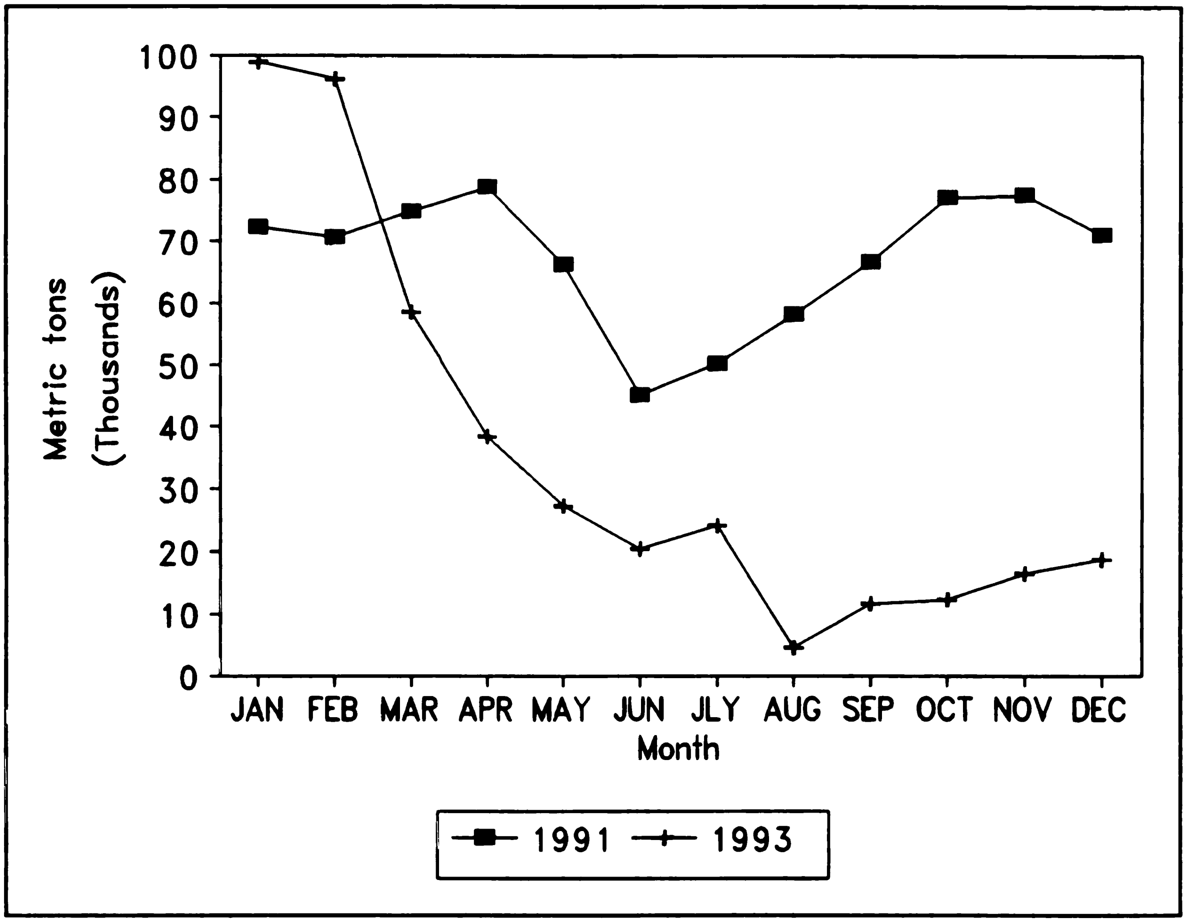


Figure 4: **Monthly GMB sales of maize to large-scale commercial millers**

The growth of hammer mill technology has led to gains for consumers since the margins in a marketing channel with hammer millers are much smaller than the margins in the large-scale milling and distribution system. The gross margins of large-scale millers using roller mill technology are effectively fixed by agreement among large-scale millers. At custom mills, not only are processing costs lower, but consumers also save money by performing many of the value-adding functions of the marketing chain themselves. Obviously the willingness of consumers to spend time travelling and queuing for milling services rather than pay extra cash for the convenience of store bought roller meal reflects the opportunity cost of time of consumers. The implications of consumers' opportunity cost of time for the development of the maize marketing system are further explored in Chapter 6.

5.3 Implications of technology choice in maize milling

In any industry, implicit or explicit choices are made about the type of technology (or technologies) chosen. The purpose of this section is, firstly, to compare production costs of large-scale roller mill and small-scale hammer milling systems. A second objective is to analyze the effects of the choice of milling technology on employment generation, capital utilization, and use of foreign exchange. A third related objective is to estimate the impact of recent policy and regulatory reforms on the market share of the three alternative milling technologies: roller mills used by large-scale firms, production hammer milling systems, and custom hammer mills.

5.3.1 Production cost comparisons

Although several choice of technology studies of grain milling enterprises in Africa and Asia have been carried out over the past two decades, very few have attempted to compare production costs associated with alternative technologies. An important exception, Mukumbu's 1992 study of the maize milling industry in Kenya, found that unit milling costs for medium-sized firms with hammer mill and dehuller technology were roughly half of those of large-scale firms using roller mills. The production costs for small-scale custom millers were, in turn, half of those of the medium-sized firms (Mukumbu, 1992).

In Zimbabwe, obtaining accurate production cost comparisons is complicated by two factors: (1) there are difficulties establishing a standard unit of comparison. Straight-run meal from custom hammer mills is produced on a service basis, is not bagged, and has a higher extraction rate than roller meal. Therefore, straight-run meal from custom mills and roller meal from roller mills are fundamentally different products, making direct or sample production cost comparisons invalid. Comparisons of cost figures of roller meal from production mills and roller mills do not present such problems; and (2) production cost data at the firm-level is difficult to obtain, particularly for large-scale millers who do not release production cost data to researchers. The only possible sources of data on roller meal production costs for large-scale millers were estimates of investment costs and labor requirements made by representatives of large-scale milling firms and confirmed by ex-employees acting as informants. Based on available best possible information, estimates of capital and labor costs of production hammer mills and roller mills were made and compared. The analysis is presented in Table 38.

Table 38: Capital and labor cost comparisons for production hammer mills and roller mills (1993 estimates)

	Production hammer mill system	Large-scale roller mill system
Output per month (maximum tons)	519	11,610
Average wage per month (Z$)*	340.01	950.83
Capital cost per 100 tons of output (Z$)**	238	840
Labor cost per 100 tons of output (Z$)	2753	2957
Total capital and labor costs per 100 tons of output (Z$)	2991	3797

* Based upon 1993 production miller survey data on wages and estimates derived from 1992 large-scale miller Annual Reports and interviews. Labor include all administrative and sales personnel but do not include the opportunity cost of time of the mill owner.

** Investment cost depreciated over the life of the equipment. Depreciation based on 10 years expected life for hammer mills and dehullers and 20 years for roller mills. No savage value assumed, although there is a market for used hammer mills.

Table 38 shows that at full capacity, production milling systems have lower capital and labor costs than large-scale firms using roller mills. Although accurate information on other input costs (electricity, water, maintenance, etc.) could not be obtained for large-scale millers, these figures lend support to the assertion of lower cost-structures for hammer milling systems. One reason for this is because wages paid by production millers are almost one-third of those paid by large-scale millers. Lower wage rates paid by production millers may reflect rural-urban wage differentials and less adherence to tax and minimum wage requirements. When maize input costs are incorporated, the cost advantages are even greater since maize acquisition prices for production millers were lower than those of large-scale millers in 1993. Table 39 shows revenue comparisons for production mills versus large-scale mills, excluding certain specified variable costs.

Table 39: Revenue comparisons for production mills versus roller mills in 1993 (in Zimbabwe dollars)

	Production hammer mill system	Large-scale roller mill system
Gross revenue per ton (wholesale price)	1478.00	1586.00
minus grain acquisitions costs per ton	856.00	1070.00
minus labor costs per ton of output	27.53	29.57
minus capital costs per ton of output	2.38	8.40
Revenue per ton of output (includes all non-labor variable costs and profits)	592.09	478.03

Source: Survey data

One important implication of Table 39 is the degree to which the policy and regulatory environment continues to drive developments in the milling industry during the reform process. In 1993, partial relaxation of maize movement restrictions gave production millers the advantage of lower raw material costs. Similarly, the production millers were not bound by the same formal and informal rules governing wage levels as the large-scale millers. Labor union activity, and perhaps enforcement of minimum wage levels, are undoubtedly higher in the more visible large-scale milling industry. Thus, while Tables 38 and 39 do reveal cost advantages enjoyed by production millers in the 1993 operating environment, many of these advantages reflected a set of formal and informal marketing rules regarding input access and labor market competition. As further market reforms are made (i.e. the complete lifting of movement restrictions in 1994), such reforms will alter relative cost structures and perhaps reduce production millers' cost advantages.

A comprehensive comparison of production costs of alternative milling technologies requires data on variable costs; unfortunately, it was not possible to obtain variable cost of production data for large-scale millers. Complete cost data is also difficult to obtain for production millers as they often operate a number of businesses on a site and attributing overhead costs such as electricity, water and insurance to specific operations is difficult. Also, given the limited time since the initiation of the liberalization process and fears regarding the possible reintroduction of controls, many production millers were reluctant to divulge detailed information on firm profitability.

However, based on data from a number of sources, a synthetic operating budget for a proto-typical production miller was constructed (Tables 40 and 41 on the following two pages). Information on capacity utilization, output per period, equipment purchase prices, grain acquisition costs, and labor expenses were obtained from a survey of production millers. Estimates of insurance, packing, transport, maintenance and repair, and miscellaneous costs were obtained from a sample enterprise budget prepared by the

Intermediate Technologies Development Group in Zimbabwe. Finally, electricity and water costs were calculated on a per ton basis from an average of three production milling enterprises. The estimates of capital recovery cost were based on a interest rate of 30 percent on the present value of the initial investment and a loan repayment period of five years. All costs in the annual operating budget were calculated on a monthly basis. Two different cases are presented: (1) a low capacity case where capacity utilization is 10 percent for six months of the year before rising to 25 percent and then 50 percent by year end; and (2) the medium capacity case, where capacity averages 46.7 percent over the year, rising from a low of 25 percent to a high of 100 percent for the last three months of the year. Grain prices reflect the acquisition price of grain plus a monthly figure to cover the opportunity cost of capital (valued at 30 percent per year) tied up in grain stocks. Therefore, in February (assumed to be the last month of the production millers' fiscal year), the acquisition price of maize is Z$1113 per ton, very close to the effective GMB selling price of Z$1106.

The sample operating budgets presented in Tables 40 and 41 show that even at relatively low rates of capacity utilization, production millers can cover all fixed and variable costs. Even using relatively conservative cost figures, production mills have a high level of profitability. In the low capacity case (average annual capacity utilization at 24 percent), the enterprise still realizes a net profit of Z$174,625 per year. In fact, net receipts are high enough to completely cover the entire initial investment cost of machinery and equipment purchase in one year. In the medium capacity case (average annual capacity utilization at 46 percent), the profitability of the enterprise goes up substantially, to over Z$560,000 per year. Thus, these proto-typical budgets indicate that the break-even rates

TABLE 40: PROTO-TYPICAL ANNUAL OPERATING BUDGET FOR PRODUCTION MILLER (IN Z$), LOW CAPACITY UTILIZATION CASE

	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	TOTAL
Percent capacity utilization	0.10	0.10	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.50	0.50	0.50	23.75
Output (tons)	51.87	51.87	51.87	51.87	51.87	51.87	129.68	129.68	129.68	259.35	259.35	259.35	1478.30
Mill price	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	18013
Dehuller price	962	962	962	962	962	962	962	962	962	962	962	962	11547
Building cost	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	12780
Other equipment	315	315	315	315	315	315	315	315	315	315	315	315	3785
Capital recovery cost	6198	6198	6198	6198	6198	6198	6198	6198	6198	6198	6198	6198	74375
Insurance	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	12000
FIXED COSTS	11042	11042	11042	11042	11042	11042	11042	11042	11042	11042	11042	11042	132501
Labor	5100	5100	5100	5100	5100	5100	7820	7820	7820	11220	11220	11220	87723
Grain purchases	44401	45594	46839	48032	49069	50470	129156	132269	135251	276467	282692	288657	1528894
Electricity	1790	1790	1790	1790	1790	1790	4474	4474	4474	8948	8948	8948	51001
Water	83	83	83	83	83	83	207	207	207	415	415	415	2365
Maintenance/Repairs	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	36000
Packing	4046	4046	4046	4046	4046	4046	10115	10115	10115	20229	20229	20229	115307
Transport	9077	9077	9077	9077	9077	9077	22693	22693	22693	45386	45386	45386	258701
Misc	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	24000
VARIABLE COSTS	69496	70690	71934	73127	74165	75565	179466	182578	185560	367666	373890	379855	2103991
TOTAL COSTS	80538	81731	82976	84169	85207	86607	190507	193620	196602	378707	384932	390897	2236493
TOTAL REVENUE	84601	84601	84601	84601	84601	84601	211502	211502	211502	423003	423003	423003	2411117
NET RECEIPTS	4062	2869	1625	431	(606)	(2006)	20994	17882	14900	44296	38071	32106	174625

TABLE 41: PROTO-TYPICAL ANNUAL OPERATING BUDGET FOR PRODUCTION MILLER (Z$), MEDIUM CAPACITY UTILIZATION CASE

	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	TOTAL
Percent capacity utilization	0.10	0.10	0.10	0.25	0.25	0.25	0.50	0.50	0.50	1.00	1.00	1.00	46.25
Output (tons)	51.87	51.87	51.87	129.68	129.68	129.68	259.35	259.35	259.35	518.70	518.70	518.70	2878.79
Mill price	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	1501	18013
Dehuller price	962	962	962	962	962	962	962	962	962	962	962	962	11547
Building cost	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	1065	12780
Other equipment	315	315	315	315	315	315	315	315	315	315	315	315	3785
Capital recovery cost	6198	6198	6198	6198	6198	6198	6198	6198	6198	6198	6198	6198	74375
Insurance	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	12000
FIXED COSTS	11042	11042	11042	11042	11042	11042	11042	11042	11042	11042	11042	11042	132501
Labor	5100	5100	5100	7820	7820	7820	11220	11220	11220	14280	14280	14280	115263
Grain purchases	44401	45594	46839	120079	122673	126174	258313	264537	270502	552934	565383	577313	2994740
Electricity	1790	1790	1790	4474	4474	4474	8948	8948	8948	17895	17895	17895	99318
Water	83	83	83	207	207	207	415	415	415	830	830	830	4606
Maintenance/Repairs	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	3000	36000
Packing	4046	4046	4046	10115	10115	10115	20229	20229	20229	40459	40459	40459	224545
Transport	9077	9077	9077	22693	22693	22693	45386	45386	45386	90773	90773	90773	503787
Misc	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	24000
VARIABLE COSTS	69496	70690	71934	170388	172982	176483	349511	355735	361700	722171	734620	746550	4002260
TOTAL COSTS	80538	81731	82976	181430	184024	187525	360553	366777	372742	733213	745661	757591	4134761
TOTAL REVENUE	84601	84601	84601	211502	211502	211502	423003	423003	423003	846006	846006	846006	4695334
NET RECEIPTS	4062	2869	1625	30071	27478	23977	62450	56226	50261	112794	100345	88415	560573

of capacity utilization are quite low. Sensitivity analysis of these sample budgets demonstrated that the proto-typical production miller can still break-even with a annual capacity utilization rate of 12 percent. That is, with a capacity utilization rate of 10 percent for the first nine months, 15 percent in the tenth month, and 20 percent in the last two months, the production miller can still (barely) break-even. Of course, this sensitivity analysis ignores the possibilities for the production miller earning income from custom milling during the slack period as discussed further in Section 5.3.5.

This analysis suggest also that production mills with relatively new equipment may not be disadvantaged vis-vis the large-scale millers whose plant investment are largely paid off. That is, the old age of many roller mills suggests that large-scale millers may have already paid off their capital investment. If so, the capital recovery costs of production millers, a consequence of their recent entrance, may present a competitive disadvantage. However, the sample operating budgets suggest that some production millers may have already recovered their capital invested during the period in late 1992 and early 1993 when virtually all production millers were operating at peak capacity due to drought. If so, any advantages enjoyed by the large-scale millers due to their low capital recovery costs would have been sharply reduced or eliminated by 1994.

5.3.2 Employment generation

Increased attention has been focussed on the potential for small-scale enterprises to provide employment and contribute to economic growth in Zimbabwe. In the short run, structural adjustment reforms in most nations have typically been accompanied by falling real wages, rising unemployment in the formal sector as loss-making state enterprises are privatized or stream-lined, and increased local prices of imported goods due to currency devaluation. The growth of small-scale enterprises can counterbalance these adverse effects by providing employment, income, and import-substituting commodities. A recent survey estimated that there are over 800,000 micro and small enterprises in Zimbabwe but that the urban food processing sector in Zimbabwe accounted for a much smaller percentage of total enterprises than in other nations (Liedholm and Mead, 1992).

Thus employment generation is one of several criteria that can be used to evaluate the suitability of hammer mills versus large-scale roller mills. Hammer mills have considerable potential for employment generation. However, the potential for employment generation differs among custom and production mills. In 1993, the typical urban custom mill employed 2.36 persons, not including the mill owner. The usual arrangement was to have one operator monitoring the flow of grain into the mill, while a second operator took the cash and monitored the flow of maize meal in the customer's container. Since on weekdays the typical custom mill operated one long shift (of over 10 hours), additional workers were often employed to fill in and stagger work schedules. For the most part, custom mill owners are absent from the actual mill for most of the day. Most are either employed elsewhere at a full-time job (40 percent) or are busy managing other businesses of theirs, often on a site very close to the mill (52 percent).

Potential for employment generation also lies in the growth of production millers. Based upon interviews with production mill owners in 1993, during periods of peak capacity, the "average" production miller employed 34 factory workers. During slack periods, when the number of shifts per day declines, this number can fall to 18 employees. By contrast a large-scale roller mill producing 18 tons per hour requires 111 factory workers at peak capacity, with 37 workers for each of 3 shifts.

Table 42 presents a complete break-down of the employment levels for each of the three technology types. The figures for custom mills and production mills are averages from survey data while the data on the large-scale roller mill is that of a medium-sized Harare mill.

Table 42: Employment levels for alternative milling technologies[a]

	Custom hammer mill	Production hammer mill system	Large-scale roller mill system
Peak monthly capacity (tons of meal)	129.2	518.7	11610
Number of factory employees during peak capacity	2.4	34.1	111
Average number of operating hours per month during peak capacity	297	559	645
Maximum capacity per 480 hours of operation (tons of meal)	209	446	8640
Hours worked by employees per day (hours per shift)	9.9	8.9	8.0
Number of employee hours worked per 100 tons of meal produced	550	1780	233

Source: Survey data
[a]Only factory workers involved in milling, packing and direct supervision are included. Administrative, sales and delivery staff are excluded.

The reason for the stark differences in employment levels is that hammer mills require much more labor to operate than do the largely mechanized roller mills used by large-scale millers. As shown in Table 42, to produce 100 tons of maize meal, it takes over seven times as many workers with production hammer milling technology than with roller mill technology used by large-scale millers. Custom milling generates considerably less employment per unit of output than production milling, most likely due to the absence of dehulling and packaging stages. However, employment generation in custom milling is still double that of large-scale milling. The implication is that production hammer milling is much more technologically "appropriate" than large-scale milling in a country such as Zimbabwe that has high rates of unemployment and under-employment.

Based on these figures, it is estimated that during peak periods, approximately 440 factory workers are employed at production mills. Yet as of mid-1993, production millers only had about a four percent share of the total market for purchased maize meal. Assuming that the number of production millers grew and that the market share of production millers rose to 50 percent, the total number of individuals employed in the production milling industry would be approximately 5,500. Since the large-scale milling industry is much more capital intensive than production milling, job losses would be considerably lower. Assuming that the average roller mill employed 111 factory workers, since there are 16 roller mill systems in Zimbabwe, total factory employment is roughly 1,776. If production milling completely replaced large-scale milling (an unlikely occurrence), the net employment gain in the milling industry as a whole would be over 9,000 new jobs.

Table 43 presents a summary of the estimated employment potential of small-scale production maize milling assuming different levels of market share of the production milling industry.

Table 43: Estimated employment levels resulting from the growth of small-scale production milling (factory employees only)

Market Share of Production Millers	Estimated employment levels in production milling industry	Estimated employment levels in large-scale milling industry	Net change in total employment in the milling industry
4 percent (1993)	1993= 440	1993= 1776	---
10 percent	1100	1665	589
20 percent	2200	1480	1504
30 percent	3300	1295	2419
50 percent	5500	925	4249
75 percent	8250	463	6537
100 percent	11,000	0	8824

Source: Calculations based on survey data

Of course, Table 43 above assumes that job gains and losses in production and large-scale milling are linear constant. That is, to the extent that production millers may be able to increase output without adding new employees, employment gains in production milling may be exaggerated. Similarly, to the extent that large-scale millers do not retrench employees despite a fall in market share, job losses in large-scale milling may be over-estimated. As the sample estimates in Table 43 indicate, the growth of production milling can have significant impact on net employment levels in the milling industry. A final caveat, however, is that job creation in hammer milling would create lower paying jobs than those in large-scale mills. Although total employment in maize milling would increase seven-fold, there would be only a doubling of the wage bill in the milling industry as a whole.

5.3.3 Investment capital and foreign exchange utilization

The investment capital required to initiate a milling enterprise differs vastly among the three types of milling technologies. Investment in a typical custom milling enterprise requires an outlay of Z$28,632, whereas a roller mill capable of processing 18 tons per hour requires Z$23.4 million (see Line 1 of Table 44). Since output levels differ among the technology types, a more meaningful comparison would be the "average investment cost per 100 tons of output." Line 3 of Table 44 shows that custom mills have a slight advantage over production mills, while both types of hammer mill enterprises offer at least seven times the output per dollar invested as large-scale roller mills. Finally, Line 5 of Table 44 shows the "cost" of creating one factory milling job in each of the three types of milling enterprises. In this case, production mills are superior, with an investment cost of Z$4,350 per job created. It costs over two and a half times as much to create a job in custom milling. The investment cost per job created for both custom and production milling is minuscule compared with a large-scale roller mill: it takes almost fifty times as much investment capital to create one job at a large-scale roller mill compared to a production mill.

The foreign exchange requirements of the different milling technologies also vary widely. All large-scale roller mills are imported. Some auxiliary components may be obtained locally, but no more than 10 percent. By contrast, the hammer mills used by custom and production millers are manufactured locally. Local hammer mill manufacturers do require some imported parts, namely diesel engines, bearings, and the raw material for sieves. Thus, although new entrants to maize milling can purchase a mill completely with local currency, hammer mill manufacturers do face some need for foreign exchange. Prior

Table 44: Investment cost comparisons for alternative milling enterprises (1992 Zimbabwe dollars)[a]

	ITEM	Custom mill	Production mill system	Roller (large-scale) mill system
Line 1	Average investment cost for milling system (1992 Zimbabwe dollars)	$28,632	$148,342	$23,400,000
Line 2	Peak monthly output (tons of meal)	129	519	11610
Line 3	Average investment cost per 100 tons of output (1992 Zimbabwe dollars)	$22,195	$28,600	$201,550
Line 4	Number of factory employees	2.4	34	111
Line 5	Cost of creating one factory milling job	$11,930	$4350	$210,810
Line 6	Number of employees per Z$100,000 invested in milling equipment	8.2	23.0	0.5

Source: Survey data

[a]Only the machinery costs are included. Additional costs for installing packing facilities, buildings, and delivery vehicles are excluded.

to 1993, the components for electric engines were imported and assembled domestically. However, in 1993, a major manufacturing firm began producing electric motors with only a very small import component. As these domestically produced electric motors are adopted by mill manufacturers, the foreign exchange costs to mill manufacturers will fall even further. Virtually all urban custom mills use electric power while only half of production mills do. Table 45 shows the foreign exchange requirement of investment in alternative milling enterprises.

Table 45: Foreign exchange requirements of investment in alternative milling enterprises (in 1992 Zimbabwe dollars)[a]

	ITEM	Custom mill (electric)	Production mill system	Roller (large-scale) mill system
Line 1	**Average investment cost for milling system (1992 Zimbabwe dollars)**	$28,632	$148,342	$23,400,000
Line 2	**Foreign exchange requirement (1992 Zimbabwe dollars)**	$12,243	$55,498	$21,060,000
Line 3	**Peak monthly output (tons of meal)**	129	519	11610
Line 4	**Foreign exchange required per 100 tons of output (1992 Zimbabwe dollars)**	$9491	$10,693	$181,395

Source: Survey data
[a]Based on December 1992 exchange rate: $1 U.S. = Z$5.

Clearly hammer mill technology, whether custom or production mills, are far superior to large-scale roller mills in terms of foreign exchange required to produce a given output of maize meal. Yet for many years, large-scale millers were given preferential treatment in foreign exchange allocations as they were considered an essential food manufacturing enterprise. Prior to financial reforms implemented in 1992 and 1993, businesses needing foreign exchange allocations for imported machinery were required to make applications for foreign exchange with the Ministry of Finance. With the over-valued exchange rate that prevailed during much of this time, administrative allocation of foreign exchange was a rationing mechanism. For certain industries, regular allocations of foreign exchange essentially meant foreign exchange could be obtained at below-market rates. With an over-valued exchange-rate, the economic cost of foreign exchange allocations to large-scale millers would be even greater than appears in the financial analysis presented here. Hammer mill manufacturers, on the other hand, cited many problems obtaining imported parts during the late 1980's due to foreign exchange rationing.

Large-scale roller mills in Zimbabwe were imported in the 1950's and 1960's, with one company claiming to have equipment from the late 1930's. During 1991 and 1992, large-scale millers submitted applications for foreign exchange to purchase newer milling equipment from Switzerland, Italy, Britain and France. In January 1993, major monetary reforms had essentially ended administrative allocation of foreign exchange. By May 1993, with demand for packaged roller meal drastically down, two major large-scale millers suspended planned refurbishments with new imported equipment citing high interest rates.

The administrative allocation of foreign exchange can lead to implicit biases towards large-scale roller mills over hammer mills, despite hammer mills' advantages in employment generation and capital utilization. This illustrates how the choice of technology in a particular industry is not merely an engineering or technical decision, but one guided by implicit and explicit government policies regarding financial markets as well as wage levels and access to inputs. In Zimbabwe, the pattern of foreign exchange allocation provided support for large-scale roller mill technology and, at the same time, inhibited the production of hammer mills by domestic manufacturers.

5.3.4 Capacity utilization in maize milling

Broadly speaking, capacity utilization is the extent to which fixed capital (such as a maize mill) is utilized in combination with other inputs. Although firms may install excess capacity as a rational economic decision, unintended excess capacity can have negative implications for firm profitability and resource allocation.

Measuring the maximum capacity of a particular piece of machinery is difficult since manufacturers' performance figures often differ from actual capacity under typical working conditions. However, since large-scale and production millers have recently experienced a time when they were operating near full capacity, for the purposes of this study, maximum capacity is defined as maximum output during a previous period of peak output. For custom millers, there are two possible "maximum" capacity figures to rely on: 1) the actual peak throughput at each custom mill during the "best" month for each mill (118.9 tons per mill per month). All custom mills experienced their "best" month after the 1993 harvest when there were long queues outside custom mills; or 2) the maximum potential capacity reported by mill operators (160.8 tons per mill per month). For the purposes of this summary, the former, more conservative, figure is used.

In the milling industry, measuring capacity utilization is also complicated due to seasonal variation in demand and recent market reforms that have aided the growth of the hammer milling industry. The capacity unitization of the three milling technologies differ markedly and recent trends are summarized in the following sub-sections.

5.3.4.1 Capacity utilization of custom mills

In 1991, due to movement restrictions, urban custom hammer mills were operating severely below capacity. Without changing business hours and factoring in the time needed for periodic cooling of the electric motors, it is estimated that the typical custom mill in Harare/Chitungwiza was operating at about 14 percent capacity. During the 1992 drought, virtually all imported maize was channeled through large-scale and production millers or rural drought relief programs, leaving essentially no maize for urban custom mills. Only 29 percent of urban custom mills even operated at this time. The average monthly throughput of all custom mills in January 1993 (during drought before the 1992/93 harvest was realized) was 6.4 tons, about 5 percent of capacity. With a good harvest in 1993, there was a dramatic reversal in the fortunes of custom millers. The removal of the roller meal subsidy induced many urban consumers to switch to straight-run meal and, as a result, throughput rose to 77.9 tons during the June 1993 (about 65 percent of capacity). However, by October 1993, throughput had fallen to 55.1 tons per mill, about 46 percent of capacity. Still, by all accounts, 1993 was a very good year for custom millers: 79 percent of millers said maize volumes milled were "a lot higher" than in 1991.

Most custom mills engage in "batch processing" where each customer's grain is individually milled: grain from a second customer does not enter the mill until all the processed meal belonging to the first customer is expelled. Yet continuous processing may be as much as four times more efficient (Gwitera, 1992). Finally, potential capacity of custom mills may be even greater than described above since most millers stated in a 1992 survey that they were willing to expand their hours of operation to meet consumer demand.

5.3.4.2 Capacity utilization of production mills

Most production mills began operating in the midst of the 1992 drought when there was great demand for maize meal. With access to grain supplies, an increasing number of production millers who were deemed eligible by the Ministry of Industry and Commerce to receive roller meal subsidies, and unprecedented rural demand, production millers were able to operate at near capacity levels almost from inception. Until the early months of 1993, most production mills reported operating near full capacity with half of the production millers operating 3 shifts. Most of the production millers operating during drought eventually gained access to roller meal subsidy payments. The roller meal subsidy was administered by providing funds for the GMB to credit the monthly accounts of approved maize millers Z$562 for every ton of roller meal produced and was discontinued in June 1993. During the 1992 drought, many production millers were also able to take advantage of limited supplies of white maize available for purchase from the GMB. With white maize supplies limited and enormous demand for maize meal, large-scale millers concentrated on milling yellow maize. Production millers, by virtue of their small size, could focus on obtaining white maize from GMB depots in small lots and still operate near capacity. The end result was high demand for maize from production millers who often were able to supply consumers with white instead of yellow maize meal.

Yet with the good harvest in 1993 and subsidy removal, business fell off for most production millers. Capacity utilization in mid-1993 was about 24 percent of drought levels, although most production millers interviewed anticipated sales to rise again toward the end of 1993. Almost half of the factory employees at production mills were reallocated to other non-mill related tasks or laid off. Yet even at low rates of capacity utilization, the sample operating budgets presented in Section 5.3.1 demonstrate that production millers can cover all fixed and variable costs and generate a profit. Assuming an average annual capacity utilization at 24 percent, the typical production mill would still yield a profit of Z$174,625 per year. Sensitivity analysis indicates that a typical production miller could still break-even with a annual capacity utilization rate of 12 percent. Some of the major sales and marketing constraints experienced by production millers, a major factor in low capacity utilization rates in late 1993, are discussed in Section 5.5.

5.3.4.3 Capacity utilization of large-scale mills

The drought also yielded enormous benefits for large-scale millers. At the peak of the drought (October 1992 to January 1993), large-scale mills were operating 3 shifts and manufacturing at peak capacity (as much as 100,000 tons of maize meal per month in total). By mid-1993, with the removal of the roller meal subsidy and increased reliance on custom millers, production fell to less than 20 percent of capacity. Although by early 1994 demand again began to grow, purchases of maize by large-scale millers from the GMB are only half of 1989-91 levels.

Clearly, large-scale millers have been hurt by the 1993 reforms. Large-scale millers have also seen demand for wheat flour from bakeries decline. The removal of bread subsidies in April 1993 resulted in a 40 percent increase in retail bread prices, leading to a reduction in consumer purchases, and a significant fall in demand for milled wheat flour from large-scale millers.

The implication of the foregoing summary is that there is no shortage of capacity in the milling industry when the potential capacity of all three types of milling technology are considered. The experience of 1993 has shown that consumers, most with falling real incomes, are seeking the lowest cost source of maize meal. Over the next few years, with excess capacity in all three technology types and assuming no policy changes that would formally create preferential market or input access, the levels of capacity utilization in each type of mill (custom, production, or large-scale) will depend upon the total acquisition price (i.e. retail price plus consumers' time and transport costs) of their products, which in turn will be a function of the existing market regulations.

5.3.5 Enterprise flexibility

With excess capacity in the industry, as well as normal inter-annual and intra-annual fluctuations in demand, the degree of "enterprise flexibility" of alternative milling technologies will gain importance. For example, in the period immediately following the 1993 maize harvest, urban custom millers processed large volumes as customers brought maize obtained from urban plots or rural-urban areas to be milled. As the year progressed, throughput at urban custom mills fell. As other sources run out, some consumers wanting maize to process at hammer mills began to rely on maize purchased from urban vendors. In the longer-term, as urban maize markets continue to develop, seasonal variations should greatly diminish. In rural areas, demand for custom milling services was also at its peak right after harvest as farmers brought their own production to be milled. As the year progressed, an increasing number of households ran out of grain. With poorly developed rural grain markets, demand in rural areas for custom milling services declined and roller meal purchases rose. In 1991, Jayne and Chisvo estimated that a total of 505,000 tons of maize meal are purchased in a "typical year" in rural and urban areas. Since current urban consumption requirements are estimated to comprise about 240,000 tons of this total (see Chapter 4), rural purchases may approach 265,000 tons in a "typical year."

Production millers face similar seasonal variations, only reversed. The decline in demand for custom milling services towards the end of the marketing year as rural and urban households run out of maize are a boon to the production miller. As the marketing year progresses, sales of packaged maize meal begin to pick up. During the 1992 drought, when few if any households had maize left by October 1992, all rural production millers experienced exceptionally strong demand for packaged maize meal.

This seasonal pattern suggests that hammer mill technology in general can offer a unique degree of flexibility in dealing with seasonality problems particular to custom and production millers. In the period after harvest, hammer mills can be operated as custom mills to meet demand for milling services. As the year proceeds, with the addition of a bagging facility and possibly a dehuller, hammer mills can begin production of a bagged maize meal product for deficit rural consumers. The equipment cost of making the transition from a custom miller to production miller is relatively small (about Z$13,200), distribution and finding market opportunities is the greatest constraint. One of the advantages of hammer mill technology is that it permits this type of flexibility in milling operations. Large-scale mills do not have this capability.

As rural-urban and rural-rural trading links develop, these intra-seasonal variations will grow less important: households desiring maize for custom milling should be able to obtain it year-round from private traders. However, households once having exhausted maize sources that entail a low cash outlay (i.e. own production or transfers from relatives) may opt to buy purchased maize meal instead of maize grain for hammer milling if the opportunity cost of time in hammer milling is too high. Chapter 6 explores further the impact of the 1993 reforms on possible equilibria between the demand for hammer milling services and demand for purchased maize meal.

5.3.6 Locational choice in milling

An issue closely related to enterprise flexibility is one of locational choice. Decades ago, large-scale millers undoubtedly situated their roller mills in major urban centers in order to be near major GMB depots and urban consumers. Urban consumers were the primary market for refined meal when roller mills were introduced to Zimbabwe. Large GMB warehousing depots in major urban centers and pan-territorial and pan-seasonal prices essentially guaranteed (and guarantee) large-scale millers a stable supply of maize at fixed prices year-round.

The criteria used by hammer mill owners in selecting the location of their mill were somewhat different. For the most part, the location of a urban custom milling enterprise was determined by the location of the owner's other businesses. Since most urban custom mill owners are established businessmen (over 80 percent said they had some type of shop), the mills were located at their existing business site at an urban shopping center. The few urban custom millers with mills located on home sites (adjacent to their residence) have fared worse than the rest and tend to cite problems attracting sufficient customers with much greater frequency. Most urban custom millers operating on home sites had been contacted by city authorities concerning zoning violations and threatened with closure. However, none of the mills surveyed in 1993 had been permanently closed for violating zoning regulations. Clearly, with zoning restrictions and long delays in getting approval to situate a new business in an urban area, there are advantages to already having a business site allocated. The ownership of other businesses at prime urban locations (i.e. shopping centers) was a pre-requisite to entering urban custom milling. As long as there continue to be long delays before municipalities grant new business sites, this will remain the case.

Production mills are primarily located in rural areas: only 3 of the nation's 14 production millers are in major urban centers. In the survey, production millers were asked the relative importance of a number of factors in the decision where to establish their milling operation. No clear pattern emerged: production millers appear to be pursing a range of business strategies. Most production mills in rural areas were powered with diesel motors and over half said that the presence of good infrastructure, namely electricity and water, was "not important" to them. Over half of respondents did say that being "close to home/family" was "very important" in their location decision. Being "close to maize producers" was also cited as "very important" by half. Even before maize movement decontrol in mid-1993, most production millers had actively begun to procure maize directly from farmers, often at prices below GMB selling prices. The two production millers in mostly maize deficit regions stressed the importance of their location adjacent to a rural GMB depot

The three urban millers tended to stress the importance of locating "close to customers." Locating in rural areas, further from urban markets, was not viewed as a liability by most production millers. First, even in good rainfall years there is some demand for packaged maize meal in rural areas among deficit consumers. In fact, roller meal produced by production millers has a higher extraction rate (92 percent on average) and lower price than roller meal from large-scale millers. Second, most rural production millers, though operating in rural areas, were either still relatively close (within 100 kilometers) of a major urban market or were very close to several smaller towns. Finally, locating in rural areas means production millers only need to transport a finished product to urban markets, saving as much as 15 percent of the equivalent weight of transporting raw maize to an urban center for processing.

5.3.7 Generation of linkages

Rural non-farm enterprises can play a crucial role in agricultural development. In summarizing 15 years of research on farm-nonfarm linkages, Haggblade, Hazell, and Brown (1989) highlight the potential importance of both production and consumption linkages in contributing to more equitable and geographically dispersed growth. Production and consumption linkages magnify the effects of agricultural growth by small farmers through demand multipliers. For example, increased demand by smallholders for construction materials, agricultural implements, and other inputs generate production linkages as small-scale brick-making and metalworking enterprises blossom. Similarly, as rural incomes grow, greater spending on consumer goods produced in rural areas (for example clothing from small-scale cotton weavers) can create consumption linkages.

Small-scale enterprises can also contribute to broad-based rural development through what may be termed "marketing linkages.[7]" Marketing linkages are distinct from both production and consumption linkages in that the central node from which backwards and forwards linkages flow is the manufacturing firm, rather than the farm. Marketing linkages

[7] I am grateful to Dr. Donald Mead for his insights on marketing linkages.

generated by rural, small-scale firms can: (1) create alternative marketing outlets for commodities produced by small farmers; and (2) by competing with large-scale urban firms, reduce the manufacturing dominance of core areas at the expense of the periphery. Rural production millers in Zimbabwe offer a prime example of the types of backwards and forwards marketing linkages induced by small-scale enterprises.

With maize market liberalization in July 1993, production millers were permitted to purchase maize from farmers at any mutually acceptable price. Even with the restrictions, most production millers had been procuring some maize from producers at market prices since beginning milling operations. During the 1993/94 marketing year, farmers still retained the option of selling to the GMB at the official GMB buying price of Z$900 per ton, but some farmers did prefer to sell maize to production millers and private traders at lower prices. By buying maize early from farmers and storing it for milling later in the year, production millers could realize substantial savings since the acquisition price of maize directly from farmers was far below the GMB selling price of Z$1,070. Prices paid by production millers when picked up from farmers ranged from a low of Z$555 to the official price set for Approved Buyers of Z$855. When maize grain was brought to the production mill by farmers, prices paid ranged from Z$750 to Z$900. Table 46 presents a summary of the average maize acquisition costs for a production miller from alternative sources in 1993.

Table 46: Average acquisition price of maize grain for production millers (July-September 1993)

Source of Maize Grain	Average Acquisition Cost (Z$)
Purchase from GMB (inclusive of bag costs)	1106
Purchase from farmers (purchase at mill)	856
Purchase from farmers (purchase at farmgate)	749

Source: Survey data

Farmers sold to production millers at lower prices to save the cost of transport required to move their grain to the GMB, and to obtain immediate payment rather than wait for a cheque from the GMB. In addition, most production millers and traders did not adhere to the same maximum moisture requirements that the GMB maintains, and many accepted grain unbagged or in non-standard grain bags. Also, by selling to millers and traders, farmers were able to avoid "stop-orders" on GMB payments imposed on farmers with overdue Agricultural Finance Corporation debts. Despite these apparently rational reasons why a farmer might sell maize at below the official GMB price of Z$900, during the 1993/94 season, private traders and millers were often criticized in the media by government officials for "exploiting" smallholder farmers (The Herald, 1994). As a result, production millers may have intentionally over-estimated prices paid to farmers as presented in Table 46.

By October 1993, most production millers had run out of relatively inexpensive maize grain purchased from farmers and were relying on supplies from the GMB at Z$1,070 per ton plus bag costs. After locally produced maize becomes scarce, most production millers are close enough to GMB grain depots to obtain maize without incurring large transport costs. Eight millers were less than 20 kilometers from a GMB depot, with four millers two kilometers or less from a depot. However, many millers believed that with sufficient cash, they could have purchased more maize directly from producers at low prices, reducing their need to buy higher-priced GMB maize. Yet only two or three millers have enough storage space for keeping a 12-month maize stock, based on peak sales patterns. All but two production millers have at least 100 tons of storage capacity, with the average about 180 tons.

Production millers have also attempted to establish forward marketing linkages with urban retailers, competing with the large-scale urban milling firms. Aspects of these forward marketing linkages are explored in Section 5.5.1, but a common trend is the tendency for production millers to vertically integrate into retailing operations due to difficulties penetrating urban markets. Anecdotal evidence gathered from firm-level interviews suggest that given the presence of oligopolistic practices in input supply and production distribution and lingering government controls, vertical integration is both a common and necessary strategy among emerging businesspersons in a number of sectors, including maize milling.

Finally, important production linkages between mill manufacturers and hammer millers have also arisen. The two largest domestic manufacturers of hammer mills experienced tremendous increases in demand for hammer mills beginning in mid-1993. During 1992, sales at the two companies averaged less than one mill per month. By June 1993, mill manufacturers were operating at their current technical capacity, producing a total of 55 to 65 mills per month.

5.4 Supply response constraints of custom millers

Although custom and production millers have some superficial similarities, they are fundamentally different types of enterprises. As a result, in the following analysis of expansion constraints, custom and production millers are treated separately. This section presents a summary of the constraints to the expansion of the custom millers, with the next section focussing on production millers. The data presented on supply response constraints is from two firm-level surveys undertaken in 1993: a survey of owners of custom mills and a survey of mill operators.

5.4.1 Access to manufacturing inputs

In previous years, with movement restrictions that effectively prevented maize grain from being transported into urban areas, access to raw material was the greatest constraint to the growth of custom milling. With the 1993 market reforms, this constraint has been relieved; although there is still seasonality in the demand for milling services, maize grain is available in urban markets in the pre-harvest period. Although the growth of custom millers has all the hallmarks of a "success story," custom millers do face constraints. For custom millers, probably the greatest constraints are obtaining spare parts and infrastructural constraints (i.e. electricity supply).

Access to spare parts is especially problematic: 79 percent of mill owners said that they had experienced trouble obtaining spares within the preceding six months. Spares which were the most difficult to obtain were sieves (cited by 79 percent of mill owners) and bearings (54 percent of owners). Both items are imported. When millers faced difficulties getting sieves they either: (1) arranged for screens to be brought from Botswana or South

Africa; or (2) repaired worn sieves as a temporary measure. When difficulties were faced obtaining bearings, they were usually obtained privately from outside the country.

Domestic manufacturers of hammer mills, who are also the main suppliers of spare parts, acknowledge the problems millers face in obtaining spares, particularly sieves and bearings. Sieves are shaped locally from imported sheets; no local firm has the equipment to manufacture sieve sheets with the required fine holes. Sieves ready for inserting into the hammer mill sell for Z$90 to Z$150. One manufacturer said that although delivery of the sheets used to shape sieves usually took 6 to 8 weeks, they had been waiting 3 months for a recent order. According to the manufacturers, shortages could also be attributed to the delays experienced in clearing shipments of sieve sheets (and other materials) through customs. With greater availability of foreign exchange through such mechanisms as the Export Retention Scheme, access to foreign exchange was not considered a problem by the manufacturers in getting imported spare parts. Mill manufacturers also noted that there is now a local company that manufactures bearings, although when stocks run out there can be delays until the company undertakes another production run.

Although the questionnaire did not ask about the reliability and accessibility of electricity, a third of mill owners surveyed specifically mentioned electricity supply problems in open-ended questions. A number of mill owners mentioned the difficulties faced by an emergent miller in getting electricity hook-ups to business sites in industrial areas. These mill owners asserted that some businessmen are discouraged from establishing mills because their sites are "unserviced" (with no electric or water connections). Getting electricity hook-ups to an "unserviced" site, if possible at all, can take over a year. Other mill owners cited the problems posed by unscheduled load-shedding, the practice of

Zimbabwe's electricity supply parastatal of interrupting power supplies to specified areas to reduce the load on the national grid. Power surges associated with load-shedding can damage the electric motors of hammer mills, leading to costly repairs. Finally, a number of respondents cited difficulties created by a recent increase in electricity tariffs.

5.4.2 Health, licensing and zoning regulations

For most custom millers, current health, licensing and zoning regulations are a potential rather than immediate problem. Only a third of custom millers surveyed said there were regulations or licensing problems that created an immediate problem to their firm. However, current health, licensing and zoning regulations deserve attention because virtually all custom millers are in violation of one or more regulations. Increased enforcement of existing by-laws and regulations could pose severe problems for most enterprises. There are two pieces of legislation that govern health aspects of food manufacturing enterprises. The Food and Food Standards Act (Chapter 321) outlines in very general terms health regulations governing food manufacture and sale. According to the Act, individuals and firms are prohibited from manufacturing or selling food that is "adulterated or falsely described" as defined by the Act.

More importantly, urban mills are subject to city by-laws, with specific health regulations contained in by-laws for each city. In Harare, city by-laws pertaining to food manufacture and sale are under the jurisdiction of the City Health Department. A hammer mill, as a entity that produces and/or trades in a food product, is required to be licensed as a "food factory." The Harare by-laws for all food-handling premises require that all premises meet certain guidelines including: connection to an approved water supply, adequate lighting and ventilation, approved construction materials (usually cement) for the floors and walls of every room in which food is handled, ceilings for every room, storage facilities that are protected from the risk of contamination, and an approved number of wash basins and toilets with piped water. The Harare City Health Department maintains a staff of 44 inspectors in Harare to check for violations. If an establishment is found in violation of the by-laws, a written warning is delivered outlining problems that need to be rectified. If no progress is made by the time an inspector revisits the establishment, a fixed spot fine is assessed for each individual violation. Finally, repeated violations can result in permanent closure and a court case brought against the owner.

Virtually no urban custom mills meet the above requirements. However, an official of the City Health Department whom was interviewed knew of only one instance in the past year where a hammer mill had been prohibited from operating. According to a former inspector, it is the practice of the Harare office to focus on obvious threats to health using "common sense." Apparently, the above regulations are not strictly adhered to and health inspectors have been operating more in terms of "common sense" rather than the letter of the law.

Only three mill owners (of 25 surveyed in the second round) had been visited by city health inspectors. In all cases, the owner was asked to make improvements such as erecting a roof or building a toilet. In two of the three cases, the mill owner had complied with the request.

The owner of any business, particularly a manufacturing enterprise, faces a myriad of licensing requirements. Some of the requirements expressed in various Acts of Parliament are nation-wide in scope. Other requirements reflect city by-laws. Each of the requirements relevant to hammer mills is outlined below in the context of the appropriate legislation.

1. **The Companies Act**. Most businesses are required to register with the Registrar and Deeds Office of the Ministry of Justice, Legal, and Parliamentary Affairs. However, apparently informal rules exist such that registration depends on the scale of business. For example, a Register and Deeds official stated that a custom miller who simply provided grain milling services would not have to register, although a production miller would. The basic fee for a Certificate of Incorporation is Z$10. Applicants also need to pay Z$0.50 per Z$100 nominal share of capital, with Z$32,000 being the usual nominal share capital. The advantages of being a licensed company are that it makes trading and contracting with other businesses easier, allows the business to get loans from formal credit-granting institutions, and gives the business owner limited liability in lawsuits. Disadvantages include taxation at the standard corporate rate of 42.5 percent as well as the cost and time involved in the registration process.

2. **The Factories and Works Act**. Under the conditions of the Factories and Works Act (Chapter 283), every hammer mill operation requires a factory license. For licensing, the premises are inspected by officials from the Factories and Works Department of the National Social Security Authority. Before issuing a factory license, clearance must be granted from the Town Planning Commission to ensure that no zoning restrictions are violated. The licensing fee is presently Z$25. Administration of the Factories and Works

Act is the responsibility of the Ministry of Labor, Manpower Planning and Social Welfare. According to an official of the National Social Security Authority, it is an informal practice that a grain miller with no employees would not be a considered "factory." Workers Compensation is also covered by the National Social Security Authority with a levy of 0.17 percent of the firm's payroll.

3. **Zoning restrictions**. In Harare, a "Master Plan" is used to regulate the location of businesses. The Master Plan, now in draft form, replaces existing Town Planning Schemes. Five major zones are outlined in the Master Plan: commercial, residential, public buildings, industrial, and agricultural. Within each zone there are further categories. For example, the industrial zone has further specific categories of general industrial, special industrial, light industrial, service industrial, overnight parking, and resthouse. Businesses are required to receive approval from the Town Planning Office that they are operating in the correct zone. If a business is not in the correct zone, special consent is needed. Hammer mills are required to be in industrial zones, although it is understood that hammer mills are often required in agricultural zones for the manufacture of stockfeeds.

According to the survey, only 29 percent of mill owners had a business license. Within the past two years, half of the mill owners who did have a license were visited by City authorities who requested to see their business license. None of the owners without a license reported requests to produce a business license. None of the custom mill owners surveyed had a factory license. However, no owners reported any visits from officials requested to see their factory license.

Of the above regulations, the most immediate problem is posed by zoning regulations, particularly regulations which restrict the operation of hammer mills in residential areas or shopping centers. There is a conflict between assuring consumer access to hammer milling services and zoning regulations. Hammer mills are generally noisy and produce maize dust in the grinding process. Of Harare/Chitungwiza millers, 17 percent of custom millers reported that City authorities had ordered closure of their mill due to operation in an area not zoned for light industry. However, all of the mills ordered to close down have continued to operate. Faced with closure, at least two mills have received support from community leaders who have stressed the need to the authorities for convenient hammer milling services in the area.

5.4.3 Seasonality of demand for milling services

For virtually all small-scale custom mill owners, milling began as a secondary occupation. Custom millers usually operated one or more other businesses since, historically, the seasonal nature of hammer milling precluded an entrepreneur from entering into milling as a primary enterprise. The demand for hammer milling services has tended to be the greatest in the months immediately after harvest (June-August) and the lowest in the months immediately preceding the harvest (January-March). The seasonality of the milling business was cited by one-third of custom mill owners as a major problem. However, marketing reforms should, in the longer run, ensure that urban consumers have access to maize grain for custom milling year-round, sharply reducing the magnitude of seasonal downturns in custom milling.

Prior to the 1993 reforms, custom millers experienced seasonal troughs in the demand for milling services in the months preceding the maize harvest since urban households ran out of maize harvested from urban plots and inflows from rural areas shrank. Additional sources of maize grain for urban consumers were virtually non-existent as maize movement restrictions effectively prevented maize sales to consumers by urban traders and vendors. However, the removal of movement restrictions in 1993, coupled with the growth of urban cultivation and an apparent increase in rural-urban inflows has meant a sharp increase in consumption of straight-run meal from custom mills, greatly reducing the magnitude of this seasonal trough in the demand for custom milling services.

In a June/July 1993 survey of urban households, 35 percent reported growing maize on urban plots in or very near the city in the 1992/93 growing season. About two-thirds of these households harvested maize grain for drying and milling. Of the households that grew maize on urban plots, the average urban maize grain production was 154 kilograms, or a five month supply of straight-run meal for the typical household. During the first six months of 1993, over half of all maize grain processed at custom mills was from urban plots. Non-commercial rural-urban maize transfers were the second most common source of maize for hammer milling, accounting for 25 percent of all maize grain inflows to urban household. Market purchases from urban vendors accounted for only 12 percent of maize grain acquisitions.

As alternative maize marketing channels, namely small-scale traders procuring maize from commercial and communal farming areas and transporting the grain to areas where there is consumer demand, begin to develop, intra-year variations in the demand for hammer milling services should be lessened. Already there is evidence that the seasonal trough in the demand for custom milling services in 1993 was not as great as the trough in 1991: the quantity of maize processed by custom mills in September 1993 was four times greater than the September 1991 figure.

In addition to intra-annual seasonal trends, there are also great inter-annual variations due to periodic drought. During periods of drought, such as 1991/92, little or no maize is marketed by producers, either through the GMB or through informal channels. Due to low production, demand for purchased maize grain or maize meal is great and imports are a necessity. However, during the 1991/92 drought, GMB depots allowed bulk sales of imported maize grain only to registered millers. The only exception was households that were permitted to purchase a maximum of one 50 or 90 kg bag. As a result, small-scale traders and custom millers found it very difficult to obtain grain. In spite of the one-bag rule, for most consumers, the only effective source of maize meal was roller meal manufactured by large-scale millers from imported maize obtained from the GMB. With maize grain supplies for the most part reserved for the large-scale millers, only 29 percent of custom millers remained open during the drought.

The only way to eliminate inter-annual variations in the demand for custom milling services is to ensure that, during drought years, urban and rural consumers have access to maize grain for custom milling and are not forced to rely on relatively more expensive roller meal from large-scale millers. Survey results show that many low-income households in both rural and urban areas would prefer to purchase whole maize grain (which could be brought to a local hammer mill for custom-milling) rather than buy roller meal. For example, in May 1993, 300 rural households in five different provinces were asked what they would prefer to purchase if they ran out of their own production. Table 47 shows that 60 percent would purchase 10 kg of maize grain at Z$12 and have it milled at their local hammer mill. Only 12 percent said they would prefer to purchase roller meal at Z$17.50 per 10 kg when maize grain was available at Z$12.

Similarly, 250 urban hammer mill customers were asked in September 1993 whether they would prefer to buy 10 kg maize grain at Z$12.00 and pay a Z$1.75 grinding fee to obtain straight-run, buy straight-run at Z$15.50 per 10 kg bag or buy roller meal at Z$17.50. As Table 48 shows, 74 percent said they would choose to obtain maize grain and have it custom milled.

Table 47: Rural household grain/meal purchasing preferences, May 1993

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

Source: Rural survey data (Probe Market Research)

Table 48: Urban hammer mill customers grain/meal purchase preferences, September 1993

Alternative choices of maize grain and maize meal products offered to mill customers (all in 10 kg packets)	**Percent of urban hammer mill customers that chose this particular type of maize grain/meal at the given prices**
Maize grain at Z$12.00 (plus Z$1.75 grinding charge)	74 percent
Straight-run meal at Z$15.50	18 percent
Roller meal at Z$17.50	8 percent

Source: Hammer mill customer survey data

5.4.4 Access to investment and working capital

Potential entrants into custom milling are constrained by difficulties obtaining credit for the purchase of hammer mills. Over 90 percent of mills surveyed in 1992 were "self-financed." Although several millers obtained loans from informal credit markets, none received formal credit. With the cost of a new mill with a 20 HP electric motor at just over Z$30,000, the lack of credit can inhibit new entrants.

Tight monetary policies and the traditionally cautious nature of the formal lending institutions have restricted access to formal lines of credit. When applying for loans from formal credit-granting institutions, potential borrowers must overcome standard collateral requirements. Also, according to many credit-granting institutions, many loan proposals are rejected because they do not contain the required supporting documents such as bank statements or cost-revenue forecasts. Although the Small Enterprise Development Corporation (SEDCO) recently began a program to finance hammer mills and other agro-industrial projects, no more than 3 hammer mill loans were approved in the 1991/92 fiscal year. In addition, of over 2,100 loans to retrenched workers made through the Z$60 million Social Dimensions Fund, about 10 were for the purchase of hammer mills.

The difficulties associated with obtaining credit from formal channels has not prevented a number of new hammer mills from being established with the past year. In February 1992, a total of 57 hammer mills were located in the Harare and Chitungwiza area. By August 1993, a further 17 mills had been established, a increase of 30 percent in 18 months. Country-wide, sales of hammer mills by the three major mill manufacturers have also increased substantially in 1993. One manufacturer reported that sales were averaging 30-35 mills per month since April 1993 and they had a delivery backlog of over 50 mills. During 1992, sales averaged 1 mill per month. Another major manufacturer said that from May 1993 to October 1993, monthly sales were averaging 25-30 mills per month, whereas only 6 mills were sold in all of 1992.

5.5 Supply response constraints of production millers

This section presents a summary of the constraints to the expansion of production millers. The results presented are based on open-ended interviews conducted with the owners of 11 production mills in 1993.

5.5.1 Marketing constraints

Since the 1993 reforms, large-scale millers have seen their sales drop significantly, tempting some observers to conclude that production millers have gained a significant share of the market for bagged roller meal. During the six month period from May to October 1990, maize sales from the GMB to these millers (a good indication of actual sales of large-scale millers) averaged 46,700 tons per month. However, during the May to October

1993, maize sales to millers only averaged 16,600 tons per month.

The large-scale millers cite the remaining restrictions which require them to purchase maize exclusively from the GMB as the reason for their fall in sales. According to this view, the requirement that large-scale millers procure their maize from the GMB at Z$1070 per ton has disadvantaged them compared to production millers who can buy maize directly from producers at lower prices.

Large-scale millers have not, however, lost market share to production millers. Although production millers can bypass the GMB and purchase maize directly from farmers, the two largest large-scale milling companies still have a very large share of the purchased maize meal market.[8] The May/June consumption survey revealed that 92 percent of maize meal purchases were of products of these two companies. Only 4 percent of purchases of bagged maize meal were from production millers. Although the total size of the market for purchased maize meal has been declining, large-scale millers have maintained their large share of the market relative to production millers.

Interviews conducted in 1993 confirm that production millers have not yet gained a significant share of the purchased maize meal market. Indeed, probably the greatest challenge facing production millers (and large-scale millers) is selling a bagged "roller meal" product at a time when the relative price difference between packaged roller meal and custom milled straight-run meal is large. More consumers can and are investigating cheaper ways of procuring maize meal, such as procuring maize grain and having it milled for a fee at a local urban hammer mill.

The average monthly "peak output" for a production miller was 519 tons of maize

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

meal produced. For most production millers, this peak output occurred in late 1992 and early 1993, at the peak of the recent drought. By contrast, by August/September 1993, average monthly output had fallen to a quarter of its peak, about 123 tons of maize meal produced per month. Capacity utilization rates, where maximum capacity is defined at output during the peak month, varied considerably at the 11 production mills surveyed. During the July-September 1993 period, some mills were producing less than 1 percent of the amount of bagged maize meal as they did before the 1993 harvest. As a result, these production millers were largely focussed on meeting demand for custom milling services in their area. Other millers, particularly two production millers that have successfully penetrated the urban maize meal market, had capacity utilization rates approaching 70 percent.

Wholesale prices charged by production millers for their roller meal products are lower than prices charged by large-scale millers for roller meal. The four large-scale milling firms agreed in June 1993 to sell maize meal at uniform prices, with the wholesale price of roller meal set at Z$15.86 for a 10 kg bag by the large-scale millers' trade association. The large urban retail chains have also agreed on a uniform mark-up of 10 percent, making the retail price of a 10 kg bag Z$17.45. By contrast, the average wholesale price of a 10 kg bag of roller meal from production millers (average extraction rate of 91 percent) was Z$14.78. The operating budgets presented in Section 5.3.1 suggest that there is scope for even further reductions in the wholesale price of roller meal from production millers, particularly if production millers are operating near full capacity. Interestingly, the only two production millers that have successfully penetrated urban retail markets sell their maize meal at the Z$15.86 price recommended by the large-scale millers' trade association.

However, despite the lower wholesale price of roller meal from production millers, production millers have not gained significant market share; large-scale millers continue to dominate the purchased maize meal market. This is puzzling since previous surveys have demonstrated that urban and rural maize meal consumers are extremely price sensitive. Thus the major question is: if production millers have under-utilized capacity and offer lower wholesale prices, why haven't they been able to garner more market share from the large-scale milling firms? Despite their lower wholesale prices, why do so many production millers cite their major problem as finding a market for their product?

The answer is that, for the most part, the lower wholesale prices of production millers have not been translated into lower retail maize meal prices. Although market reform has encouraged the growth of production milling firms, there are bottlenecks in the retailing stage of the maize marketing system that are preventing consumers from fully realizing the benefits of a more competitive milling industry. Furthermore, there is evidence that the large-scale firms have developed marketing strategies that have effectively limited market access by production millers. Without their lower wholesale prices being translated into lower retail prices (and greater total revenue), production millers have little incentive for further wholesale price reductions at this time.

Although many retailers purchase maize meal from production millers at prices below those of the large-scale millers, their retail prices are the same across all producers. Therefore, a 10 kg bag of roller meal purchased from a production miller at Z$14.75 and a 10 kg bag purchased from a large-scale miller at Z$15.56 would both be sold at Z$17.45. The mark-up received by the retailer on the production miller's product would be 18 percent and the mark-up on the large-scale miller's product the standard 10 percent. Assuming the consumers are very price sensitive, this would not be a profit-maximizing strategy by the retailer. After all, the retailer could offer the roller meal from the production miller at a price of, say, Z$17.00 and greatly increase sales. The mark-up would be lower (15 percent instead of 18 percent), but the total units sold would be much higher as consumers were attracted to the low roller meal price of Z$17.00, increasing the retailer's total revenue.

Why then would a retailer adopt a retail pricing formula that ensured that roller meal was sold at a uniform price regardless of the retailer's acquisition price? Results from a rapid appraisal of retailers in Harare and Mutare in October 1993 suggests two reasons for such an outcome.

First, many small retailers, especially those in rural areas, are dependent upon the distribution networks provided by large-scale millers and are reluctant to undertake measures that would jeopardize their supplies of stock. For example, large-scale milling firms, in addition to manufacturing maize meal and wheat flour, package and distribute a wide range of other foodstuffs such as salt, sugar, cooking oil, kapenta and dry beans that are the mainstay of many small retailers. Small retailers receive regular deliveries of these items from the large-scale milling firms based on orders placed with area sales representatives that regularly visit their stores. Some retailers contacted during the rapid appraisal feared that stocking a lower-priced roller meal from a production miller could jeopardize their access to the wide range of foodstuffs the large-scale millers offer. Many retailers cited the challenges in receiving allocations of cooking oil and sugar from large-scale millers during shortages in 1991/92 as another reason for maintaining good relations with the large-scale milling firms and their sales representatives.

Even those retailers who have considered stocking low-priced roller meal from production millers voiced concerns about the reliability of supplies from production millers. In their view, selling maize meal procured from production millers at lower prices may be a way to increase maize meal sales (and profits) in the short run, but there are concerns about whether production millers can guarantee reliable supplies. One retailer who had stocked maize meal from a production miller noted that a mechanical problem with a delivery truck can delay deliveries by one week while large-scale millers have a fleet of vehicles. However, when asked about problems facing their business, none of the production millers interviewed cited difficulties with transportation.

Second, the structure of the food retailing in urban areas of Zimbabwe suggest the scope for possible monopolistic collusion. Consumer surveys in mid-1993 revealed that 46 percent of consumers of bagged maize meal purchased maize meal at large supermarkets. About 44 percent of consumers purchased maize meal at small grocery stores with 9 percent purchasing at very small neighborhood "tuck shops."

While most of the large supermarkets stock maize meal from three of the four large-scale millers, only two of the eleven production millers interviewed had been able to regularly market their products through large supermarket chains. Both of these production milling firms gained access to the major chains at a time when production millers were the only milling firms able to supply white maize meal exclusively. During the drought, while the large-scale milling firms sold maize meal manufactured from imported yellow maize, these two production millers, by virtue of their very small size, were able to rely almost completely upon the small quantities of white maize that were periodically available at

GMB depots. By June 1993, when the large-scale millers had access to their required amounts of white maize, these two production millers were able to maintain access to the large supermarket chains, although not without some difficulties.

A buyer for a large supermarket chain argued that with the number of products available constantly growing it was impossible for even the largest store to stock products from all manufacturers. However, with essentially two large supermarket chains, the scope for informal agreements between large supermarkets and large-scale millers is substantial. For example, in March 1993, a large supermarket chain introduced a low-priced roller meal produced by a production miller and bagged exclusively for the supermarket chain. According to a representative of the supermarket chain, the product (priced at Z$7.15 for 5 kg versus the uniform large-scale millers price of Z$8.83 for 5 kg) sold very well. Yet the product was discontinued after one month. An informant in the large-scale milling industry asserted in an interview that the product was discontinued after an agreement between the supermarket and a representative of the large-scale millers who were concerned about the possible impact on sales. As a result of these difficulties breaking into established maize meal marketing channels dominated by large-scale millers and retailers, it is no surprise that the most commonly cited constraint by production millers was difficulties marketing their product. In order to overcome these marketing constraints, production millers have adopted a variety of marketing strategies:

1. **Vertical integration.** Faced with difficulties convincing small groceries and large supermarkets to stock their items and the inability for production millers to induce retailers to pass on the lower wholesale prices to consumers, production millers have been forced to look for alternative

retailing options. One common strategy has been for production millers to focus on selling their maize meal at their own retail shops. Most production millers have a diversified range of businesses, ranging from bus companies to bakeries to nightclubs. The majority of production millers have at least two retail shops, with two millers having as many as six shops. Five production millers said they had recently opened a retail store in an urban area, or were planning to do so.

2. **Offer an expanded product range.** As mentioned, large-scale millers offer retailers, in addition to maize meal, a wide range of staple foods such as salt, sugar, rice, cooking oil, kapenta and dry beans. In order to compete with large-scale millers, production millers have begun to purchase bulk quantities of these foodstuffs and package them for re-sale. Offering an expanded product range requires very little new investment: all that is needed is a bag sealing machine and an initial supply of plastic bags. The only limitation is the allocation system (i.e. for rice) whereby limited supplies of certain foodstuffs are administratively allocated to firms. In the past, there were perceptions by production millers that established firms had advantages in receiving allocations over emergent firms.

3. **Cultivate relationships with small urban retailers in high-density suburbs.** Small urban retailers are not as dependent upon large-scale millers for deliveries as rural shops since there are a wider array of possible suppliers. All three of the production millers whose manufacturing sites are in urban areas have targeted their marketing strategy at small urban retailers

in the high-density suburbs. Typically, the mill owner will visit the retailer with samples of the maize meal. The mill owner will highlight the potential advantages to the retailer of selling a low-priced maize meal. Sometimes the retailer and mill owner have a pre-existing business or familial relationship. By focussing on a handful of small urban retailers, there is anecdotal evidence that urban production millers have gradually begun to penetrate urban markets in high-density suburbs.

4. **Target institutional buyers.** Potential opportunities for sales to institutional buyers have caught the eye of production millers. Institutional buyers (schools, hospitals, prisons, refugee camps, military units, etc.) often have year-round demand for maize meal and purchase large quantities. The major problem for production millers hoping to supply to Government institutions is the government tender process. The Tender Board typically calls for tender proposals in large amounts. For example, tenders may be solicited for firms that can supply a given amount of roller meal to all hospitals under the purview of the Ministry of Health. Many production millers do not have a production and distribution network required to bid for a nation-wide tender. However, two areas in which production millers have made headway is in supplying private schools and refugee camps run by private voluntary organizations.

With the increased dependence in urban areas on custom mills, a stable year-round demand for packaged maize meal can no longer be assured. In the coming months, production millers will continue to battle over market share and large-scale millers amidst an overall decline in the demand for purchased maize meal. Yet without greater market access for production millers at the retail level, consumers will not realize the benefits of lower maize meal prices on bagged and branded products.

5.5.2 Technological limitations

Production millers use the same hammer milling technology as custom millers. In many instances, the same size hammer mills are used by both production and custom millers; production millers just have more mills. However, production millers, unlike most custom millers, also possess dehullers in order to manufacture a more refined product. Since equipment originally manufactured for custom milling has simply been adopted to production milling, it is no surprise that there are certain limitations with the existing technology. Production millers interviewed identified three areas in which further technological innovations are needed.

1. **Improved dehuller technology.** The dehuller type currently used by production millers was originally designed to dehull millet and sorghum. Several years ago, a Zimbabwean NGO introduced dehullers in the western provinces of the country based on the hypothesis that the major constraint to increased smallholder reliance on millet and sorghum was processing difficulties. Millet and sorghum must be dehulled prior to milling, a task that was (and still is) mostly done by hand pounding. Virtually all production millers agreed that the dehullers currently in use were simply too slow. The standard hammer mill with a 15-20 HP electric motor can mill five to eight 90 kg bags of maize per hour depending upon the age of the

mill and the condition of the hammers. By contrast, the type of dehuller now in wide use can only mill one to three 90 kg bags per hour. As a result, most production millers have unused milling capacity even at maximum output levels: the current dehullers simply cannot keep up with the hammer mills. As a partial remedy, during periods of heavy demand, production millers may operate dehullers around the clock while only milling 12 hours per day. Other production millers have several dehullers for each hammer mill, substantially raising their initial investment cost. One major mill manufacturer was very critical of the design of the dehullers now in use. The mill manufacturer stated that his firm had only sold or had orders for 10 dehullers in the past 2 years. In a factory test, the dehuller only processed one 90 kg bag of maize per hour.

2. **Improved hammer mill technology.** Some production millers also had complaints about the existing hammer mill technology. Seven of the production millers were relying on hammer mills manufactured by the two largest manufacturers of hammer mills, which are identical to hammer mills used by custom millers. The general consensus was that the standard mills, particularly those of one manufacturer, were not designed to stand up the continuous processing operation of a production milling enterprise. Few problems were reported from standard mills bought from the second manufacturer. However, a larger, improved hammer mill design does exist and is currently used by four production millers. This design, custom-manufactured by a Harare engineering firm, is based on the same hammer

mill technology only larger-scale. These newer hammer mills are powered by a 60 HP or larger electric motor and have the ability to process three times as much grain as the standard hammer mill.

3. **Flexibility to mill wheat.** Five of the eleven production millers also owned or were partners in a bakery. Since current hammer mill technology was found after experimentation to be inappropriate for milling wheat for baking flour, all owners relied on the large-scale millers for deliveries of wheat flour. In some instances, the dual position of the large-scale millers vis-a-vis the production millers, competitor (in maize milling) and input supplier (in wheat flour) has created difficulties for production mill owners. All five expressed a desire to be free of any input-dependency on the large-scale milling firms. Hammer mills may be able to mill wheat flour with an innovation of an addition of a processing step that ensured adequate gluten content in the wheat flour. Furthermore, the same cost advantages that hammer mills possess over roller mills in the manufacture of maize meal may apply to wheat milling. Wheat flour milling is currently the exclusive preserve of the four major large-scale milling firms. Increased reliance on hammer mills for wheat processing could lead to lower bread prices for consumers just as has occurred for maize meal.

4. **Technical assistance in stockfeed manufacture.** All eleven production millers sell the by-product from maize dehulling. The average selling price for this residue was Z$653 per ton. Buyers are mostly small-scale and large-scale farmers from the surrounding areas. Several millers mentioned

that there were opportunities to market a properly formulated stockfeed, just as the large-scale millers do. For example, women's clubs, schools, and cooperatives often maintain poultry projects and have a steady demand for nutritionally balanced feeds. The major limitation for production millers is a lack of the technical knowledge required for the formulation of different types of animal feeds with the correct nutrient balance.

5.5.3 Borrowing working capital

Most production millers are well-established businesspersons with a wide range of business activities, of which grain milling is only a small part. Six of the production millers financed their foray into milling with their own savings or revenue from other enterprises. Five production millers started milling after they received loans: four received loans from commercial lending institutions and one was provided with a subsidized loan at part of an NGO development project. Interest rates on commercial loans ranged from 19 percent (in 1989) to 35 percent (in 1993). Despite the use of bank loans and the extent of self-financed investments, access to finance was a commonly cited constraint; seven millers cited obtaining finance for expanded operations as a major constraint in an open-ended question. A major complaint of production millers was the difficulties experienced in obtaining loans without possession of title deeds for land. Although there has been considerable debate, the GRZ has not granted title deeds for land to small-enterprises in rural areas. The result is greater difficulty meeting collateral requirements. All but three production millers are located in rural areas and do not possess title deeds.

In addition to enterprise expansion, one of the primary reasons many millers wanted finance was to enable them to buy maize from farmers early in the season. With the lifting of maize trading restrictions during the 1993/1994 marketing year, production millers were legally able to buy maize from private traders and farmers at any mutually acceptable price. By buying maize early and storing it for milling later in the year, production millers could realize substantial savings since the acquisition price of maize directly from farmers ranges from Z$555 to Z$855, far below the GMB selling price of Z$1,070. With sufficient working capital to purchase maize directly from producers at low prices, the need to buy higher-priced GMB maize later in the year could be eliminated. For some millers, especially those distant from urban markets, buying early from producers does have certain risks. With a good harvest in the area, a production miller may find little demand for maize or maize meal and, instead, be induced to focus on providing custom milling services. Although eventual re-sale to the GMB may be an option, storage costs and losses may be large.

5.6 Implications of choice of technology in maize milling for development policy

The foregoing sections have demonstrated that, given the market conditions in Zimbabwe in 1993, production millers using hammer mill technology had lower labor and capital costs than large-scale roller mills. Hammer mill technology was also found to be superior to roller mill technology based on criteria such as employment generation, use of investment capital, foreign exchange utilization, and enterprise flexibility. Although production mills were able to produce a very similar product to the roller meal produced by large-scale roller mills, the wholesale prices of roller meal-like products from production mills were as much as 12 percent lower, and there are indications that wholesale prices could drop even further. Labor-intensive production mills employed over seven times as much labor to produce a given output than large-scale roller mills. Production mills also only required one-seventh the amount of investment capital and one-sixteenth the amount of foreign exchange as hammer mills to produce a given unit of output. These conclusions support similar findings of inappropriate technology choice in grain milling in developing nations (Timmer, 1973; Stewart, 1977; Bagachwa, 1991).

Such findings inevitably raise the broader question as to why capital-intensive roller mills were repeatedly selected by large-scale milling firms despite the apparent advantages of labor-intensive hammer mill technology in Zimbabwe. After WWII, urbanization and growing urban demand for maize meal contributed to the steady growth of the maize milling industry. Why didn't investors in maize milling choose hammer mill technology around which to build a large-scale milling industry? Given the low wage rates that prevailed, why was roller mill technology selected? This remainder of this section draws on the developing literature on incorrect factor proportions to posit possible explanations. There are four categories of possible explanations:

1. Distorted factor prices encourage adoption of capital-intensive technologies.
2. Decision-makers possess bounded rationality.
3. Firms have broader objectives than cost-minimization.
4. Technology choices observed today are dependent upon initial, perhaps seemingly insignificant events, that have determined the path of development over time (path-dependency).

The first explanation, that factor prices distortions cause the wrong economic decisions, fits well within the neo-classical paradigm. A firm faced with distorted factor prices may make a rational choice that differs substantially from the firm's choice with a set of less apparent distortions. White (1978) notes that labor costs in developing countries are often inflated by minimum wage legislation, mandated benefits, union activity, and restrictions on laying off workers, while capital costs are often kept artificially low with mechanisms such as below-market interest rates, over-valued exchange rates and accelerated depreciation schedules. Although high-wage and cheap-capital policies may have well-defined goals, the net result is often that manufacturing enterprises tend to favor capital-intensive technologies.

A second possible explanation is that decision-makers within firm or planning agencies possess bounded rationality. Information on all available technologies may be difficult to obtain and search is costly. In a study of technology choice in three public-sector manufacturing enterprises in Nigeria, Igwe and Ndekwu (1985) argue that decision-makers did not review all of the possible technological alternatives and therefore made choice errors in a number of cases. Igwe and Ndekwe stress that there was no explicit criteria for selection of technology. A variant of this view is that technology choices involve much more than evaluating current factor prices but also reflect managers' expectations of future factor prices. Fears of labor's future intransigence have often been suggested by firm managers as a reason for a capital-intensive method (Winston, 1979). When such fears are not borne out, it appears to the observer that an inappropriate technology choice was made.

A third, wide ranging explanation is that cost-minimization is only one component of the decision-making criteria in technology choice. Leibenstein (1966) argues that firms often exhibit X-inefficiency: a rather ambiguous type of inefficiency largely, but not wholly, reflecting insufficient motivation. In situations where competitive pressure is light, decision-makers may not work as effectively as they could. In a similar vein, Winston (1979) suggests that mangers may make choices designed to maximize their ability to collect bribes and that high pay-offs are more closely linked to capital-intensive enterprise choices. Wells (1975) takes a broader (and less materialistic view) and argues that inappropriate technological choices result from preference for more sophisticated and modern technologies over traditional ones. Thus, in an example of inter-disciplinary blame-shifting, Wells argues that inappropriate technology choices may reflect instances where the preferences of the "engineering man" took precedence over "economic man."

Finally, a fourth explanation is based on the concept of path-dependency. Path-dependency theory, as described and elaborated by David (1985), Arthur (1988) and North (1990), describes how current technologies and institutions are dependent upon an entire series of sometimes insignificant historical events. For example, an occurrence of "bad luck" early on can determine the fate of alterative superior technologies. A small stroke of "bad luck" may give one technology a slight advantage over another and then, with large fixed costs (implying falling unit costs fall as output increases) as a self-reinforcing mechanism, the small lead is quickly turned into an insurmountable advantage. David (1985) describes how societies "lock-in" to technologies such that once choices are made, they are difficult to exit from. Coordination effects, which confer advantages to "going along" with other agents taking similar action, are another example of a self-reinforcing mechanism that may favor a possibly inferior technology (Arthur, 1988).

Making definitive conclusions about the explanations for the milling firms' choice of roller mills in Zimbabwe is difficult since it has been a half century since the principal decision-makers made the choice to mill branded maize meal products with roller mills. Yet based upon open-ended interviews with representatives of large-scale milling companies, several promising avenues for future inquiry can be suggested.

First, mill managers in Zimbabwe often view large-scale capital intensive industries as symbols of progress and a source of national pride. Mill managers often resent what they perceive as an overall stereotype of industrial underdevelopment in Africa and are eager to display modern technologies to visitors. Occasions when "state-of-the art" manufacturing technologies are adopted by Zimbabwean firms are well-publicized in the government-owned media.

Perception of a "principal-agent" problem in maize meal manufacturing may also induce greater substitution of labor by capital. In maize meal manufacture, the labor-intensity of hammer milling (even assuming relatively rare large-size hammer mills are utilized) means supervision and quality control becomes more difficult than for a capital-intensive roller mill. Managers of large-scale mills, primarily members of the European settler elite, often possess strongly-held preconceived notions about the scope for effectively managing labor-intensive enterprises.

Finally, the historical path of maize marketing and seed technology development contributed to the long dominance of large-scale mills concentrated in urban areas. Clearly, once roller mills were established in Zimbabwe, an entire set of formal and informal market regulations were erected that effectively protected the large-scale milling industry from competition. Grain movement restrictions, maize meal subsidies, zoning laws, and a foreign exchange allocation system were strong barriers to entry and gave a handful of large-scale milling firms a great deal of market power. The dominance of a parastatal marketing agent, urban GMB depots, and pan-territorial prices conferred the urban large-scale millers further advantages. Once established, until the policy and regulatory changes that began in 1992, the market power of large-scale millers was insurmountable for potential competitors.

The historical reliance on white dent maize varieties also enabled large-scale roller mills to flourish, suggesting some degree of path-dependence in technology choice. Within 30 years of the arrival of European settlers in 1890, improved dent varieties had largely replaced flint varieties among both smallholder and commercial farmers in Zimbabwe (Weinmann, 1972). Smallholders found the yield of the western-bred dents superior to traditional flint varieties. Commercial farmers, who mainly produced for export, grew dent varieties since dent maize was preferred in the British starch market. Dent maizes were preferred since the soft starch requires less processing. In roller mills, when maize flour is produced for human consumption, dent maize is easier to process than flint varieties (Kydd, 1989). Thus, the sustained dominance of roller mills may simply reflect a fortuitous series of historical events, stemming from a set of initial favorable conditions such as the controlled, single-channel maize marketing system and the dominance of dent maize, without which choice of technology in the milling industry might have been radically different.

CHAPTER 6:

MAIZE MARKETING REFORM AND THE DEVELOPMENT OF ALTERNATIVE MAIZE MARKETING CHANNELS

Prior to 1993, maize marketing restrictions and roller meal subsidies prevented the development of alternative maize marketing channels. There were also doubts within government and the donor community whether there was consumer demand for less refined products and whether small-scale mills could effectively compete with large-scale mills. Yet in the aftermath of the 1993 reforms, consumption of straight-run meal grew rapidly and small-scale hammer mills thrived. This chapter uses survey data from the months following the June 1993 reforms to examine the initial effects of reform on participants in the subsector and evaluate the effectiveness of market reforms in meeting food policy objectives. Second, this chapter explores the likely path of the evolution of alternative marketing channels, with special focus on the implications of consumers' opportunity cost of time and constraints to the transformation of the custom-milling industry. Third, maize market liberalization, although a necessary condition, may not be a sufficient condition for the growth of alternative marketing channels and resolution of the food-price dilemma. The potential need for investments in selected market-facilitating institutions may be needed to promote the development of alternative marketing channels. Finally, maize market liberalization is only one component of an overall maize subsector reform strategy; further policy measures and parastatal reforms may be required to meet performance criteria such as affordable and stable food prices, low public sector deficits and renumerative producer prices.

6.1 Effects of the 1991-1993 maize market reforms

In mid-1993, the GRZ faced an acute dilemma: the budgetary costs of the roller meal subsidy made continued subsidies unsustainable, yet removal of subsidies was perceived to have an adverse impact on low-income maize meal consumers. By coupling subsidy removal with further maize movement decontrolled, some of the adverse effects of subsidy removal were avoided. Figure 5 shows the alternative marketing channel for straight-run maize meal from urban custom mills that developed as a result of the reforms.

The main beneficiaries of the 1991-1993 maize market reforms have been consumers and urban custom millers. The number of urban households consuming straight-run meal has grown considerably, providing a lower-cost option to roller meal from large-scale millers. In May/June 1993, 27 percent of all urban households were consuming straight-run meal processed at custom mills. The low price of straight-run meal relative to store-bought roller meal was cited by 93 percent of respondents as the reason for this decision. The percentage of consumers eating straight-run meal has continued to grow rapidly. Custom mill throughput figures in Harare and Chitungwiza indicate that by October 1993, half of all urban consumers were eating straight-run meal. These findings are further supported by December 1993 data from the Inter-Ministerial Committee for Social Dimensions of Adjustment monitoring.

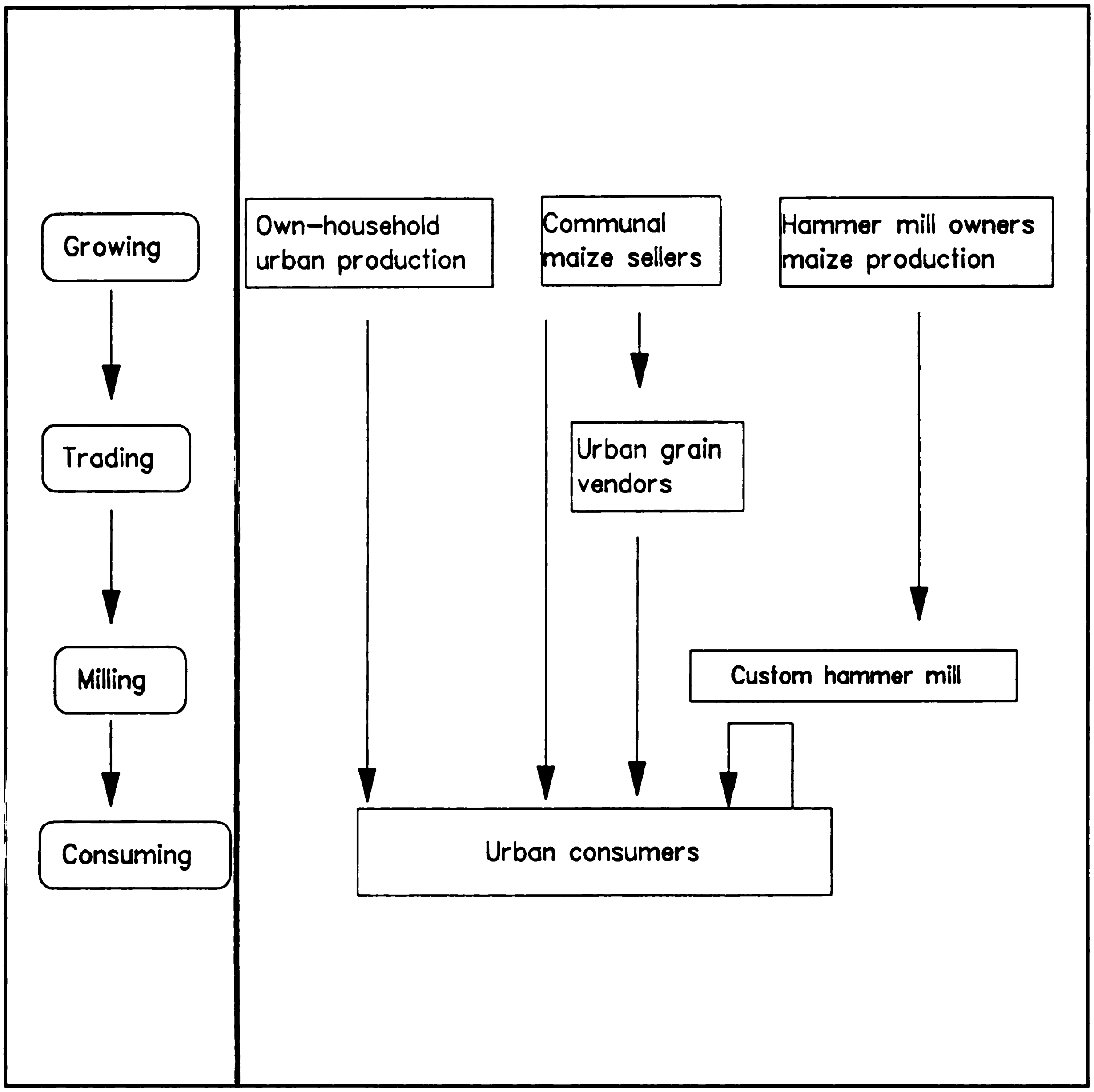


Figure 5: Immediate post-reform marketing channels for hammer-milled straight-run meal, mid-1993

As discussed in the previous chapter, the reforms have also meant a tremendous boost in the amount of maize processed by urban custom millers. Total throughput at custom mills in the Harare and Chitungwiza area peaked in June 1993, with 5,076 tons processed. By September 1993, total custom milling throughput had fallen to 3,707 tons. Yet the quantity of grain processed by custom mills in September 1993, although below the June 1993 figure, was still almost four times greater than the September 1991 figure.

Furthermore, a survey of customers at hammer mills shows that as the 1993/94 marketing season progressed, purchases from urban vendors rose. For example, while purchases from urban vendors averaged only 4 kgs per urban household per month in April/May, by September/October purchases from urban vendors averaged 11 kgs per month. In April/May, own household production on urban and rural plots was by far the

Table 49: Maize grain acquisitions by urban households, April/May 1993 and September/October 1993

Source of maize grain	April/May 1993 (percent of total quantity)	Sept/Oct 1993 (percent of total quantity)
Purchase from urban vendor	2	37
Own household urban production	28	3
Own household rural production	63	36
Relatives rural production	6	13
Rural trader	-	3
Other*	1	8

Source: Survey data
* communal farmers, commercial farmers, relatives' urban production, and gleanings.

most common source of maize grain for hammer milling, accounting for almost all grain acquisitions. Yet by September/October 1993, purchases from urban vendors were the most common source of maize grain for custom milling, accounting for 37 percent of household grain acquisitions. Table 49 highlights this contrast.

Similarly, when hammer mill customers were asked in October 1993 where they obtained the grain they had brought for custom milling on each visit over the previous four weeks, the most common source was urban purchases (36 percent), followed by own rural production (30 percent). This indicates that alternative grain marketing channels, namely small-scale traders procuring grain from commercial and communal farming areas and transporting the grain to areas where there is consumer demand, have begun to develop. During the 1993 marketing year, an 18 kg bucket of maize grain could be purchased from informal vendors at many urban locations. The price of an 18 kg bucket of maize ranged from Z$15 to Z$20, with the lower price tending to prevail in June/July (immediately after harvest). When sold by custom millers, the average reported price of 18 kg of grain was Z$18.10. The average hammer milling cost in October 1993 was Z$2.04 per bucket, so the total cash acquisition cost of 20 kg of straight-run meal ranged from Z$18.70 to Z$24.25. By contrast, a 20 kg bag of roller meal from the largest industrial millers cost consumers Z$34.65. By having grain ground by hammer millers, households could realize substantial savings. This option would simply not have been widely possible before the 1992 maize market reforms.

Since roughly half of the 240,800 tons of maize meal consumed in the home by urban households has been replaced by hammer-milled straight-run meal, consumers are saving over Z$78 million per year. The main "losers" from this switch have been the large-scale millers who have seen sales of roller meal tumble. Yet the losses to large-scale millers are much less than the gains to urban consumers. Assuming that the entire large-scale millers' mark-up of Z$286 on a ton of roller meal is all profit, the net loss in millers' profits amounts to about Z$34 million per year.[9]

Parallel studies in other nations in Southern and Eastern Africa suggest that these results are not unique to Zimbabwe. The willingness of a significant proportion of urban consumers to switch to hammer-milled straight-run meal when available at a price discount is supported by results from Kenya, Zambia and Mozambique (Mukumbu and Jayne, 1994, Diskin and Sipula, 1994; and Tschirley et al., 1994). Furthermore, as in Zimbabwe, urban consumers in Mozambique express willingness to substitute yellow maize for white maize when yellow maize is available at a price discount (Tschirley et al., 1994).

In Zimbabwe, the greatest disadvantages of reform have so far been felt by the GMB, whose trading deficits have grown dramatically. Losses for the July 1993/March 1994 trading period estimated at Z$1.1 billion, or 2.8 percent of GNP (IMF, 1994). GMB losses, and resultant GRZ deficits, hamper efforts to achieve macroeconomic stability and ultimately endanger the entire reform process. Thus parastatal reform is a critical element in the reform process. Changes in the administration of the GMB pricing system to introduce more market-oriented price variation can reduce GMB losses. Potential gains to GMB pricing reform include lower marketing costs and greater responsiveness to market supply and price changes over time. By focussing on price reform, rather than wholesale privatization, sudden "shocks" during the transitional period of maize market reform may be avoided. Possible strategies for GMB reform are explored in Section 6.4 of this chapter.

[9] Of course, the millers' mark-up of $286 per ton of roller meal is probably not entirely profit, as the large-scale millers have often argued. If this is so, the lost profits to large-scale millers would be even lower than $34 million.

6.2 The key determinants of the evolutionary paths of alternative maize marketing channels

Alternative maize marketing channels of the type summarized in Figure 5 blossomed very quickly in 1993, much more rapidly than many GRZ officials and donors thought possible. Yet the reform process is by no means complete: alternative maize marketing channels will continue to evolve as private sector participants (particularly millers and traders) respond to changing market conditions. This section explores some of the key determinants of the evolution of alternative channels, focussing on (1) the importance of consumers' opportunity cost of time in determining the development of urban maize marketing channels; and (2) estimating equilibrium market shares of straight-run meal and roller meal; and (3) forces inducing transformation of the small-scale custom milling industry.

6.2.1 Opportunity cost of time, demand for marketing services and equilibrium market shares for maize meal

Data from the consumer surveys show that urban consumers have switched to straight-run meal largely because of its lower price relative to roller meal. With more marketing functions performed by the consumer, the gross margins of straight-run meal are much smaller than the gross margin of roller meal when produced by large-scale millers.

For example, as of May 1994, the gross margin obtained from processing and distributing one ton of roller meal was fixed by tacit agreement among large-scale millers. In order to produce one ton of roller meal, 1.11 ton of maize grain are required at Z$1,070 per ton. With a net realization on by-product sales of Z$471 per ton, and the uniform ex-mill price of Z$1,586, the gross margin was Z$445 per ton. By comparison, the gross margin of custom milling is simply the milling fee; all other functions are performed by the consumer. In October 1993, the average milling fee at custom mills in Harare and Chitungwiza was Z$2.04 per 18 kg. bucket, or a gross margin of Z$113 per ton, about a quarter of the gross margin for roller meal. Due to this wide difference in gross margins, the final cash price of roller meal (Z$1,745 per ton) is substantially higher than the cash outlay to acquire one ton of hammer-milled straight-run meal (Z$1,119 per ton).

Yet a full cost accounting of the relative prices of roller meal and straight-run meal must incorporate the additional value of time in obtaining straight-run meal. Unlike roller meal, straight-run is not sold in plastic packages in retail shops.[10] To obtain straight-run meal, the consumer must procure grain, travel to the local hammer mill, and wait for the maize to be milled. To account for the procurement time, a measure of consumers' opportunity cost of time is needed. It is not clear, however, exactly what measure is most appropriate. Hourly wage rates are common measures of the opportunity cost of time, yet the true opportunity cost of time of grain procurement may be higher than wage rates given the effort required to carry 20 kg of meal to the mill. On the other hand, if the majority of people visiting the hammer mill are unemployed members of an urban household, the true measure of the opportunity cost of time may be lower than prevailing urban wage rates. For this analysis, three different measures of the opportunity cost of time were used. Opportunity cost of time was represented by: (1) the average hourly wage of hammer mill customers (Z$2.03); (2) the average hourly wage of adult employed urban residents

[10] One small urban production miller did begin bagging straight-run meal on an experimental basis in late October 1993.

(Z$3.20); and (3) the opportunity cost of time derived from hypothetical market data from the conditional logit model presented in Chapter 4 (Z$5.36).

Table 50 presents the estimated total acquisition cost (i.e. cash outlay plus opportunity cost of time spent in procurement) of roller meal from an urban retail shop. To arrive at the total acquisition cost for roller meal presented in the final line of Table 50, the opportunity cost of time in travelling to and from the shop is valued and then the total calculated. Since in custom milling more of the marketing functions are performed by the consumer, comparable figures can be derived using custom milling costs and valuing the opportunity cost of the consumers' time in travel to and from the mill and waiting in line at the mill. Grain prices vary seasonally, but the average in October 1993 for the 40 percent of custom millers that sold grain was Z$18.10 per bucket. Of course, many consumers get maize grain with less cash outlay. The opportunity cost of time estimates are based on the actual reported travel and waiting times of consumers. Table 51 presents the estimated total acquisition cost (i.e. cash outlay plus opportunity cost of time spent in procurement) of straight-run meal from a custom hammer mill.

A comparison of Tables 50 and 51 demonstrates the price advantages of straight-run meal from custom mills even after factoring the time spent travelling and waiting in the queue. The typical urban consumer of roller meal faces an acquisition cost (retail price plus opportunity cost of time) of Z$35.98 of a 20 kg bag. By contrast, for a typical hammer mill customer, the acquisition cost of 20 kg of straight-run meal ranges from Z$25.90 to Z$30.03. Depending upon which measure of opportunity cost is used, this translates to 17 to 28 percent below the price of store-bought roller meal.

Table 50: Acquisition costs of bagged roller meal including opportunity cost of time (OCOT)

DESCRIPTION OF COST ITEM	@ OCOT of Z$2.03	@ OCOT of Z$3.20	@ OCOT of Z$5.36
Cost of 22.2 kg of maize grain from GMB needed to produce 20 kg of roller meal	23.78	23.78	23.78
plus large-scale miller gross margin	7.72	7.72	7.72
Ex-mill price of 20 kg bag of roller meal	31.50	31.50	31.50
plus retailers margin (10 percent)	3.15	3.15	3.15
Retail price of 20 kg of roller meal	34.65	34.65	34.65
plus opportunity cost of time to buy roller meal at retailer (24.5 minutes)	0.83	1.31	2.19
Total acquisition cost of 20 kg of roller meal	$35.48	$35.96	$36.84

Source: Survey data

Table 51: Acquisition costs of straight-run meal from custom mills including opportunity cost of time (OCOT)

DESCRIPTION OF COST ITEM	@ OCOT of Z$2.03	@ OCOT of Z$3.20	@ OCOT of Z$5.36
Average cost of 20 kg of maize grain purchased from custom miller (Z$18.10 per bucket)	21.11	21.11	21.11
plus milling costs (Z$2.04 per 18 kg bucket)	2.27	2.27	2.27
plus opportunity cost of consumers' time travel to and from mill (54.5 minutes)	1.85	2.91	4.88
plus opportunity cost of consumers' time waiting in queue at mill (19.8 minutes)	0.67	1.06	1.77
Total acquisition cost of 20 kg of straight-run meal	$25.90	$27.35	$30.03

Source: Survey data

Clearly, the increased consumption of hammer-milled meal has benefitted consumers by reducing the acquisition cost of maize meal. Part of the reason for lower acquisition costs is that processing costs at custom mills are lower. Yet consumers also save money because custom mills satisfy consumer demand for fewer marketing services: many consumers would rather spend time travelling and queuing for milling services than pay extra cash for the convenience of store bought roller meal.

These acquisition costs for straight-run meal derived in Table 51 can also be used to predict the market share of straight-run meal vis-a-vis roller meal. Such predictions can then be compared to actual, post-reform market share comparisons to test their accuracy. To estimate the demand for straight-run assuming alternative acquisition costs, the coefficients from the straight-run meal demand equation estimated in Section 4.3.1 were used. Since the contingent valuation data collection procedure considered only pair-wise companions, super-refined meal is excluded from the forecasts of market share. Market share is considered in terms of only roller meal and straight-run meal. In December 1993, super-refined meal had a market share of five percent.

The forecasts of market share shown in Table 52 are surprisingly accurate. Assuming an opportunity cost of time figure of \$5.36, the predicted market share of 53 percent is very close to the actual December 1993 value of 56 percent. With lower values of opportunity cost of time (Z\$2.03 or Z\$3.20), predicted values are less accurate. Two factors could be a work here; (1) the actual market share data from December 1993 (six months after reform) represent a transitional phase: more consumers will switch to straight-run as urban grain markets develop further; or (2) the opportunity cost of time of straight-run meal procurement is high (Z\$5.36) relative to average hourly wage.

Table 52: Estimated and predicted market share of roller meal and straight-run meal based on total acquisition cost of maize meal*

	Percentage price differential	Roller meal market share (percent)	Straight-run market share (percent)
Predicted values based on acquisition cost of Z$25.90 (OCOT = $2.03)	28	32	68
Predicted values based on acquisition cost of Z$27.35 (OCOT = $3.20)	24	37	63
Predicted values based on acquisition cost of Z$30.03 (OCOT = $5.36)	17	47	53
Actual post-reform values**		44	56

* Estimates based upon the demand equation for straight-run meal from Table 22 and total acquisition cost estimates from Table 51.
** Actual market share data (percentages excluding super refined) from Minot, 1994

In any case, this example demonstrates the predictive value of contingent valuation data of maize meal choices. Just as in the model presented in Chapter 4, the forecasted market share of straight-run meal estimated from consumer responses to hypothetical scenarios was fairly close to the actual post-reform market share.

6.2.2 The transformation of the custom milling industry

As of early 1994, there were 14 production millers in Zimbabwe. Yet in urban areas there are over a hundred custom hammer millers, and literally thousands in rural areas. One important question is identifying ways in which custom millers can make the transformation from custom milling to performing a broader range of marketing and processing functions as production millers have begun to do. The transformation of the custom milling industry can result as existing custom millers expand their milling enterprises and undertake new investments.

Since the business of a typical custom miller has increased at least four-fold, funds will be generated for possible re-investment. When interviewed, 63 percent of mill owners said that they were thinking of applying for a loan to expand their existing hammer mill enterprise, although only 13 percent of owners had actually applied for a loan.

A major question facing urban and rural custom millers is what type of transforming investments should be undertaken. There are at least two alternative strategies, both with important implications for evolving marketing channels. The first type of investment would be entering the private grain trade as some custom millers have already done. Entering the grain trade involves investment such as: (1) working capital investments in purchasing maize from producers or first-handlers and selling maize to mill customers without their own grain; and/or (2) purchasing a vehicle for transporting grain from producing areas (or the GMB) to the mill. A second type of transformation involves becoming a production miller by selling packaged maize meal products. At the least, this type of transformation would involve: (1) obtaining a dehuller; and/or (2) acquiring a bagging machine and ordering printed plastic bags.

The results of the consumption survey, showing that urban consumers are generally quite price sensitive, would seem to suggest that expansion into the grain trade may be the best of the two options for the custom miller, at least in the short-run. Selling maize at custom mills involves a convenience factor that other urban traders might not be able to match. Integrated grain sellers/custom millers can meet urban demand for grain year-round. Although 44 percent of urban custom millers sold maize grain to customers, the majority of the maize they sold was obtained from their own rural production.

Table 53: Source of maize grain purchased by custom millers for later re-sale to mill customers, percentage of volume from source

Source of maize grain	Percentage obtained
Custom mill owner's own rural production	59
Purchased from communal farmers	40
Purchased from urban residents	1

Source: Survey data

Table 53 shows that 40 percent of the total amount of maize grain sold to customers by custom millers was obtained from direct purchases from communal farmers. No grain was obtained for later re-sale to customers from urban traders, commercial farmers or the GMB. Table 53 suggests that expansion of alternative marketing channels is feasible as more custom millers and urban traders (and vertically integrated miller/traders) begin to engage in bulk purchases of maize from smallholder areas and transport the maize for sale in urban areas. Clearly some custom millers and urban grain traders have already begun to engage in bulking up and transport activities, although few have significant storage capacity. Over time, as participants specialize, custom millers may concentrate on milling and procure maize from private traders instead of communal farmers. As these rural-urban marketing linkages evolve, the urban maize marketing channels centered on small-scale mills will continue to develop. Figure 6 suggests the possible evolution of marketing channels centered on small-scale custom and production millers.

By contrast, expansion into production milling necessitates overcoming existing marketing constraints. Unless an emerging custom miller can offer a packaged straight-run meal product at a retail price of below Z$28.70 per 20 kg (derived from the acquisition cost of hammer-milled straight-run meal with opportunity cost of time of Z$5.36 per hour), relatively few consumers of straight-run meal would likely be induced to shift. With the declining quantities of roller meal consumed, manufacture of roller meal by production millers seems even less promising. However, the data from the consumption survey do show that, at the same prices, two-thirds of the urban population would prefer roller meal. In the longer run, assuming rising wage and employment levels from economic growth and a resultant rise in the opportunity cost of time in maize meal procurement, the market for packaged meal (including both straight-run meal and roller meal) will grow.

The analysis presented in Chapter 4, showing strong WTP for packaged over loose meal, also implies that consumers have a strong preference for either: (1) maize meal products packaged in plastic; or (2) the ability to inspect the maize grain before it is ground. There is little demand for already milled maize sold in an unpackaged state. Consumers value clean grain: when buying maize for hammer-milling, consumers place importance in inspecting the quality of the maize. Yet consumers also place high value on maize meal packaged in plastic (see Chapter 4) even though the grain quality is unknown. One hypothesis is that branded, plastic packaging (long the sole preserve of the large-scale millers) is a "signaling device" to the consumer that hygienic practices (such as washing the grain before milling) have been observed.

Finally, the development of a marketing channel with custom millers selling a bagged straight-run meal product may also be constrained if the shelf-life of straight-run meal differs substantially from the more refined types of meal. It has been argued that the greater oil content in straight-run meal (from the retention of the germ) sharply limits its

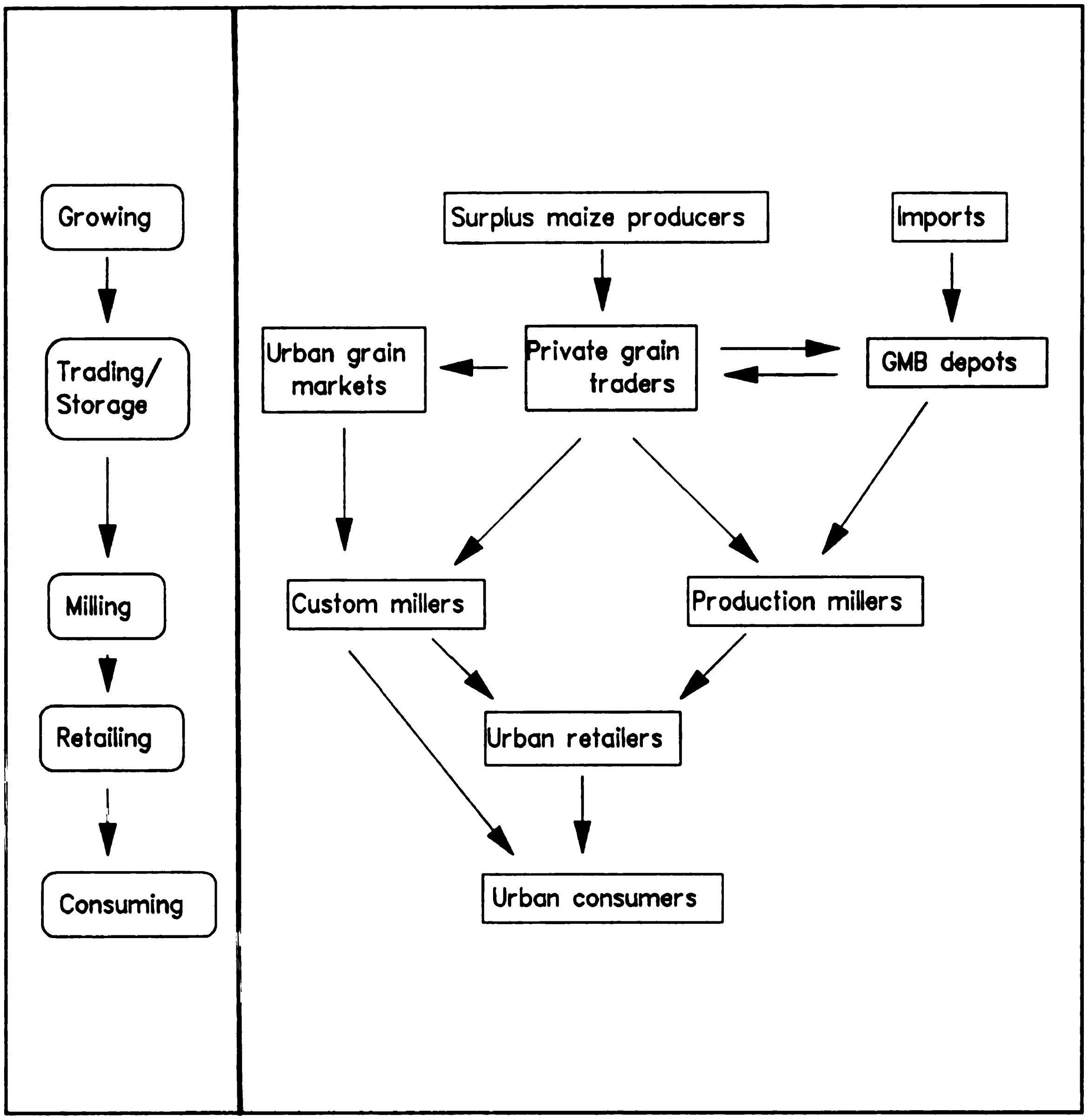


Figure 6: **Urban maize marketing channels with custom and production millers: developed stage**

shelf life. However, estimates of shelf-life of straight-run meal are widely divergent (ILO, 1984). In Zimbabwe, consumer perceptions are that the shelf-life of straight-run is little different than that of roller meal. Consumers were asked how long they could keep various maize meal products after opening the packet without it going bad. The average reported shelf-life of straight-run meal was 40.8 days, only slightly less than the average reported shelf-life of roller meal of 41.9 days. One explanation may be that shelf-life is a function of many factors including moisture of the grain, processing conditions, and storage conditions. Thus the dry climate in the Zimbabwean highveld region may limit storage losses.

6.3 Facilitating investments in the development of alternative marketing channels: a role for yellow maize

The rapid shift in urban consumption patterns toward straight-run meal in Zimbabwe has quickly become part of the urban landscape as custom mills sprout and urban maize markets blossom. Yet it bears repeating that in late 1991, straight-run maize meal was viewed with derision by key GRZ officials: the notion that a majority of urban consumers would voluntarily switch to straight-run meal when roller meal was available seemed far-fetched. However, as policy and regulatory constraints that had prevented consumer demand for straight-run meal from being articulated were lifted, consumers responded as they indicated they would in the contingent valuation results.

A similar set of circumstances may exist for yellow maize in Zimbabwe. Chapter 4 used contingent valuation techniques to argue that at a significant price differential, there is consumer demand for yellow maize, especially among lower-income groups. However, since yellow maize movement has been liberalized and producer prices of yellow maize are generally below official, government-set producer prices for white maize, an important question is: why hasn't the apparent consumer demand for yellow maize been met? Clearly, a collection of policy and regulatory reforms have permitted alternative marketing channels for white maize to develop. If there is demand for yellow maize, what prevents traders from purchasing yellow maize, transporting it to urban areas, and selling yellow maize to urban consumers for hammer milling?

The answer seems to be because the purchase price of yellow maize is significantly higher than that of white maize for most maize traders and hammer millers. Most emerging traders and millers obtain white maize from smallholders at prices below the Z$900 GMB buying price as shown in Chapter 5. Emerging millers and traders offer services that the GMB does not, including immediate cash payments, farm-gate pick-up, and exemption for GMB moisture requirements and stop-orders. Since communal farmers do not grow and dry yellow maize,[11] if emerging millers and traders wanted yellow maize, the only source would be commercial farmers. Since the GMB no longer operates a floor price for yellow maize, the primary trading arena for yellow maize is the newly-formed Zimbabwe Agricultural Commodities Exchange (ZIMACE). ZIMACE acts primarily as a clearinghouse for commodities grown by commercial farmers. Virtually all the yellow maize sold on the ZIMACE for domestic usage is sold by commercial farmers to stockfeeders. During 1993, the ZIMACE price for yellow maize fluctuated around Z$1,000, within the margin between the GMB white maize selling price of Z$1,070 and the GMB white maize buying price of Z$900. For small-scale millers and traders to

[11] Limited quantities are grown to eat fresh without being dried.

consider selling yellow maize, it would have to be cheaper than white maize obtained from smallholders.

Yield evidence from commercial farms suggests that it may be possible to produce yellow maize at a lower cost than white maize. If so, the challenge is identifying ways to translate production advantages into price advantages at the consumer level. One option is to promote the development of alternative marketing channels for yellow maize that rely on smallholders, emerging traders, and small-scale millers. Very few smallholder farmers grow yellow maize and are often discouraged from doing so by AGRITEX extension agents (Mutikani, 1994). This informal practice has its roots in formal legislation. The Maize Act of 1925 permitted growers in any area to petition the Governor of Southern Rhodesia to restrict the growing of maize in their area to any color of maize (Weinmann, 1972). The purpose of the legislation was to protect growers of white maize from damage through hybridization caused by growing yellow maize in the vicinity of white maize. The Maize Act of 1925 remained in force until 1970 (Weinmann, 1972). Although this regulation was originally intended for commercial farmers, it was also in force in smallholder areas. Due to current informal prohibitions against yellow maize, a prerequisite to the development of alternative smallholder marketing channels for yellow maize is an explicit redefinition of the content of maize extension programs directed towards smallholder farmers. Growing yellow maize as a cash crop and emergency food crop, even with strong household preferences for white maize meal, may make economic sense to smallholders. The real challenge may be altering the preconceived notion of extension experts.

Conditions also prevail in the large-scale milling industry which effectively prevent the manufacture of yellow maize meal. Although the GRZ no longer mandates the setting of milling margins, the four large commercial millers currently agree, in cartel-like fashion, on ex-mill prices and provide "recommended" retailing margins. This price setting behavior is legal in Zimbabwe and, by and large, retailers accept the recommended prices of the commercial millers. Since commercial millers, by virtue of current price-fixing arrangements, receive higher margins (in absolute terms and as a percent of final ex-mill price) for more expensive products, there may be a natural incentive to reject the proposition that there is demand for yellow maize meal at a given price discount. In other words, given the strong positive correlation between the final value of a particular maize meal product and the net revenue per unit received by the miller, there are strong incentives to develop markets for higher value maize meal products, such as white roller meal and white super-refined meal.

Furthermore, interviews with large-scale commercial millers revealed that some large-scale millers are not likely to introduce yellow maize meal during non-drought years in order to avoid tarnishing valuable brand names. In interviews, large-scale millers expressed fears about the damage done to well-known brand names by being obliged in 1992 and 1993 to manufacture yellow maize meal. With the unavailability of sufficient supplies of white maize due to drought, large-scale millers manufactured yellow maize well into 1993. As white maize became available to large-scale millers after the 1993 harvest, market share was being lost to hammer-milled meal. Therefore, at least two major large-scale commercial millers have made the "superior" qualities of more refined white maize meal a pillar of their marketing strategy. Introducing yellow maize meal in 1993 and 1994 while engaged in a battle for market share was seen by large-scale millers as counter-productive. Thus even if yellow maize buying prices are below those of white maize, the four large-scale commercial millers may continue to choose not to manufacture a yellow maize meal product. Consumer preferences for a low-cost yellow maize meal product may not be articulated through the marketing channels dominated by large-scale millers.

Promoting access to low-cost yellow maize meal products demanded by consumers may require select interventions by government. Alterations in the advice given by extension agents is required. Yet greater production of yellow maize by smallholders may require further institutional innovations at the communal-level to reduce maize quality problems caused by the contamination of white maize by nearby yellow maize plots. Changes in the grading procedures of maize buyers, which currently penalize farmers heavily for grain of mixed color, may also help. Finally, contracting large-scale and small-scale production millers to produce an experimental quantity of yellow maize meal for distribution as normal food relief may contribute to a greater realization by millers of the potential demand for yellow maize meal and ultimately may induce one or two millers to meet this niche market.

6.4 Parastatal reform: an essential component to maize market liberalization

With the announcement of the third phase of reform in April 1994, the complete liberalization of maize movement and trade reforms, the maize market reform process entered an interval of reflection, with the GRZ emphasis on evaluating the effects of past reforms and determining the path of future reform. Despite the successfully phased liberalization of maize marketing, certain policy dilemmas remain to be addressed.

For example, the reform process has placed a tremendous burden upon the GMB as its trading deficits have grown dramatically. GMB reform is a critical, yet often neglected, element in the maize market reform process. Yet surplus smallholder farmers, the main beneficiaries of the post-Independence expansion in the GMB marketing network, fear that GMB reform will have adverse effects on the producer prices they receive. In light of this dilemma, this section investigates the causes of the GMB's worsening financial situation, presents maize market reform strategy options for the future, and finally explores possible dimensions of GMB pricing reform.

6.4.1 Market reform and the GMB financial crisis

Estimated GMB losses for the July 1993/March 1994 trading period are enormous: Z$1.1 billion, or 2.8 percent of GNP (IMF, 1994). A portion of the 1993/1994 losses can be attributed to losses on the GMB's yellow maize account. With the 1992 drought and initial uncertainties about the quality of the 1993 harvest, the GMB was forced to import yellow maize for possible consumption into the 1993/94 marketing year even though a good harvest eventually resulted. By the beginning of the 1993/1994 marketing year, there was little demand for yellow maize. Lack of domestic markets and a deterioration in the quality of yellow maize stocks meant that the GMB's yellow maize stocks were disposed of at a considerable loss.

Yet the GMB's losses on yellow maize in 1993/94 were only a minor component of the GMB's financial problems. Due to the GMB's underestimate of the 1992/93 harvest, actual deliveries exceeded the forecasted amount of 1,167,000 tons. The GMB's stock position at the conclusion of the 1993/94 marketing year (March 30, 1994) was 934,000 tons. Large stocks have persisted and with intake during the 1994/1995 marketing year predicted at 1.7 million tons and projected local and export sales at only 800,000 tons, the GMB could accumulate over 1.5 million tons by the outset of the 1995/1996 marketing year (April 1, 1995). With almost 60 percent of the GMB's projected operating costs being devoted to interest payments on maize stocks, the maintenance of large stocks has created a potential financial crisis at the GMB. There are four fundamental reasons for the GMB's operating deficit:

1. The GMB's role as a residual buyer at government-mandated prices fixed throughout the marketing year gives the GMB no decision-making authority over stock accumulation;
2. High nominal interest rates (averaging 32 percent), coinciding with large GMB borrowing requirements, increases the cost of maintaining maize stocks;
3. The GMB trading margin of Z$170 per ton is insufficient to cover operating costs at most of its depots in communal areas;
4. Domestic maize sales have been far below expected given harvest levels;
5. Export markets are limited and export parity prices are below Z$500 per ton.

Declining GMB domestic sales are largely a consequence of the successful implementation of other reforms in the maize sector. The progressive decontrol of maize marketing between 1991 and 1993 has encouraged greater trade flows through alternative channels. In past years, a seasonal pattern in demand for GMB maize could be observed. However, decontrol of maize marketing has encouraged greater flows through alternative channels, greatly intensifying the magnitude of the GMB's seasonal variation in sales. As a result of marketing reforms, more consumers are consuming maize marketed through non-GMB channels where processing is done by small-scale custom and production millers. The growth of small-scale milling, although benefitting consumers, has severely depressed monthly GMB sales, especially during the months after harvest when grain is readily available through informal channels. From 1987-1993, average monthly GMB sales on the domestic market were over 84,300 tons, with a peak of 150,000 tons per month during the drought periods of 1992 and early 1993. For the 1993/94 marketing year, monthly GMB sales on the domestic market averaged just over 40,000 tons per month.

The GMB deficit may be further worsened by the decision in April 1994 to complete the maize market liberalization process by removing remaining Zone A movement restrictions. Since the GMB loses more money as stock levels rise, it was thought that relaxing Zone A restrictions for the 1994/95 marketing year would benefit the GMB by reducing the volumes purchased by the GMB, thereby reducing the GMB operating deficit. Yet an analysis of the composition of GMB margins and revenues demonstrates that the April 1994 removal of the remaining Zone A movement restrictions may not lead directly to a reduction in the GMB deficit.

The GMB trading margin is the difference between the GMB buying price and the GMB selling price (currently Z$170). Ideally, the GMB margin is set to reflect "Board costs," namely collection, handling, transport, storage, interest, and administration costs. Since GMB prices are pan-seasonal and pan-territorial, the GMB operating margin is constant throughout the year and throughout the country. However, the Board costs of any particular ton of maize are not the same. Board costs per ton are lowest when the grain is procured from commercial farmers close to Harare and transported to Aspindale via rail. Board costs per ton also fall when the maize intake is quickly sold ("buy early, sell early") as the quick turnaround reduces storage costs and interest charges on borrowed funds. Similarly, Board costs rise when stocks must be stored for a long time before being sold or when maize is purchased in small lots at depots far from demand centers. Thus, the uniform GMB operating margin (reflecting Board costs) represents a cross-subsidization of maize with "high Board costs" by maize with "low Board costs." That is, the operating margin ideally would reflect the average Board costs for a ton of maize. However, since the GMB sets its operating margin before average Board costs are known, it can under- or over-estimate the operating margin required. Part of the reason that the GMB deficit has soared is that the partial liberalization that occurred in 1993 meant that the GMB lost one of its low-cost lines of business ("buy early, sell early") so that its average operating margin per ton has risen.

That is, in the months immediately following the 1993 harvest, it was possible for private traders to undercut the GMB operating margin of Z$170 if they procured grain and immediately resold it. Since the GMB margin reflected the expected average of Board costs, it was higher than the actual costs of a private trader pursuing a "buy early, sell early" policy. Thus, the decontrol of maize marketing, by encouraging greater flows through alternative channels early in the season, has reduced the amount of maize on which the GMB could realize a quick turnaround at Board costs below Z$170.

Even with a poor growing season during the 1994/95 production year that allows the GMB to dispose of mounting stocks during 1995, the ingredients for another financial crisis (characterized by low domestic sales relative to intake, stock build-up and large annual deficits) remain intact. Since GMB deficits, through the need for greater government spending, fuel inflation and contribute to higher interest rates, donor agencies supporting Zimbabwe's economic reforms have expressed fears that the magnitude of GMB and other parastatal losses could derail the entire economic reform process (Reuters Financial Report, 1995)

6.4.2 GMB strategy options: alternative views and competing objectives

Significant reforms have been implemented in Zimbabwe's maize sector over the past two years, but designing further reforms to overcome existing dilemmas is often difficult because of the many participants in the maize market reform process and their differing views as to the relative importance of certain performance objectives. All desired performance objectives cannot be met simultaneously; some objectives are contradictory and trade-offs are inevitable. From GRZ policy statements, it is possible to summarize the sometimes contradictory, yet desired, performance objectives expected of the maize marketing system:

1. **Equitable access to marketing services.** Within the context of the maize marketing system, one of the primary mechanisms for assisting surplus smallholders have been the provision of marketing services through the expansion of the GMB depot network in the post-Independence era. Although most smallholder farmers sell little maize to the GMB, a small but politically powerful group of surplus smallholders depend heavily on the continued provision of subsidized marketing services.

2. **Stable, renumerative producer prices.** For decades, the GRZ has stabilized maize producer prices by directing the GMB to maintain pan-seasonal and pan-territorial producer prices and, prior to 1993, the GMB's virtual monopoly in crop purchasing. Again, the maintenance of pan-seasonal and pan-territorial producer prices has primarily benefitted a minority of smallholders and large-scale commercial farmers that have been able to regularly sell surpluses to the GMB. Stable producer prices also help maize traders and millers avoid the inherent risks of maize price fluctuations.

3. **Consumer food price stabilization**. The desire to protect consumers from large fluctuations in prices of basic commodities is a key GRZ objective. Prior to June 1993, roller meal subsidies and fixed, government-mandated retail prices were the primary mechanisms by which the GRZ stabilized retail consumer maize meal prices.

4. **Reduction of parastatal losses.** For the GMB, the impetus for further reforms is driven by a mounting trading deficit caused by insufficient margins between buying and selling prices, the need to maintain "non-viable" high-cost depots, and the costs of holding a government-mandated Strategic Reserve maize stock. With GMB trading losses the largest contributor to the budget deficit, deficit reduction is also a major GRZ concern.

5. **Increased efficiency in maize marketing.** By the early 1990's there was growing recognition that the high margins captured by participants in the formal sector marketing chain and circuitous flows of maize from rural areas to urban centers and back again as maize meal, raised maize meal prices to consumers.

GRZ policy statements have stressed the need to expand the role of private traders in providing lower-cost marketing services to consumers and producers (GRZ, 1992).

6. **National food security.** Given the importance of maize and the often extreme variability in national grain output, meeting food production goals in order to ensure adequate food supplies at the national level is an important GRZ objective. Inter-annual stockholding has been a major GMB function since its inception, and the perceived importance of maintaining large maize stocks is reinforced by periodic drought. Although food-deficit smallholders are largely under-represented in policy debates since the major smallholder farm lobbying group is dominated by wealthier, surplus farmers, the welfare of communal farmers is a major concern of the GRZ. Not only do rural smallholders compose the bulk of the population, but they also offer substantial political support for the post-Independence government.

The single-channel maize marketing system designed in the 1930's and 1940's, and refined in the post-Independence era, endured for so long precisely because it was successful in achieving several of these performance objectives, particularly stabilizing producer and consumer prices. Only relatively recently did high marketing costs and mounting GMB deficits highlight the failures of the single-channel system.

Undertaking market reforms that will help facilitate the growth of a financially sustainable maize marketing system involves recognizing that all of the preceding performance objectives cannot be met in full. In the wake of market liberalization and successful expansion of the role of the private sector, there is still a fundamental tension between the rationalization of the GMB pricing system that leads to a reduction in the GMB trading deficit versus the maintenance of subsidized marketing services and pricing arrangements that benefit surplus smallholders. After three phases of reform that effectively liberalized maize movement and trade throughout the country, the reform process has reached a difficult stage. Policy decisions regarding the "next step" are complicated by dilemmas regarding the role of the state in the maize marketing system.

Without flexibility to alter buying and selling prices across time and across depots, high interest rates, relatively low domestic sales, and limited export opportunities, the GMB effectively has no ability to prevent a recurring financial crisis. Yet reforms that address the GMB's financial situation may impose considerable costs on surplus farmers with limited access markets. A major question is: What are the GRZ's strategy options at this transitional stage in the grain market reform process? The GRZ has three immediate options:

1. Instruct the treasury to reimburse the GMB for "non-commercial" activities
2. Rapidly privatize the GMB
3. Permit the GMB to make pricing reforms

The first option, having the GRZ reimbursing the GMB for "non-commercial" activities, prevents a cash-flow crisis at the GMB. For example, with a direct budgetary subvention, the Ministry of Finance could assume the budgetary responsibility for the financial burden the GMB has incurred as mandated residual buyer. However, a budgetary subvention is a cosmetic measure that does not address the root of the problem: it simply transfers the deficit to another government budget. Instructing the treasury to reimburse the GMB for "non-commercial" activities is an implicit statement that the GRZ is willing to incur deficits in order to meet other performance objectives such as assisting surplus smallholders. If the magnitude of current GMB deficits are indicative of future deficits, it may not be a sustainable option.

A second option would be for the GRZ to rapidly privatize all GMB functions. Rapid privatization is a very appealing strategy to many: it offers scope for the emergence of low-cost, efficient marketing channels dominated by the private sector without the GMB having to undertake seemingly complex pricing reforms in the transitional period. Yet privatization of the GMB might seriously restrict the marketing services available to smallholders, especially in the short-run.

At Independence, when the GRZ embarked on a major effort to redress some of the inequities of the grain marketing system, an expansion of the role of the GMB was one of the major policy tools. The number of GMB depots rose from 35 to 74, with most of the new depots located in or near communal farm areas. In 1988/89, a good rainfall year, the GMB also operated 53 temporary collection points from which grain was purchased. Between 1979 and 1985, smallholder maize production more than tripled (Rohrbach, 1989). Communal farmers were responsible for over half of all maize production and over a third of GMB intake. Improved access to markets through the provision of GMB marketing services was one of the reasons for this dramatic growth.

There is also uncertainty whether, given a decision to privatize the GMB, private traders could quickly replace the GMB. Rural grain traders face difficulties obtaining access to credit and must contend with poor marketing infrastructure. Longer-term grain storage requires technical expertise that many traders may not have, meaning greater risk of storage losses, and ultimately higher costs. Grain markets in rural areas are often thin, with a limited number of buyers and sellers in a particular area. If an area can only support one or two traders, the scope for monopolistic profits is much greater. Therefore, the continued presence of the GMB buying and selling at prices that reflect market conditions can provide a stabilizing influence on rural grain markets.

In Angola, Madagascar, Mozambique and Tanzania, by the advent of market reform programs, extractive pricing policies had depressed producer prices to such a degree that the bulk of trade had been directed into illegal parallel markets. Many of the functions of these official marketing systems were relatively easy to privatize given their relatively small market share, their large trading losses, and an existing vibrant private trade (Coulter and Compton, 1991). In Zimbabwe, the pace or extent of reform is not so straightforward. Decisions about how to proceed with reforms are complicated when, as in Zimbabwe, a marketing board has been able to maintain its position as a monopolistic trading agent and private, parallel markets are relatively underdeveloped. In such cases, "shock therapy" in the form of rapid privatization might not be the best path.

The third option involves the introduction of more flexible GMB pricing mechanisms. Select GMB pricing reforms can help overcome the inherent tendency for mounting GMB deficits in the current system as well as possibly reduce many of the adverse effects that would result from rapid privatization. The main difficulty is that pricing reform entails trade-offs between GMB deficit reduction and the provision of marketing services and guaranteed pricing arrangements. The major reason that the GMB has not been given greater pricing autonomy is GRZ fears regarding possible price outcomes. For example, a bumper harvest might induce very low producer prices. Yet when a minority of smallholders are net-sellers, maintaining high producer prices does not benefit the bulk of smallholders (Weber et al., 1988). The various dimensions of possible

GMB pricing reform are explored in the next section.

6.4.3 The dimensions of GMB pricing reforms

Developing a strategy that attacks the root of current GMB problems involves recognizing that the mounting GMB deficit is, in part, a direct result of its continued use of fixed, government-mandated prices. Currently, the GMB must defend uniform buying and selling prices in an environment where grain trade has been deregulated. The GMB will only be able to better control its deficit when it has the autonomy to alter its buying and selling prices in response to market conditions. Implementing GMB pricing policy reforms, although introducing an additional layer of complexity to GMB pricing policy, may be the best way to overcome many of the transitional difficulties the GMB faces.

Setting aside until the next section (Section 4.4) issues associated with the level of Government mandated stock levels, the GMB's marketing and pricing arrangements can be reformed in three main dimensions: (1) graduated (or inter-annual storage) pricing to reduce imbalances in annual supply and demand; (2) seasonal (or intra-annual) price variation to spread the costs of seasonal storage among consumers and producers; and (3) regional (depot-specific) price variation to reduce imbalances between surplus and deficit areas.

6.4.3.1 Graduated pricing: inter-annual price variation

Since Independence, Zimbabwe's maize market has suffered from severe supply-demand imbalances and recurrent price cycles (Muir and Blackie, 1988; Masters, 1993). Table 54 presents a maize balance sheet for Zimbabwe showing this cyclical pattern of maize production, GMB intake, exports, imports and the GMB stock position.

Table 54: Maize balance sheet for Zimbabwe, in thousands of metric tons

Marketing year[a]	Total domestic production available[b]	GMB intake	Net exports (imports)	Domestic GMB sales[c]	Yearly changes in GMB stocks	GMB ending stocks
1980/81	1511	815	3	719	93	158
1981/82	2833	2013	305	665	1043	1201
1982/83	1808	1391	492	1065	(166)	1035
1983/84	910	616	252	1277	(912)	123
1984/85	1133	942	(269)	872	339	462
1985/86	2711	1828	285	579	964	1426
1986/87	2398	1594	495	719	380	1806
1987/88	1021	403	393	1113	(1051)	755
1988/89	2176	1197	314	698	185	940
1989/90	1743	1165	174	777	214	1154
1990/91	1842	781	410	882	(511)	643
1991/92	1532	606	147	1036	(577)	66
1992/93	340	63	(2072)	1987	148	214
1993/94	2012	1350	148	484	720	934

Sources: GMB annual reports, various years; CSO agricultural production statistics; National Early Warning Unit Monthly Food Security Bulletin, various months.

[a] Marketing year is April 1 to March 31.
[b] Production figures refer to the production period immediately preceding the start of the marketing year on April 1.
[c] Includes GMB storage losses (never more than 3 percent of domestic sales)

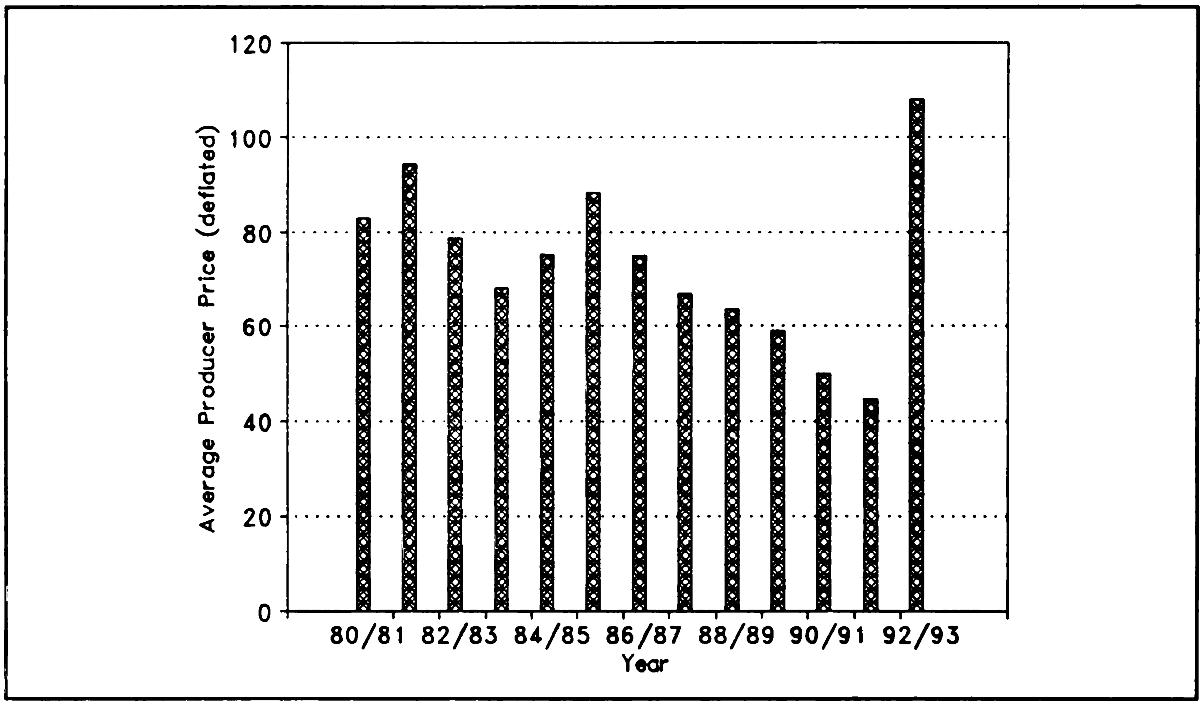


Figure 7: **Average maize producer price in 1980 Zimbabwe dollars, 1981-1993**

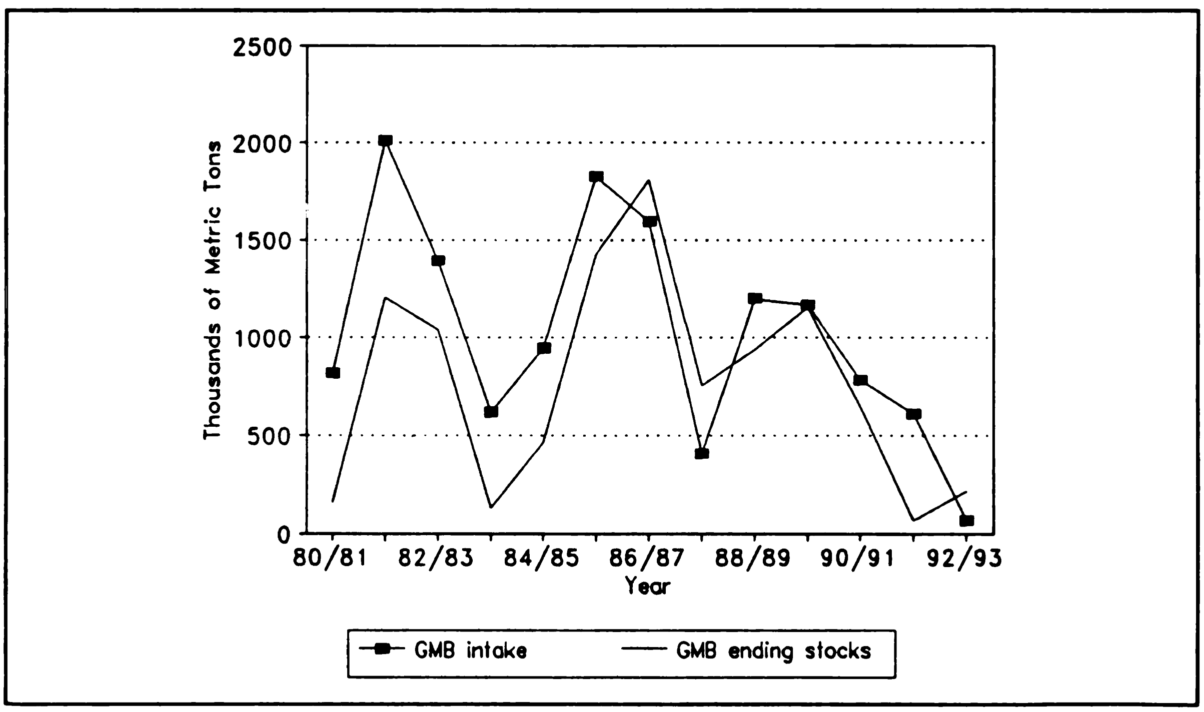


Figure 8: **GMB maize intake and ending stock levels, 1981-1993**

High producer prices in 1980/81 and 1981/82 led to large maize surpluses, which were then drawn down only through lower producer prices in 1982/83 and 1983/84 (Figure 7). Low producer prices caused a decline in area planted which, combined with drought, brought a need for imports in 1984/85. The cycle was then repeated with high prices and bumper harvests in 1985/86 and 1986/87, followed by poor rainfall and stock draw-down in 1987/88. After a bumper harvest in 1988/89, real producer prices fell drastically and area planted to maize declined until 1993 when a drought-induced trebling of the producer price led to another large supply response. The graph presented in Figure 8 further traces the cyclical pattern of GMB ending stocks caused by fluctuations in GMB intake and, ultimately, domestic maize production. Comparison with Figure 7 demonstrates how changes GMB intake and ending stocks have largely mirrored the upward and downward trends in real producer maize prices.

These price and production cycles have proven extremely costly for the maize sector and for the country. What is needed to break these cycles is a mechanism for making pricing more responsive to the weather, so producer prices will better offset the effects of yield variation, rising in bad years and falling in good years.

The current system of fixed pre-announced prices helps stabilize consumers' real incomes, to the extent that it keeps official retail food prices constant. But stabilizing producer prices destabilizes GMB's financial outlays. In good years, fixed pre-announced GMB prices would tend to exceed prices in informal channels, with the result that the GMB must buy a large quantity while selling very little. In drought years, by contrast, fixed pre-announced GMB prices would fall short of informal trading prices, causing frequent GMB "stockouts" without resorting to imports.

A system of graduated producer pricing would permit the GMB to simulate some of the price adjustments that would occur in a competitive market, while reducing the speed and magnitude of adjustment. To ensure that the timing of delivery is not affected, the final price to farmers could be paid in two installments: an initial payment on delivery, followed by a supplementary payment once the total intake is known.

A graduated-price system would be based on a pre-announced schedule of prices, corresponding to particular intake levels. The highest level of prices would be paid if intake fell below the level that would require imports, given current stocks and anticipated sales. At such a level, producers would be paid at import parity. Higher levels of intake would lead to lower prices; the lowest price level (export parity) would be reached if production exceeded the GMB's desired stock build-up, leading to exports.

Naturally the quantity-price schedule announced by the GMB would change from year to year depending on ending stocks the previous year, anticipated domestic demand, and anticipated import/export parity prices. The schedule could also be made a continuous function of intake, to avoid discrete price "jumps." The main advantage of the graduated price system is that it would stabilize the GMB's total credit needs and surplus farmers' incomes more than either a controlled system (where prices would be fixed) or a fully liberalized market (where prices would generally be given by trade values). Graduated pricing would also lower stockholding costs, since stocks would be accumulated in relatively low-price (high-intake) years, rather than in high-price (low-intake) years. Depending upon producer price levels chosen, the GMB might still carry large stocks from one year to the next, but graduated pricing would reduce the acquisition cost of the stored grain and increase the chances for profitable export in high output years.

The overall impact of the graduated pricing system would be to reduce the disruptive effects on the nation's financial markets and economic growth caused by maize production cycles. Under the current system, the GRZ is forced to respond to high intake years with declining real producer prices, and then raise prices sharply after drought years. These cycles worsen the natural variability in yields caused by the weather, whereas a graduated pricing system would do more to offset and dampen the effects of weather cycles. At the same time, by setting the extremes of the graduated prices at import and export parity levels, the scheme ensures that national price levels remain internationally competitive over time, while year-to-year price fluctuations would be determined by local rather than international conditions.

6.4.3.2 Seasonal pricing: intra-annual price variation

Currently GMB buying and selling prices are changed about once per year, after a long negotiation process. The GMB is then mandated to defend these "pan-seasonal" prices throughout the year. In prior years, the maintenance of a fixed trading margin (the difference between buying and selling price) did not cause problems due to the GMB's monopoly position. However, with the liberalization and resulting expansion of private grain trading, the GMB loses market share early in the season when private traders can undercut GMB margins. Later in the season, GMB sales pick up as private traders cannot cover storage and interest costs and still undercut the GMB. The result has been rising GMB deficits as the profitable "early sales," which would normally cross-subsidize the loss-making "late season sales," are eliminated.

Furthermore, infrequent producer price changes make adjustments in consumer prices large and traumatic. Prices must rise sharply to compensate for past inflation.

Real prices then fall slowly over time, only to rise sharply again at the next price adjustment. Real prices could be made more constant by smaller, more frequent price changes.

The GMB could introduce seasonal flexibility to its selling prices without much difficulty, by adjusting selling prices on a weekly or bi-monthly basis after harvest using a formula designed to cover both inflation and storage costs. After harvest when maize is most plentiful, prices would be lowest, and would then rise gradually depending on seasonal storage costs to a peak in February when grain is most scarce.

Seasonal producer prices could also be adopted by paying "supplements" to the scheduled producer prices in the graduated pricing scheme. For example, a producer price supplement of Z$10 or Z$20 per ton per month could be paid to reflect storage and interest costs incurred by the seller of the grain. The supplement could be simply added on to the "base price" the seller receives. Such a system would reduce the payment burden on the GMB by spacing out purchases from farmers over the course of the year. With the current system, late deliveries are in effect penalized since the producer receives the same price whether delivering in April or December. There is no price incentive to store on-farm for sale to the GMB later in the year. The result is a tremendous strain on GMB grain handling and payment facilities during two or three peak delivery months.

6.4.3.3 Depot-specific pricing: regional price variation

In principle, GMB prices are "pan-territorial," in that uniform producer and consumer prices apply at all depots. This policy effectively cross-subsidizes smallholder maize sellers in remote areas facing high transport costs at the expense of most commercial farmers and the few surplus smallholders close to urban centers. The pan-territorial GMB margin means that GMB operations in most commercial farming areas generate profits that partially offset its losses in remote, surplus communal areas.

Although pan-territorial pricing does help remote, surplus smallholders, most communal areas are net grain deficit, even in relatively good years. In deficit areas, the economic value of grain is above the national average, being its purchase price in the supplying region, plus transport costs (Muir and Takavarasha, 1989). Pan-territorial pricing thus reduces prices paid to producers in or close to remote deficit areas. Survey data presented in Chapter 3 supports the supposition that non-GMB buyers offer higher prices in deficit areas than prevail in surplus regions. Of course, non-GMB buyers only operate in a limited number of areas.

Given the complete liberalization of maize marketing, the introduction of depot-specific pricing by the GMB could be another option to avoid continued trading losses. Private traders have already concentrated their activities in areas where their marketing costs are low relative to the GMB's margin. If the GMB is to reduce losses, it must be able to offer prices that are competitive with the emerging private traders. Depot-specific prices could be set administratively without changing the current marketing system, by assigning a transport cost margin to each depot according to the GMB's cost of moving grain in or out of that location. Each depot's buying or selling price would then be some national base rate, plus or minus the transport margin. Transport margins for each depot could be calculated and announced at the start of the marketing season, based on the expected pattern of inter-depot transfers given harvest levels in each region.

Introducing transport margins would raise the prices received by farmers selling grain in deficit areas, and increase GMB intake in those areas. Transport margins would also provide incentives for the GMB and private traders to engage in more long-distance grain movement from surplus to deficit areas. The few consumers in deficit areas who now have access to subsidized pan-territorial prices through consumer grain purchases directly from the GMB may lose from depot-specific pricing, at least in the short run. However, deficit households in deficit areas that depend upon purchases of refined maize meal would benefit from greater availability of grain in deficit areas. The development of a maize trade from surplus to deficit areas would improve household-level food security by offering households a lower-cost source of maize meal than purchased roller meal.

From the GMB's point of view, depot-specific pricing would make GMB intake and sales at each depot self-financing, and eliminate any need to close "non-viable" depots. A further step to rationalize GMB operations would be to allow the gap between buying and selling prices to vary across depots, to account for different unit costs. Such a system would allow the GMB to be more competitive against private traders in each local market: at high-volume, low-cost depots, small margins would allow the GMB to compete against commercial wholesalers. Elsewhere, GMB management might recognize that its operating costs were higher than those of local marketing agents.

It seems logical to assume that smallholder surplus maize producers in remote surplus areas would lose from depot-specific pricing. GMB prices at local depots would be lower and there would be no convenient private markets for maize. However, to the extent that remote surplus producers can develop trading links with deficit areas, the prices received by remote surplus producers may rise. In the longer term, as maize markets across the nation become more integrated, maize price differentials may only reflect transport costs to the nearest areas of demand, be they rural or urban areas. Also, there may be shifts in maize production as producers respond to local grain prices rather than pan-territorial prices.

The introduction of depot-specific pricing could be a fundamental step toward the rationalization of the GMB grain pricing structure and reduction of GMB deficits, but it does involve fundamental trade-offs. In particular, the major beneficiaries of the post-Independence expansion of GMB marketing services (remote surplus smallholders) would lose from depot-specific pricing, at least in the short-run. Furthermore, depot-specific pricing may be seen as discriminating against more remote southern and western regions of the country, the home of the minority Ndebele ethnic group. Minimizing the potential political fallout may involve phasing in depot-pricing or stressing that differential depot prices reflect differential transport costs by announcing a uniform nationwide selling price minus specified transport costs for each depot.

6.4.3.4 Possible GMB pricing strategies

With the three "dimensions" of pricing reform sketched out above, it is possible to delineate all the combinations that could comprise a GMB pricing strategy. Table 55 lists the various strategies. It is apparent that the pricing reform options detailed here entail fundamental trade-offs between GMB deficit reduction goals and the provision of guaranteed, stable prices to smallholders. For the GMB to meet the goal of a sustainable reduction in its deficit, the main beneficiaries of the existing pricing system (communal maize sellers in surplus areas) will be made worse off. The specifics of each strategy are

Table 55: GMB pricing strategy options

	Seasonal Pricing	Depot Pricing	Graduated Pricing	GMB financially viable?	Large-scale farmers	Communal maize sellers		Communal maize buyers		Urban consumers
						surplus area	deficit area	surplus area	deficit area	
Status quo	No	No	No	Distributional effects relative to the status quo						
Strategy #1	Yes	No	No	No	0	+	+	-	-	0
Strategy #2	Yes	Yes	No	No	+	-	+	?	?	0
Strategy #3	Yes	Yes	Yes	Yes	+	-	+	?	?	+
Strategy #4	No	No	Yes	Yes*	0	0	0	0	0	+
Strategy #5	Yes	No	Yes	Yes*	0	0	0	-	?	+
Strategy #6	No	Yes	No	No	+	-	+	+	?	0
Strategy #7	No	Yes	Yes	No	+	-	+	+	?	0

Notes:
- * in short run only
- \+ positively affected
- \- negatively affected
- ? not enough evidence to predict

described below.

Seasonal pricing alone (Strategy 1) is an insufficient option for reducing the GMB's budget deficit under a competitive maize trading environment. Unlike the existing fixed price system, monthly price adjustments would allow the GMB to be a year-round player in the market. Over the past two seasons, GMB sales have been very low in the months after harvest because of the fixed pan-seasonal price structure imposed on the GMB by the GRZ. GMB sales would exhibit less seasonality if the GMB could set a lower margin in the period immediately following harvest, effectively competing with private traders. But there would still be losses on the GMB trading account unless it also adopted depot and graduated pricing. Seasonal pricing would, however, benefit communal maize producers in that most communal maize producers sell little early in the marketing year.

Seasonal pricing with depot pricing (Strategy 2) would be an improvement over Strategy 1 as it would account for regional and temporal variation in prices, but does not solve the problem of rationalizing the overall GMB price structure with changes in annual supply and demand conditions. Without a means to alter the overall level of prices at the beginning of each year in response to changes in market conditions, the GMB loses most of its influence over intake and quantity demanded, and hence maize stock levels.

The combination of seasonal pricing, depot pricing, and graduated pricing (Strategy 3), is a financially sustainable option for the GMB over the long run. There are at least two variants of this option. In the first, the GMB would set prices for a particular base depot and then derive all other depot prices on the basis of inter-depot transport costs. All prices would then be adjusted weekly or bi-monthly to account for seasonal stockholding costs. Prices would be lowest directly after harvest and rise progressively through the season as storage costs rise. In each year, the price at the base depot would be determined based on expected GMB intake and a pre-announced schedule of graduated prices.

Strategy 3 would theoretically allow the GMB to break-even on its trading account, assuming that it sets the base depot and transport prices correctly. Losses could still arise, however, if the GMB "guesses wrong" about the expected geographical pattern of intake and sales in a particular year. But since the GMB would have complete flexibility, any losses would be the result of misspecification of the formula for base depot price determination. A variant of Strategy 3 is that the GRZ devolves authority to GMB to alter its depot prices at its own discretion. Thus if GMB prices at a certain depot were out of line with prevailing market conditions, the GMB would have the authority to reduce its price without authorization from the MLAWD. The GMB would still be a residual buyer in name, but if the price were low enough, sellers would seek other markets. The GMB would effectively have the pricing flexibility of a private firm. Either variants of this pricing reform strategy would allow the GMB to operate on a break-even basis, spreading the costs of its operations more evenly than is currently the case. Reform of GMB pricing would assist liberalization by bringing spatial and temporal marketing margins closer to competitive levels: margins above marketing costs will be narrowed, and margins below costs will be widened. This protects the GMB from accumulating deficits when its profitable activities are taken over by private traders, and also protects the public from sudden rises in marketing margins if the GMB were to withdraw from a particular function.

While Strategy 3 may be the best option for GMB financial sustainability, it imposes costs on smallholder maize sellers in remote areas that currently rely on GMB marketing services. The effect on communal maize buyers in deficit areas is largely an empirical question. To the degree that communal deficit households have access to maize from GMB depots at pan-seasonal and pan-territorial prices, they are harmed; however, if most communal deficit households rely on purchased roller meal, real price differentials between markets could induce greater participation in the maize trade by the private sector, eventually lowering the cost of maize to communal deficit households. If this strategy does raise maize prices for smallholders in certain deficit areas, it may be necessary to explore potential interventions to protect the rural poor from rising consumer maize prices.

Graduated pricing alone (Strategy 4) may be considered a transitional first step, as it establishes a link between GMB stock levels and intake and producer payments and can reduce the GMB deficit in a series of good harvest years. However, it does not solve all of the GMB's financial problems, especially those associated with a loss of market share on quick turnaround trading early in the season and in the low-cost marketing routes. Similarly graduated pricing with seasonal pricing (Strategy 5) may address inter-annual losses, but it still does not address the problem of financial deficits associated with loss of market share in low-cost trading areas. Depot specific pricing is required to permit the GMB to be competitive in all markets.

Finally Strategy 6 (depot-specific pricing) and Strategy 7 (depot-specific pricing with graduated pricing) are not coherent strategies. Any form of depot pricing without seasonal pricing would be financially unsustainable. The GMB would still not have the ability to limit financial losses associated with loss of market share on quick turnaround trading early in the season.

Thus, although there may be intermediate steps (i.e. Strategies 4 and 5 in Table 55), addressing the GMB financial crisis in a sustainable way requires comprehensive price reform in the mechanism for determining inter-annual, intra-annual and regional prices. Introduction of a combination of seasonal pricing, depot-specific pricing, and graduated pricing (Strategy 3 in Table 55) would best meet the needs of the GMB. However, since communal maize sellers in surplus regions (and possibly communal maize buyers in deficit regions) may be harmed, especially in the short-run, targeted interventions may be required. Given the magnitude of GMB deficits associated with the supporting pan-territorial, pan-seasonal producer prices, such interventions may ultimately be very cost-effective.

6.4.4 GMB stockholding policy

Large weather-induced variations in output make it very difficult, and costly, for the GMB to pursue a policy of maize self-sufficiency based on long-term maize storage. As the maize balance sheet presented in Table 54 shows, since Independence the nation has experienced two periods of poor harvests, a draw down of GMB stocks and ultimately the need for large quantities of imported maize. Relatively infrequent, yet severe, production shortfalls (for example, in 1984 and 1992) created a period of import-dependency and ultimately led to pressures for large stocks in succeeding years (Table 54). With large stocks, government-set producer prices have tended to fall in real terms, eventually exacerbating the drop in output during drought years.

In the aftermath of the 1992 drought, in an effort to cope with future droughts, the GRZ directed the GMB to maintain a Strategic Grain Reserve with a targeted stock level of 936,000 tons. In large part, the determination of the level of the Strategic Grain Reserve was a political decision. Presented with a number of stock level options, the GRZ

Cabinet chose the highest figure submitted despite the GMB analysis suggesting smaller stock of 550,000 tons may be sufficient. Much of the disagreement stems from differing perceptions about the function of stocks: should Zimbabwe follow a policy of maize self-sufficiency (where all domestic needs are met through domestic production and stockholding) or a policy of maize self-reliance (where a least-cost mix of imports, domestic production and stocks is used to meet national needs)?

Although Zimbabwe's high bridging costs mean that the cost of imported maize has historically been higher than the acquisition cost of domestically-produced maize, a maize self-sufficiency policy centered around the GMB holding large maize stocks is not a least-cost national food security strategy given past and current local and world maize price trends. There is compelling evidence that rather than relying on a maize self-sufficiency policy at any cost, the least cost approach would involve the GRZ pursuing a policy of maize self-reliance. Maize self-reliance, based on the concept of comparative advantage, entails meeting national maize needs through a cost-minimizing combination of domestic production, imports, and an appropriate stockholding policy. Maize self-reliance can mean lower costs than a maize self-sufficiency policy, even when imported maize is more expensive than domestically produced maize.[12] But a policy of maize self-reliance also means that, to minimize procurement costs, the nation may import maize even when there is not severe drought. When the cost of inducing additional maize supply response or costs of longer-term storage are greater than the costs of importing maize, importing maize

[12] This reflects the supply responsiveness of maize producers: a as greater percentage of national requirements are sought from domestic production, higher prices must be paid to all producers. A mix of domestic production and imports may often be a less costly strategy for meeting national maize needs.

r

i

a

ir

would be practical. Although most imported maize has historically been yellow maize, survey data presented in Chapter 4 suggests that consumers are much more willing to accept yellow maize than previously supposed.

Although developing a least-cost stockholding policy that helps ensure national food security is a complex endeavor that is beyond the scope of this study, a few general principles can be explored here as a background for future research. A least-cost stockholding policy based on food self-reliance would have several components. First, the GRZ, through the GMB or other entity, would maintain an import buffer stock. This buffer stock would be enough maize to cover the lead time required to arrange and receive imported maize in the event of drought. The amount of this buffer stock would vary seasonally and from year to year dependent upon the local requirements, quality of impending harvests and stocks held by farmers and private traders. For example, import buffer stocks could be much lower in the months right before a good harvest. The current Strategic Grain Reserve may be viewed as an import buffer stock (i.e it is only a portion of the total maize stock held by the GMB), although it does not vary seasonally and from year to year and may be larger than warranted given needed import lead times.

Second, the decision whether to maintain additional stocks could be explicitly based on relative costs of procurement from alternative sources using an inventory stocking model combined with econometric forecasts. Such a model would have the objective function of minimizing the total cost of maize procurement from all sources. Relevant variables to be incorporated the stocking model include: the domestic acquisition price, domestic output and consumption, estimated storage costs, existing stock levels, and expected export and import parity prices. Expected length and costs of storage, future production levels, and expected import and export parity prices would have to be based upon past trends and probabilities of alternative domestic production outcomes.

Such a stockholding policy would minimize the costs to the nation of meeting national maize needs. Yet before a rational stocking policy can be designed, GMB pricing policy must be reformed. At present, GMB stock levels are simply a residual outcome of the weather and the fixed buying and selling prices mandated by the GRZ. The GMB has no ability to influence its own stock level by adjusting its buying and selling prices. Only if GMB had the ability to adjust its prices in response to prevailing market conditions, could it regulate its intake and domestic sales, and hence have some control over its stock level. With GMB pricing reforms, the issue of an appropriate target stock level would become relevant. Hence, as is the case with the GMB's financial problems, the fundamental change required to make the management of a Strategic Grain Reserve operable is a more flexible pricing system that would allow the GMB to flexibly adjust its buying and selling prices in response to market conditions.

CHAPTER 7:

CONCLUSIONS AND POLICY IMPLICATIONS

After a brief synopsis of the background of this dissertation, this chapter summarizes the results of this study and presents the implications of this research for on-going maize market reforms in Zimbabwe. Possibilities for wider applications of this methodological approach are explored and future needed research is identified.

7.1 Background to the study

With the initiation of economic reforms in 1991, Zimbabwe faced an increasingly acute food price dilemma: in order to offer remunerative maize producer prices and reduce government deficits associated with grain marketing, there was great pressure to increase government-fixed retail maize meal prices above politically acceptable levels. A major concern of the GRZ was specifying policy changes that could be undertaken in the maize subsector that would keep food prices affordable while still maintaining producer prices at levels sufficient to induce the necessary supply response.

This research was predicated upon the hypothesis that, due to policy-imposed constraints, there was unmet demand in urban areas for lower-cost maize products such as straight-run meal and yellow maize. As a result, select policy changes could create an environment where small-scale hammer millers could offer consumers maize meal products at lower prices than the dominant parastatal-industrial miller marketing channel, thereby benefitting consumers and creating employment through the growth of labor-intensive small-scale enterprises.

7.2 Implications of results for the maize subsector in Zimbabwe

The analysis presented in the foregoing chapters has important implications for both the continuing evolution of the maize subsector in Zimbabwe as well as other nations in Southern and Eastern Africa that have relatively centralized and state-controlled grain marketing systems. This section attempts to summarize the results of this study and presents the implications of these results for consumers, small enterprises, maize marketing and food security policy, and GRZ macroeconomic goals.

7.2.1 Implications for consumers

Evidence from consumer surveys shows that there is significant demand for white straight-run meal and yellow roller meal. While urban consumers may prefer more refined white maize meal products, price considerations are paramount. The demand functions estimated in Chapter 4 show that as the price difference between white roller meal and cheaper alterative products grows larger, increasing number of consumers would choose to shift away from white roller meal. White straight-run meal and yellow roller meal are substitutes for the more refined white maize meals produced by large-scale mills. Using the price-quantity relationships generated from responses to realistic hypothetical price scenario comparisons with white roller meal, the price elasticity of demand for straight-run meal was estimated to be -2.7. Similar estimates for yellow roller meal found the price elasticity of demand to be -1.8.

There is also strong evidence that white straight-run meal and yellow roller meal have a negative income elasticity of demand. As incomes rise, cross-sectional data shows that consumers are less likely to substitute white straight-run meal or yellow roller meal for refined white maize meal. Furthermore, in a discrete choice model of the decision to consume straight-run meal, the explanatory variable "household income" had a significant, negative coefficient.

Contingent valuation data provided a fairly accurate estimate of the potential market share of straight-run meal in this study. The conditional logit model in Chapter 4 predicts a straight-run market share of 41 percent in the three-product case. In Chapter 6, an estimate of consumers' opportunity cost of time from hypothetical data is used to predict a straight-run meal market share of 53 percent in the two-product case if it were available. By late 1993, after policy reforms that removed constraints that limited access to straight-run meal were undertaken, straight-run meal was being consumed by 56 percent of the urban population. Thus the "pre-reform" contingent valuation estimates of maize meal market share were close to the actual "post-reform" market share figures prevailing six months after movement decontrol and subsidy removal. The magnitude of this switch to straight-run meal supports the hypothesis that consumer preferences could not be articulated in pre-1992 maize marketing channels. Due to policy-imposed constraints, there clearly was unmet demand for straight-run meal.

A major implication is that observed consumption patterns in urban Zimbabwe are a direct result of the policies that promote and protect a formal marketing channel dominated by a grain parastatal and large-scale millers. Until 1993, the single-channel marketing system limited the choices of consumers. In the pre-reform period, many consumers would have chosen to consume lower-priced straight-run meal had it been available. Also, in the case of yellow maize meal products, preferences of a significant number of consumers were altered by the experience of using yellow maize meal. Survey results show that for the small proportion of the population that preferred (or were indifferent to) yellow maize, over two-thirds cited the drought-induced or "forced" consumption of yellow maize meal as the reason for their change in preferences. Changes in preferences may be much more common than supposed. Changes in prices and supply conditions (i.e. for yellow maize meal) can lead to "irreversibility of demand" as new habits are formed and as households learn new food preparation and acquisition "technologies." When prices and supply conditions revert to their original level, changes in preferences mean an altered level of demand.

Maize movement deregulation was a vital parallel reform to the removal of the roller meal subsidy in June 1993. Although subsidy removal boosted the retail price of roller meal 53 percent, many of the poorest urban consumers were cushioned from the full impact of this price increase by procuring maize grain and bringing it to urban hammer mills for custom milling into straight-run meal. The probit model presented in Chapter 4 shows that household income, household size, distance to hammer mill, and years lived in an urban area were all significant explanatory factors in the decision to consume straight-run meal. By late 1993, about half of the 240,000 tons of maize meal consumed in the home by urban households was hammer-milled straight-run meal, saving urban consumers over Z$78 million per year. Without movement decontrol, access to straight-run meal would have continued to be limited. The main losers from this switch to straight-run meal have been large-scale milling firms who have seen sales of roller meal tumble. Yet the losses in profits to large-scale millers are much less than the gain in lower maize meal prices to urban consumers. Also, with the majority of urban households switching to a nutritionally superior product (straight-run meal rather than the more refined roller meal), consumers have realized nutritional gains.

Furthermore, there may be unmet demand for yellow maize among urban consumers. Although 90 percent of urban consumers express a strong preference for white maize when priced the same as yellow, at a 10 percent price discount, as much as a quarter of the population would switch to yellow maize meal in a pair-wise comparison. Therefore, further policy changes that permit latent demand for low-cost yellow maize products to be articulated could mean additional benefits to consumers.

7.2.2 Implications for small enterprise development

With the 1991-1993 market reform, decentralized maize marketing channels, particularly those composed of urban grain traders and custom mills, developed rapidly. The number of hammer mills in Harare and Chitungwiza rose by 30 percent in just 18 months (February 1992 to September 1993). The growth in the number of urban custom hammer mills can be attributed to the rapid growth in the consumption of straight-run meal since early 1993. During 1991, 8 percent of urban consumption needs were met by straight-run meal. However, by May/June 1993, 27 percent of urban households were consuming straight-run meal. By October 1993, estimates of monthly throughput at Harare and Chitungwiza custom mills show that 48 percent of consumption needs were being processed by custom hammer mills. Maize throughput at custom mills in Harare and Chitungwiza peaked in June 1993 with total throughput of 5,076 tons, about three and a half times the peak amount in June 1991. The volume of maize sold by urban traders has also increased greatly since reform in mid-1993.

There is sufficient small-scale hammer milling capacity to meet demand for straight-run meal under most policy reform and weather scenarios. For example, without changing current operating hours, Harare/Chitungwiza hammer mills have the capacity to mill 66 percent of Harare/Chitungwiza maize meal requirements. Yet some small enterprises in the emerging maize marketing channels are facing problems, including production millers who specialize in the manufacture of a bagged maize meal product and compete directly with large-scale millers. The market for purchased and packaged maize meal continues to be dominated by two industrial milling companies, and production millers have not yet gained a significant share of the shrinking market for purchased maize meal. The greatest constraint to production millers are difficulties they face in marketing their products, despite the lower wholesale prices of most production millers. Much of the difficultly stems from penetrating 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 large-scale millers and are reluctant to undertake measures that would jeopardize regular deliveries of stock. Even those retailers who considered stocking low-priced roller meal from production millers expressed uncertainty about the reliability of supplies from production millers. Also, the structure of the food retailing in urban areas suggests scope for possible monopolistic collusion. Almost half of urban consumers purchase bagged maize meal at large supermarkets owned by two conglomerates.

Production millers 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. Yet the GRZ could also play a role by: (1) reforming Tender Board procedures to permit emergent businessmen to bid on the supply of small lots; (2) directing the nascent Monopolies and Mergers Commission to investigate claims of collusive trade practices that raise retail prices to consumers; (3) providing technical assistance to develop techniques for milling an appropriate wheat flour with hammer milling equipment; (4) providing the appropriate technical knowledge required for the formulation and manufacture of different types of animal feeds; and (5) facilitating the importation of critical spare parts by reform of customs procedures.

Most custom and production milling operations have been self-financed by well-established indigenous businesspersons. 2For most new entrants, formal credit markets are inaccessible due to: (1) complexities of making a formal loan application with the required supporting documents; or (2) the difficulty 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 own-savings, 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) granting of title deeds to rural businesspersons in communal areas.

7.2.3 Implications for maize marketing and food security policy

For decades, Zimbabwe's maize marketing system was characterized by a highly controlled distribution, storage and processing network. The GMB effectively served as a procurement agent for the highly concentrated private industrial milling industry. Millers bought maize from the GMB and sold processed maize meal to retailers at government-controlled "cost-plus" prices. The advantages of this single-channel system are apparent: that it permitted the enforcement of various government price controls and ensured a stable supply of a staple food for all urban dwellers at uniform prices. It also provided a limited number of participants with high returns. Yet the maintenance of this centralized system effectively prevented lower-cost marketing channels from developing. Reforms from 1991 to 1993 which permitted private grain trading and transport have quickly yielded benefits to consumers and spurred greater investment in labor-intensive maize milling enterprises.

Yet despite substantial maize market reforms, Zimbabwe still has not broken the inherent pattern of maize price cycles created by climatic variation and rigid pricing policies. After maize market liberalization and movement decontrol, the next key step to averting future food security crises is GMB pricing reform. The growth of alternative maize marketing channels, although benefitting consumers and small-scale mill enterprises, has contributed to the rapidly rising GMB deficit. The combination of the maintenance of GRZ-mandated GMB buying and selling prices and liberalization of private maize trading has left the GMB with only the higher cost segments of the market. The only sustainable way to reduce the GMB deficit without jeopardizing the recently realized benefits of grain market reform would be for the GRZ to grant the GMB greater autonomy in price setting. Although there are intermediate steps, addressing the GMB financial crisis in a sustainable way requires comprehensive price reform through the introduction of a combination of seasonal pricing, depot-specific pricing, and graduated pricing. Such reforms, although preventing mounting GMB deficits, inter-annual, intra-annual and regional price variation may harm a small group of politically powerful communal maize sellers in surplus regions.

A key to the reform process involves the recognition that there are cheaper ways of protecting certain segments of the farming community that do not rely on pan-territorial and pan-seasonal pricing policy.

Many nations in Eastern and Southern Africa have found the introduction and maintenance of some level of subsidies on staple foods a political necessity. Fears regarding the possible repercussions resulting from subsidy removal are often the primary impediment to agricultural price policy reform. The experience of Zimbabwe during 1991-1993 suggests that the food subsidy debate need not be always seen in terms of a stark choice between "short-term pain" and "long-term gain." While blanket subsidies on a widely consumed food staple implemented through a centralized food marketing system may offer some protection to low-income consumers, there may be lower-cost alternatives. One option is accompanying subsidy removal with complementary policy reforms that permit the development of alternative, decentralized, and lower-cost marketing channels. In Zimbabwe, the rapid growth in consumption of straight-run meal from hammer mills has enabled the majority of urban consumers to avoid bearing the burden of increased roller meal prices resulting from GRZ subsidy removal. While capital-intensive, seemingly industrial food marketing systems may be symbols of development, alternative marketing channels based on more appropriate factor proportions may be able to provide food staples at lower cost, especially when more marketing functions performed by the consumer or processors have lower unit costs. Yet without an empirical basis for *ex-ante* knowledge of the potential demand for straight-run meal, essential complementary reforms may be stymied by the misconceptions held by policy-makers and donors as to the overall acceptability to consumers of alternative food products. Empirical evidence regarding the consumer responses to price changes and reactions to a wider range of food products is imperative, particularly when there are risks of jeopardizing the food security status of large segments of the population.

Other options for protecting lower-income households from the short-term effects of the removal of blanket subsidies involve targeted subsidy schemes. For example, had the GRZ subsidized a less preferred maize meal product such as yellow roller meal, the cost of the targeted subsidy would have been one-fifth of the cost of the white roller meal subsidy. Data from urban consumers show that yellow roller meal and white straight-run meal are both inferior goods with a negative income elasticity of demand. Should subsidies be reintroduced, both have potential as a vehicle for a "self-targeted" subsidy. However, any subsidy would have to be carefully designed to minimize leakage of grain to animal feeds and not disadvantage small-scale millers. Yellow straight run meal may be the most attractive vehicle for a "self-targeted" subsidy as it is certainly an inferior good. However, the highly decentralized nature of the straight-run meal production and marketing system would seriously complicate the subsidization of yellow maize grain. Without costly, and perhaps impractical, safeguards, selling yellow maize grain at a significant price discount for eventual consumption as straight-run meal could mean large leakages as grain is diverted to animal feeds. The difficulties inherent in subsidizing yellow maize grain demonstrate the trade-offs between the administrative control of subsidy schemes and the market-driven development of low-cost marketing channels in centralized and decentralized marketing systems.

Even without subsidies, the possible yield advantages of yellow maize may mean that the unsubsidized yellow straight-run meal could be obtained by low-income households at a price below that of white-straight-run meal. An expanded role for yellow maize in a national food security strategy would give the GRZ greater flexibility in its pursuit of food security. Rather than relying on a food self-sufficiency policy at any cost, the GRZ would be free to pursue a policy of food self-reliance. Consumer acceptance of yellow maize at a price discount would provide the GRZ with greater flexibility to meet domestic needs through a combination of domestic production, stocks, and imports.

Although urban households are often seen as the primary beneficiaries of roller meal subsidies, during poor rainfall years large segments of the rural population are maize-deficit. For example, during the 1992 drought, despite widespread distribution of food aid, as much as two-thirds of roller meal purchases (almost 50,000 tons per month) were made by rural households. By facilitating the availability of maize grain rather than subsidized roller meal, the GRZ could have ensured that rural consumers had access to a maize meal product at a price not significantly different than the price of subsidized roller meal. If instead of subsidizing rural access to roller meal during drought, the GRZ had sold maize grain to rural households at the GMB selling price of Z$1,070 per ton, the GRZ would have saved over Z$280 million per year in roller meal subsidies that can be directly attributed to rural households. Greater reliance on straight-run meal would also benefit the country during times of maize shortages since the higher extraction rate of straight-run meal relative to more refined maize meal would reduce import needs.

7.2.4 Implications for GRZ macroeconomic goals

Over the next five years, as Zimbabwe's structural adjustment program enters its second five-year phase, the greatest challenges are meeting target growth rates, reducing unemployment, and reining in inflation. A major contributor to high inflation[13] has been large fiscal deficits which crowd out private sector borrowing. Maize market reforms can contribute to lower budgetary deficits in two ways: (1) alternative marketing channels have helped make an affordable maize meal accessible to urban consumers, eliminating the need for costly roller meal subsidies; and (2) reforms that give the GMB greater pricing flexibility can reduce or eliminate losses created by GRZ mandated buying and selling prices.

The maintenance of roller meal subsidies effectively sheltered a high-cost marketing channel from competition of other, lower-cost channels. In 1992, the purchasing of unprocessed grain from the GMB was more expensive than purchasing packaged roller meal from a retail shop. With the removal of subsidies and a 53 percent increase in roller meal prices in 1993, alternative channels composed of private traders and hammer millers blossomed. After reform, the average acquisition costs of obtaining straight-run meal were only 3 percent more than the former subsidized price of roller meal (Z$1,169 versus Z$1,140 per ton). By eliminating the need for blanket subsidies on roller meal, the GRZ has realized average budgetary savings of over Z$265 million per year, and may save as much as Z$420 million in poor rainfall years.

Embarking on GMB pricing reform is another mechanism for reducing fiscal deficits. GMB deficits currently approach Z$1.1 billion, or about 3 percent of GNP. Mounting GMB deficits are a direct result of its continued use of fixed, government-mandated prices. Currently, the GMB must defend uniform buying and selling prices in

[13] The Consumer Price Index increased at a rate of 43 percent in 1992 and the annualized rate of increase has been 18 to 22 percent during 1993 and the first half of 1994.

an environment where grain trade has been deregulated. The GMB will only be able to control its deficit when it has greater autonomy in price setting. The next step in the reform process is permitting the GMB to alter its buying and selling price in response to market conditions. The GMB's pricing arrangements require reform in three main dimensions: (1) annual storage and year-to-year price variation, to reduce imbalances in annual supply and demand; and (2) seasonal storage and month-to-month price variation, to spread the costs of seasonal storage among consumers and producers; and (3) regional price variation, to reduce imbalances between surplus and deficit areas.

Maize market reform can also contribute to solving other macroeconomic dilemmas. Emerging alternative marketing channels composed of hammer millers and private traders are labor-intensive and can contribute to reducing unemployment. Hammer mill enterprises (custom and production mills) are superior to large-scale roller mills in terms of employment generation, investment capital utilization, foreign exchange utilization, and enterprise flexibility. In particular, production mills use over seven times as much labor to produce a given output than large-scale roller mills. Production mills also only require one-seventh the amount of investment capital and one-sixteenth the amount of foreign exchange as hammer mills to produce a given unit of output. Rather than being an exogenous choice of the "best technology," the choice of roller mill technology reflected the former needs of a centralized, single-channel marketing system.

There are important inter-linkages between macroeconomic and sectoral policies. Sectoral polices that aid the development of alternative marketing channels can reduce the magnitude of Zimbabwe's food price dilemma during market reform. By lessening the magnitude of trade-offs inherent in the food-price dilemma, macroeconomic adjustment becomes easier. But the linkages work both ways: macroeconomic reforms can also improve the scope for contributions to economic growth and employment from the maize subsector. For example, reduction in the delays in the importation of spare parts could increase the milling capacity of custom mills. Likewise, parastatal reform in other sectors of the economy (such as the Zimbabwe Electrical Supply Authority) could contribute to a reduction in unplanned power outages. Successful reform of the maize sector is linked to parallel developments and reforms in other sectors and macroeconomic reform.

7.3 Methodological issues and needed research

A major methodological finding of this research is the usefulness and accuracy of contingent valuation techniques in the *ex-ante* valuation of potential benefits of maize market reform in Zimbabwe. Such methods may be appropriate in other settings. By identifying commodities for which demand cannot be articulated and quantifying potential demand, the effects of subsidy removal may be ameliorated through reform that permits marketing channels for new products to develop. Furthermore, this research suggests that even quick, low-cost contingent valuation surveys of a well-known yet unavailable product may offer reliable data on potential demand and market share.

This maize subsector study did reveal several areas where future research is needed. For example, although maize processing has been transformed with the growth of small-scale enterprises, there are still bottlenecks in maize meal retailing. Although the wholesale prices charged by medium-scale production millers for their roller meal-like products are lower than roller meal prices charged by large-scale millers, the lower wholesale prices have not been translated into lower retail roller meal prices. Concentration in urban retailing is high: almost half of maize meal purchases are from two large chains. There is also anecdotal evidence of collusion between large-scale millers and large-scale retailers to restrict market access of lower-priced maize meal products from emergent millers. Furthermore, large-scale millers have adopted marketing strategies, such as effectively tying sales of roller meal to small retailers to the supply of other food staples, that have limited market access by production millers. Future research is needed to suggest reforms that may reduce oligopolistic power in urban retailing and wholesaling and identify constraints to the growth of a more competitive urban retailing base.

By identifying constraints to the development of small-scale maize milling enterprises, this dissertation raises broader questions about small-enterprise development in Zimbabwe. Lack of access to inputs constrained hammer mill development for years and, more recently, monopolistic practices by large-scale millers and retailers have restricted access to markets, forcing many hammer millers to vertically integrate. The challenge is identifying ways to assist small-enterprises in overcoming the barriers to input and market access without resorting to explicit distortions such as quotas. The highly dualistic nature of industrial production in many subsectors in Zimbabwe (the advanced industrial technology possessed by some firms operating alongside a multitude of small firms using often more cost-effective mechanical technologies) makes it very difficult to create a policy environment where the nation can reap the benefits of greater competition between established and emerging firms. Questions also arise about the distributional effects of small-enterprise development. Although the growth of hammer milling enterprises does improve the distribution of industrial earnings in the maize milling industry and increases employment in the industry, a new group of entrepreneurial small-business owners has not been created in the wake of maize market reform. Virtually all the hammer mills in urban areas in Zimbabwe are owned by wealthy and established businessmen and businesswomen that manage a variety of other enterprises. Additional research may be required in order to identify the conditions by which individuals with limited resources can take advantage of emerging market opportunities to begin new small-scale enterprises.

Finally, as Chapter 6 shows, the process of maize market reform in Zimbabwe is only half-completed. Although maize movement was progressively controlled from 1991 to 1994, no significant reforms have been made in GMB operations and, as a result, GMB deficits have mounted. GMB pricing policy reform is the remaining essential component of market reform. As the GMB reforms outlined in Section 6.4 are enacted in full or in part, the current dilemmas faced by the GMB can be addressed. Yet even with the evolution of the GMB into a quasi-commercial entity with autonomy in pricing, there are still unanswered questions in the longer term about the GMB's ideal intra-annual stock levels and appropriate price stabilization functions. Current stock levels are simply a residual of domestic production minus local and export sales that reflect mandated domestic buying and selling prices. A rational, well-defined stockholding and price stabilization strategy needs to be developed by the GRZ to ensure national food security in the potential crisis periods between domestic stock-out and the arrival of imported grain.

There is also some uncertainty about the effects of GMB pricing reform on surplus and deficit smallholders. Economic theory can provide indications of potential gainers and losers but efforts to model and quantify predicted gains and losses by type of farmer and region have led to greatly conflicting results (Masters and Nuppenau, 1993; Jayne and Nuppenau, 1991). With reform efforts well underway, continued collection of data on smallholder grain sales and purchases can enable researchers to monitor the effects of reform on surplus and deficit smallholders in different geographic areas and inform the reform debate.

7.4 Final summary

In a nation where the food system is dominated by parastatal marketing agents and monopolistic private firms, select market reforms that allow alternative food marketing channels to develop can ameliorate the adverse effects of structural adjustment and subsidy removal, helping to ensure urban household food security in the short and medium term. Contingent valuation techniques and other forms of *ex-ante* analysis, used in context of a subsector perspective, can contribute to the reform process by identifying commodities for which policy and regulatory constraints prevent consumer demand from being articulated and obstruct the development of responsive marketing channels.

Important linkages also exist between policy reform in the food system and improvements in macroeconomic performance. Parastatal reform, particularly granting marketing boards greater pricing autonomy, can reduce the budgetary costs of parastatal losses. Reforms that permit the birth and growth of labor-intensive, small-scale processing and marketing enterprises can provide employment and improve balance of payments through reductions in foreign exchange requirements. Similarly, given that foreign exchange and investment capital are often allocated through administrative mechanisms, macroeconomic reforms that increase access to foreign exchange and scarce investment capital at market rates are essential to sustained small-enterprise development.

BIBLIOGRAPHY

BIBLIOGRAPHY

Addelman, Sidney. 1962. Orthogonal Main-Effect Plans for Asymmetrical Factorial Experiments. *Technometrics* 4: 21-46.

AGRITEX. 1993. National Early Warning Unit Monthly Food Security Bulletin, August. Harare, Zimbabwe: AGRITEX.

Arthur, W. Brian. 1988. Self-Reinforcing Mechanisms in Economics. In *The Economy as an Evolving Complex System: Proceedings of the Evolutionary Paths of the Global Economy Workshop,, September, 1987, Santa Fe, New Mexico*, eds. Philip W. Anderson, Kenneth J. Arrow, and David Pines. Redwood City, CA: Addison-Wesley Publishing Company, Inc.

Bagachwa, M.S.D. 1991. *Choice of Technology in Industry: The Economics of Grain-Milling in Tanzania.* Ontario, Canada: International Development Research Centre.

Bain, Joseph, 1968. *Industrial Organization.* New York: John Wiley and Sons.

Bear, Marshall. 1993. *CARE and Subsector Analysis: A Report on CARE's Formative Experience.* GEMINI Working Paper No. 43. Bethesda, MD: Development Alternatives, Inc.

Beggs, S., S. Cardell and J. Hausman. 1981. Assessing the Potential Demand for Electric Cars. *Journal of Econometrics* 16: 1-19.

Bishop, Richard C., and Thomas A. Heberlein. 1979. Measuring Values of Extramarket Goods: Are Indirect Measures Biased? *American Journal of Agricultural Economics* 61.5: 921-30.

Blundell, Richard W. and Richard J. Smith. 1989. Estimation in a Class of Simultaneous Equation Limited Dependent Variable Models. *Review of Economic Studies* 56: 37-58.

Boomgard, James J. 1983. The Economics of Small-scale Furniture Production and Distribution in Thailand. Ph.D. dissertation, Michigan State University.

Boomgard, James J., Stephen P. Davies, Steven J. Haggblade, and Donald C. Mead. 1992. A Subsector Approach to Small Enterprise Promotion and Research. *World Development* 20.2: 199-212.

Boughton, Duncan. 1994. A Commodity Subsector Approach to the Design of Agricultural Research: The Case of Maize in Mali. Ph.D. dissertation, Michigan State University.

Bratton, Michael. 1989. Drought, Food and the social organization of small farmers in Zimbabwe. In *Drought and Hunger in Africa: Denying Famine a Future*, ed. Michael Glantz. New Yrok, NY: Cambridge University Press.

Coulter J. and J.A.F. Compton. 1991. *Liberalization of Cereals Marketing in Sub-Saharan Africa: Implementation Issues.* Chatham: Natural Resources Institute.

David, Paul. 1985. Clio and the Economics of QWERTY. *American Economic Review* 75: 332-337.

Deaton, Angus. 1987. *Quality, Quantity, and Spatial Variation of Price: Estimating Price Elasticities from Cross-Sectional Data.* Living Standards Measurement Study, Working Paper No. 30. Washington, D.C.: The World Bank.

Dickie, Mark, Ann Fisher, and Shelby Gerking. 1987. Market Transactions and Hypothetical Demand Data: A Comparative Study. *Journal of the American Statistical Association* 82.397: 69-75.

Diskin, Patrick and Kapola Sipula. 1994. Maize Meal Preferences and Consumption in Lusaka, Zambia: Survey Results and Implications for Reducing Urban Food Prices. East Lansing, MI: Michigan State University. Mimeo.

Drakkis-Smith, David. 1991. Urban Food Distribution in Asia and Africa. *The Geographic Journal* 157.1: 51-61.

Eckaus, R. S. 1955. The Factor Proportions Problem in Underdeveloped Countries. *American Economic Review* 45.4: 539-565.

Edwards, Edgar O. 1974. Employment in Developing Countries. In *Employment in Developing Nations*, ed. Edgar O. Edwards. New York, NY: Columbia University Press.

Farris, Paul L. 1983. Agricultural Marketing Research in Perspective. In *Future Frontiers in Agricultural Marketing Research,* ed. Paul L. Farris. Ames, IA: Iowa State University Press.

Gasela, R. 1992. As a Matter of Fact. In *The Herald.* Harare: Mass Media Trust. 30 July.

GMB. 1991. Grain Marketing Board: Response from the Management of the Grain Marketing Board to the Economic Structural Adjustment Programme. Harare: GMB Planning Unit. Mimeo.

Green, Paul E. 1974. On the Design of Choice Experiments Involving Multifactor Alternatives. *Journal of Consumer Research*, 1: 61-68.

Green, Paul E. and V. Srinivasan. 1978. Conjoint Analysis in Consumer Research: Issues and Outlook. *Journal of Consumer Research*, 5: 103-123.

Green, Paul E. and Yoram Wind. 1975. New Way to Measure Consumers' Judgements. *Harvard Business Review*, 53, 107-117.

Greene, William H. *Econometric Analysis*. New York, NY: Macmillian Publishing Company.

GRZ. 1992. Policy Statement for the 1992/93 Agricultural Production Year. Harare, Zimbabwe: Ministry of Lands, Agriculture and Rural Resettlement.

GRZ. 1993. Policy Statement for the 1992/93 Agricultural Production Year. Harare, Zimbabwe: Ministry of Lands, Agriculture and Water Development.

Gwitera, Joshua. 1992. Conversation with author, 30 April.

Haggblade, Steven. 1987. Vertical Issues in Choice of Technique Studies: A Case Study of Africa's Indigenous Beer Industry. *Economic Development and Cultural Change* 34.4: 723-742.

Haggblade, Steven, Peter Hazell and James Brown. 1989. Farm and Nonfarm Linkages in Rural Sub-Saharan Africa. *World Development* 17.8: 1173-1201.

Haggblade, Steven and Nick Ritchie. 1992. *Opportunities for Intervention in Thailand's Silk Subsector*. GEMINI Working Paper No. 27. Bethesda, MD: Development Alternatives, Inc.

Harman, Wyatte. 1972. An Evaluation of Factors Affecting the Hierarchy of Multiple Goals. Oklahoma State University, Technical Bulletin T-134. Stillwater, OK: Oklahoma State University.

Harrison, Kelly, Donald Henley, Harold Riley and James Shaffer. 1987. *Improving Food Marketing Systems in Developing Countries: Experiences from Latin America*. MSU International Development Paper No. 9. East Lansing, MI: Michigan State University.

Harriss, Barbara. 1979. There is a Method in My Madness: Or is it Vice Versa? Measuring Agricultural Market Performance. *Food Research Institute Studies* 16.2: 197-218.

Hayami, Yujiro and Vernon W. Ruttan. 1985. *Agricultural Development: An International Perspective*. Baltimore: Johns Hopkins University Press.

Hedden-Dunkhorst, B. 1990. The Role of Small Grains in Semi-Arid Smallholder Farming Systems in Zimbabwe: Preliminary Findings. Matopos, Zimbabwe: SADCC/ICRISAT. Mimeo.

The Herald. 1992. Drought Relief Not Getting to Enough People. 20 August. Harare: Mass Media Trust.

The Herald. 1993. Peasants Exploited Says GMB. 7 June. Harare: Mass Media Trust.

The Herald. 1993. State Pays $500 Million for Maize Subsidies. 23 September. Harare: Mass Media Trust.

Hoehn, John P. and Douglas Krieger. 1988. Methods for Valuing Environmental Change. Department of Agricultural Economics Staff Paper 88-30. East Lansing, MI: Michigan State University.

Holtzman, John S. 1986. *Rapid Reconnaissance Guidelines for Agricultural Marketing and Food System Research in Developing Countries*. MSU International Development Paper No. 30. East Lansing, MI: Michigan State University.

Igwe, B.U.N. and E.C. Ndekwu. 1985. *Technological Choice Decision-Making in Nigeria's Public Sector*. Ibadan, Nigeria: Nigerian Institute of Social and Economic Research.

ILO. 1984. Small-scale Maize Milling. Tecchnology Series Technical Memorandum, No. 6. International Labour Office and the United Nations Development Organization.

IMF. 1994. Preliminary Proposals by the IMF Mission for a Reform of the Operations of the Grain Marketing Board. Harare, Zimbabwe: International Monetary Fund. Mimeo.

Jayne, T. and M. Chisvo. 1991. Unravelling Zimbabwe's Food Insecurity Paradox. *Food Policy* 16.5.

Jayne, T. and E. Nuppenau. 1991. Measuring the Effects of Decontrol on Maize Movement and Pricing in a Dual Marketing System: An Analytical Framework and Preliminary Results from Zimbabwe. Harare: University of Zimbabwe. Mimeo.

Jayne, T., 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, Zimbabwe: University of Zimbabwe.

Jiriyengwa, S. 1991. Market Liberalization in Basic Grains: Options for the Development of Parastatal Marketing in Zimbabwe. Paper presented at IFPRI conference on Regional Agricultural Trade and Integration, 18-20 November, Nyanga, Zimbabwe

Jones, William O. 1972. *Marketing Staple Food Crops in Tropical Africa*. Ithaca, NY: Cornell University Press.

Kohls, R.L. 1957. A Critical Evaluation of Agricultural Marketing Research. *Journal of Farm Economics* 37: 1600-1609.

Kydd, Jonathan. 1989. Maize Research in Malawi: Lessons from Failure. *Journal of International Development* 1.1: 112-144.

Lancaster, Kelvin. 1971. *Consumer Demand: A New Approach*. Columbia University Press: New York.

Leibenstein, Harvey. 1966. Allocative efficiency vs. X-inefficiency. *American Economic Review* 56.3: 393-415.

Liddell, W. 1992. Conversation with author, 11 December.

Liedholm, Carl and Joan Parker. 1989. Small Scale Manufacturing Growth in Africa: Initial Evidence. MSU International Development Working Paper Number 33. East Lansing, MI: Michigan State University.

Liedholm, Carl and Donald Mead. 1992. The Structure and Growth of Microenterprises in Southern and Eastern Africa: Evidence from Recent Surveys. A draft report presented to USAID, Office of Small, Micro, and Informal Enterprise Development. Mimeo.

Maddala, G.S. 1983. *Limited-Dependent and Qualitative Variables in Econometrics*. New York, NY: Cambridge University Press.

Masters, W.A. 1993. Maize Market Reform in Zimbabwe: Optimal Intervention During and After Liberalization. *Food Research Institute Studies* 22.3: 227-251.

Masters, William A., and Ernst-August Nuppenau. 1993. Panterritorial Versus Regional Pricing for Maize in Zimbabwe. *World Development* (forthcoming).

McFadden, D. 1973. Conditional Logit Analysis of Qualitative Response Models. In *Frontiers in Econometrics*, ed. P. Zarembka. New York, NY: Academic Press.

Meissner, Frank. 1989. Effective Food Marketing: A tool for socioeconomic development in the Third World. *Food Policy* 14: 90-96.

Minot, Nicholas. 1994. Letter to author, September 28, 1994.

Morawetz, David. 1974. Employment Implications of Industrialization in Developing Countries: A Survey. *The Economic Journal* 84.335: 491-542.

Morris, Michael L. and Mark D. Newman. 1989. Official and Parallel Cereals Markets in Senegal: Empirical Evidence. *World Development* 17.12: 1895-1906.

Muir, Kay and Malcolm Blackie. 1988. Maize Price Cycles in Southern and Eastern Africa. Department of Agricultural Economics and Extension Working Paper AEE 6/88. Harare, Zimbabwe: University of Zimbabwe.

Muir, Kay and Tobias Takavarasha. 1989. Pan-territorial and Pan-Seasonal Pricing for Maize in Zimbabwe. In *Household and National Food Security in Southern Africa: Proceedings of the Fourth Annual Conference on Food Security Research in Southern Africa, October 31- November 3, 1988*, eds. G. Mudimu and R. Bernsten. Harare, ZImbabwe: University of Zimbabwe.

Mukumbu, Mulinge. 1992. The Effects of Maize Market Liberalization on the Maize Milling Industry in Kenya. Paper presented at the Conference on Maize Supply and Marketing under Market Liberalization, 18-19 June.

Mukumbu, Mulinge and Thomas Jayne. 1994. Urban Maize Meal Consumption Patterns: Strategies for Improving Food Access for Vulnerable Urban Households in Kenya. Paper presented at the Symposium on Agricultural Polices and Food Security in Eastern Africa, 19-20 May.

Mutikani, Veronica. 1994. Conversation with author at Crop Production Branch, AGRITEX, Harare, March 1994.

Nath, Kamla. 1985. Labor-Saving Techniques in Food Processing: Rural Women and Technological Change in the Gambia. Boston University African Studies Center Working Paper Number 108, Boston, MA: Boston University.

North, Douglass C. 1990. *Institutions, Institutional Change, and Economic Performance*. New York: Cambridge University Press.

Reuters Financial Report. 1995. Zimbabwe Sets Higher Deficit Target. 10 January. New York: Reuter Wire Service.

Riley, Harold and John Staatz. 1981. Food System Organization Problems in Developing Countries. Agricultural Development Council Report No. 23. New York: Agricultural Development Council.

Rivers, Douglas and Quang H. Vuong. 1988. Limited Information Estimators and Exogeneity Tests for Simultaneous Probit Models. *Journal of Econometrics* 39: 347-366.

Rogers, Beatrice L. 1989. Reaching the Target Group. Paper presented at the A.I.D. Workshop Targeted Consumer Food Subsidies in Africa, 21 November, Washington, D.C.

Rohrbach, David D. 1989. The Economics of Smallholder Maize Production in Zimbabwe: Implications for Food Security. MSU International Development Paper No. 11. East Lansing, MI: Michigan State University.

Ross, Clark. 1979. Grain Demand and Consumer Preferences, Dakar, Senegal. Center For Research on Economic Development Discussion Paper 80. Ann Arbor, MI: University of Michigan.

Sen, Amartya K. 1957. Some Notes on the Choice of Capital-Intensity in Development Planning. *Quarterly Journal of Economics* 71.4: 561-584.

Shaffer, James D. 1973. On the Concept of Subsector Studies. *American Journal of Agricultural Economics* 55.2: 333-336.

Shaffer, James D. 1980. Food System Organization and Performance: Toward a Conceptual Framework. *American Journal of Agricultural Economics* 62.2: 310-318.

Staatz, John M. and Richard H. Bernsten. 1992. *Technology Development and Household Food Security*. Department of Agricultural Economics Staff Paper No. 92-39. East Lansing, MI: Michigan State University.

Stewart, Frances. 1977. The Choice of Technique: Maize Grinding in Kenya. In *Technology and Underdevelopment*, ed. Frances Stewart. New York, NY: The Macmillian Press Ltd.

Stewart, Frances and Gustav Ranis. 1990. Macro-policies for Appropriate Technology: A Synthesis of Findings. In *The Other Policy: The Influence of Policies on Technology Choice and Small Enterprise Development* eds. Frances Stewart, Henk Thomas and Ton de Wilde. London: Intermediate Technology Publications, 1990.

Timmer, C. Peter. 1973. Choice of Technique in Rice Milling on Java. *Bulletin of Indonesian Economic Studies* 9.2. Reprinted in *Agricultural Development in the Third World*, eds. Carl K. Eicher and John M. Staatz. Baltimore, MD: The Johns Hopkins University Press, 1984.

Timmer, C. Peter. 1983. *Food Policy Analysis*. Baltimore, MD: Johns Hopkins University Press.

Trelogan, Harry C. 1951. Marketing Research in the United States during the Past Five Years. *Journal of Farm Economics* 33: 932-943.

Tschirley, David and Ana Paula Santos. 1994. Who Eats Yellow Maize: Some Preliminary Results of a Survey of Consumer Maize Meal Preferences in Maputo. Department of Agricultural Economics Staff Paper. East Lansing, MI; Michigan State University.

Weber, Michael T., John M. Staatz, John S. Holtzman, Eric W. Crawford, and Richard H. Bernsten. Informing Food Security Decisions in Africa: Empirical Analysis and Policy Dialogue. *American Journal of Agricultural Economics* 70:5 1044-1052.

Weinmann, H. 1972. Agricultural Research and Development in Southern Rhodesia, 1890-1923. Department of Agriculture Occasional Paper Number 4. University of Rhodesia.

Wells, Louis T. 1975. Economic Man and Engineering Man: Choice of Technology in a Low-Wage Country. In *The Choice of Technology in Developing Countries; Some Cautionary Tales* eds. C. Peter Timmer, John W. Thomas, Louis T. Wells, and David Morawetz. Harvard Studies in International Affairs Number 32. Boston, MA: Center for International Affairs, Harvard University.

West, Pepping, Scholte, Schultink, Jansen and Albers, 1987. *Food Consumption Tables*. Food and Nutrition Cooperation for East, Central and Southern Africa, Department of Human Nutrition Summary Table. Netherlands: Wagening Agricultural University.

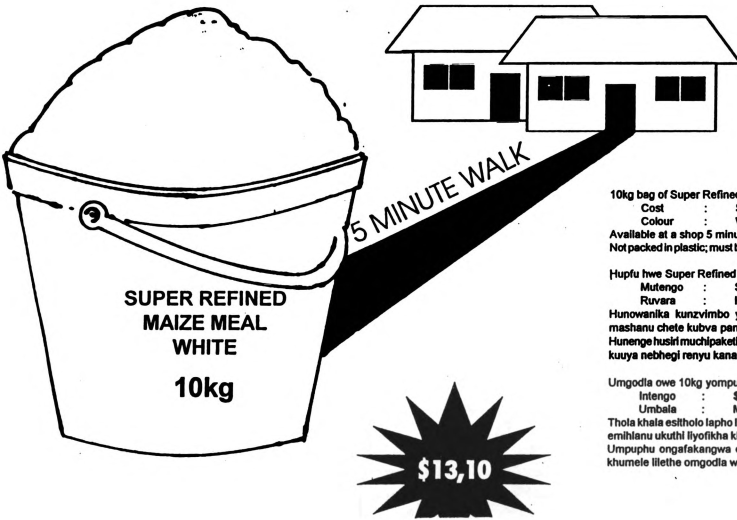
White, Lawrence J. 1978. The Evidence on Appropriate Factor Proportions for Manufacturing in Less Developed Countries: A Survey. *Economic Development and Cultural Change* 27.1: 27-60.

Winston, Gordon C. 1979. The Appeal of Inappropriate Technologies: Self-Inflicted Wages, Ethnic Pride and Corruption. *World Development* 7: 835-845.

World Bank, 1981. *Accelerated Development in Sub-Saharan Africa: An Agenda for Action*. Washington, D.C.: The World Bank.

World Bank. 1986. *Poverty and Hunger: Issues and Options for Food Security in Developing Countries*. Washington, D.C.: The World Bank.

Card 1

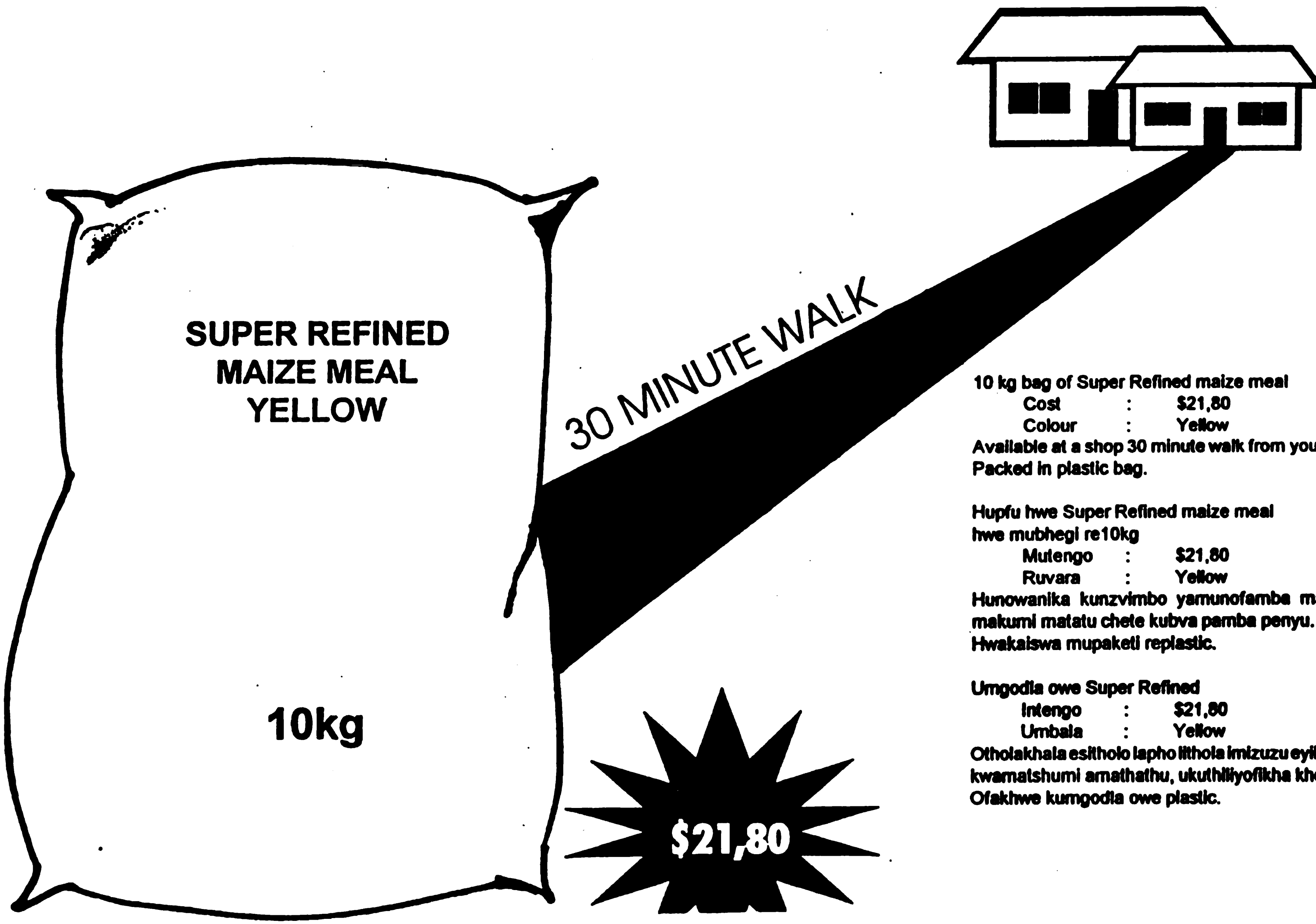


10kg bag of Super Refined maize meal
Cost : $13,10
Colour : White
Available at a shop 5 minute walk from your home.
Not packed in plastic; must bring your bag or container.

Hupfu hwe Super Refined hwemu bhegi re10kg
Mutengo : $13,10
Ruvara : Huchena
Hunowanika kunzvimbo yamunofamba maminitsi mashanu chete kubva pamba penyu.
Hunenge husiri muchipaketi cheplastic munotofanirwa kuuya nebhegi renyu kana chihomwe chenyu mega

Umgodla owe 10kg yompuphu owe super refined
Intengo : $13,10
Umbala : Mhlophe
Thola khala esitholo lapho lithola imizuzu eyikhwana emihlanu ukuthi liyofikha khona.
Umpuphu ongafakangwa emgodlweni owe plastic; khumele lilethe omgodla wenu ngokwenu.

Card 2



10 kg bag of Super Refined maize meal

Cost	:	$21,80
Colour	:	Yellow

Available at a shop 30 minute walk from your home.
Packed in plastic bag.

Hupfu hwe Super Refined maize meal
hwe mubhegi re10kg

Mutengo	:	$21,80
Ruvara	:	Yellow

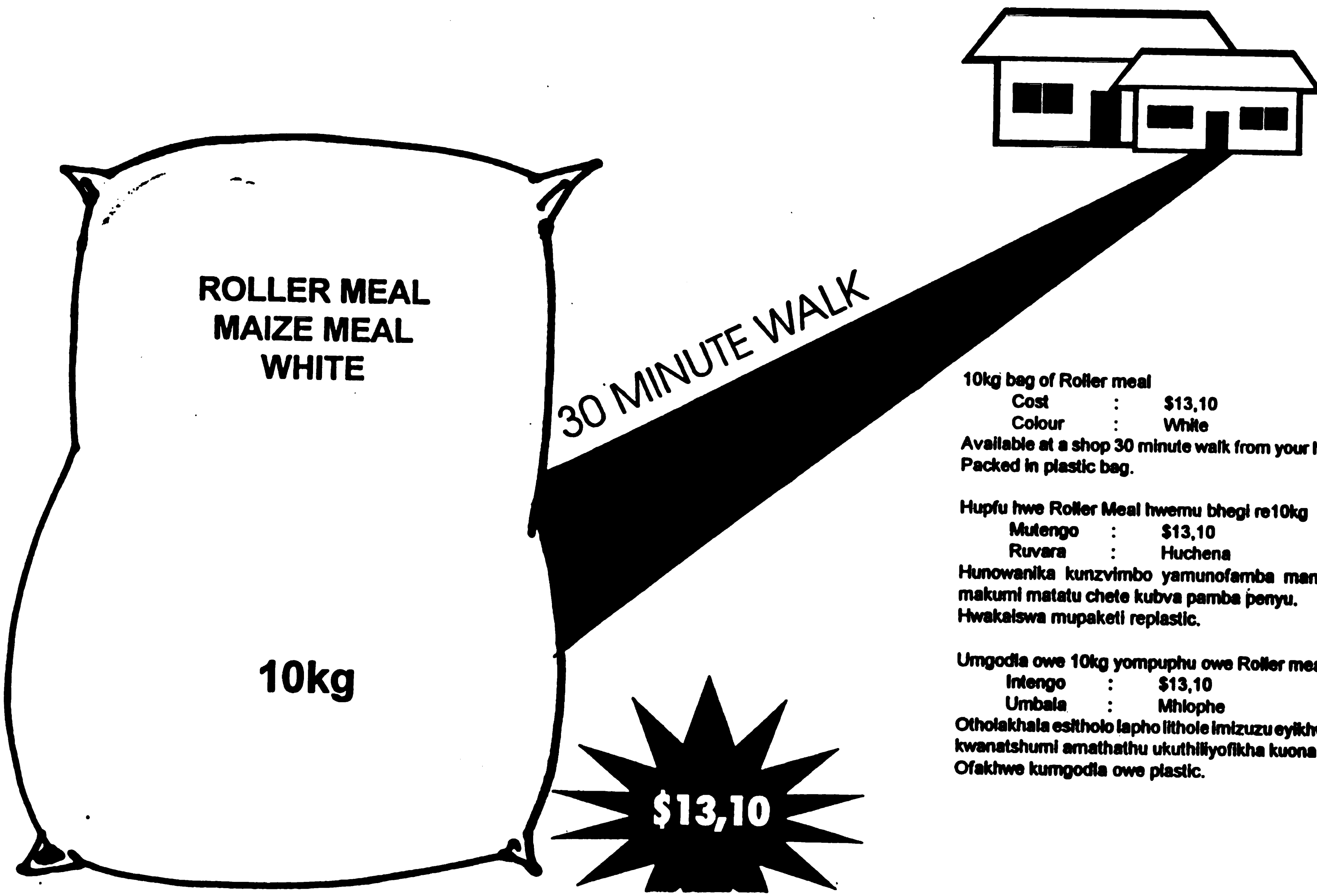
Hunowanika kunzvimbo yamunofamba maminitsi makumi matatu chete kubva pamba penyu.
Hwakaiswa mupaketi replastic.

Umgodla owe Super Refined

Intengo	:	$21,80
Umbala	:	Yellow

Otholakhala esitholo lapho lithola imizuzu eyikhwana kwamatshumi amathathu, ukuthiliyofikha khona.
Ofakhwe kumgodla owe plastic.

Card 3



10kg bag of Roller meal
Cost : $13,10
Colour : White
Available at a shop 30 minute walk from your home.
Packed in plastic bag.

Hupfu hwe Roller Meal hwemu bhegi re10kg
Mutengo : $13,10
Ruvara : Huchena
Hunowanika kunzvimbo yamunofamba maminitsi makumi matatu chete kubva pamba penyu.
Hwakaiswa mupaketi replastic.

Umgodla owe 10kg yompuphu owe Roller meal
Intengo : $13,10
Umbala : Mhlophe
Otholakhala esitholo lapho lithole imizuzu eyikhwana kwanatshumi amathathu ukuthiliyofikha kuona.
Ofakhwe kumgodla owe plastic.

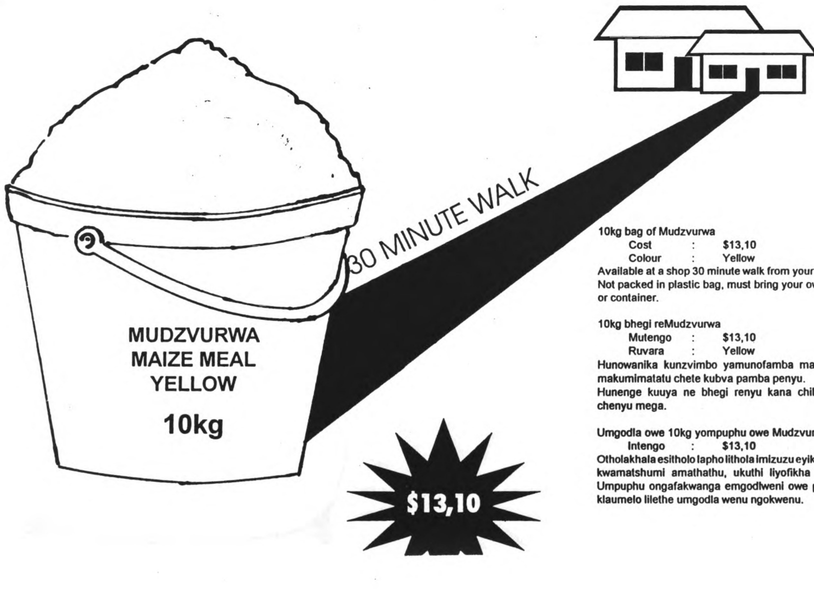
Card 4

10kg bag of Roller meal
    Cost : $21,80
    Colour : Yellow
Available at a shop 5 minute walk from your home.
Not packed in plastic; must bring your own bag or container.

Hupfu hwe Roller Meal hwemu bhegi re10kg
    Mutengo : $21,80
    Ruvara : Yellow
Hunowanika kunzvimbo yamunofamba maminitsi mashanu chete kubva pamba penyu.
Husina kuiswa muplastic munotofanirwa kuuya nechihomwe chenyu chekuisira kubva kumba?

Umgodla owe 10kg yompuphu owe Roller meal
    Intengo : $21,80
    Umbala : Yellow
Otholakhala esitholo lapho lithola imizuzu eyikhwana emihlanu ukuthi liyofikha khona.
Umpuphu ongafakangwa emgodlweni oweplastic khumele lilethe.

Card 5

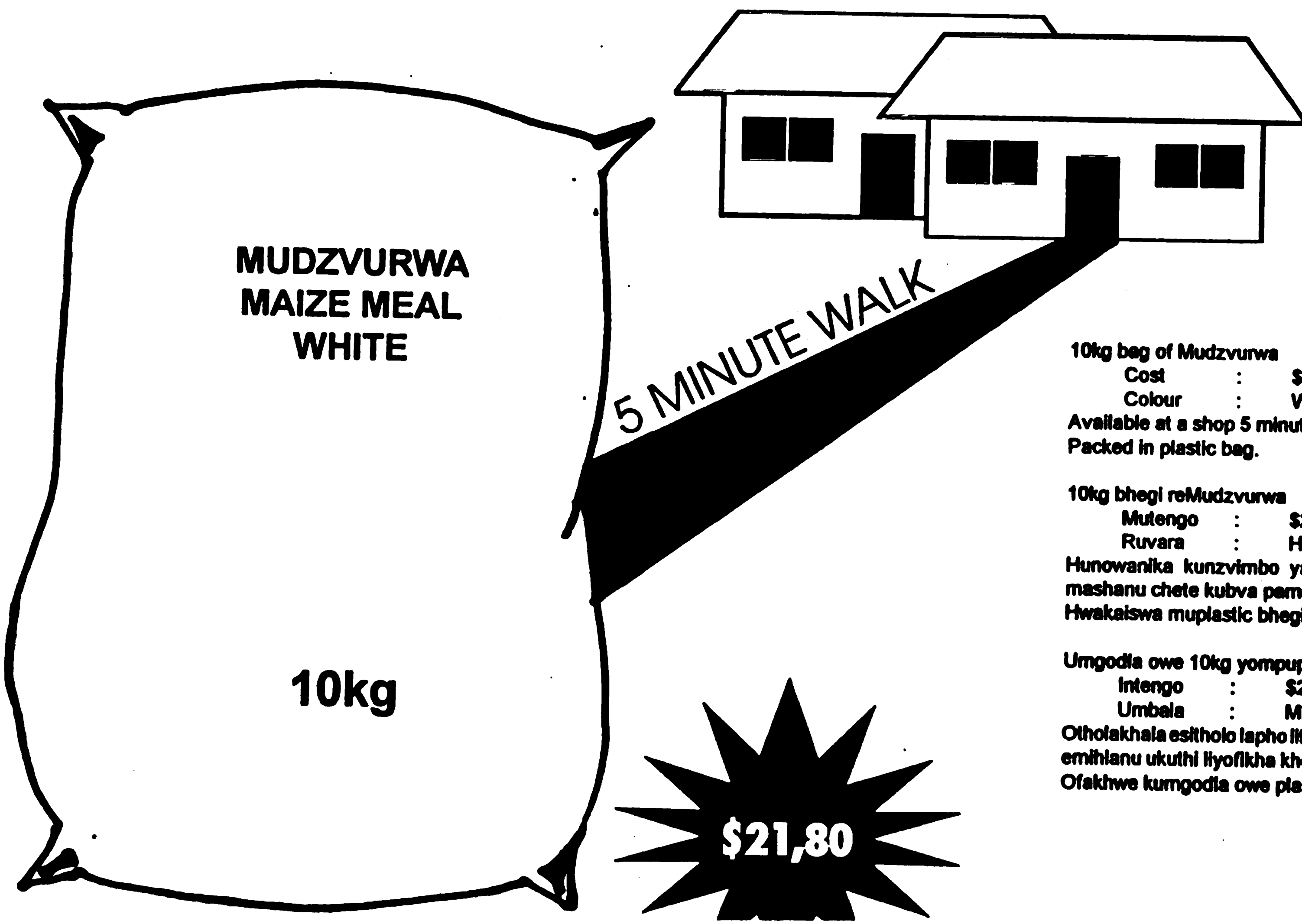


10kg bag of Mudzvurwa
Cost : $13,10
Colour : Yellow
Available at a shop 30 minute walk from your home. Not packed in plastic bag, must bring your own bag or container.

10kg bhegi reMudzvurwa
Mutengo : $13,10
Ruvara : Yellow
Hunowanika kunzvimbo yamunofamba maminitsi makumimatatu chete kubva pamba penyu.
Hunenge kuuya ne bhegi renyu kana chihomwe chenyu mega.

Umgodla owe 10kg yompuphu owe Mudzvurwa
Intengo : $13,10
Otholakhala esitholo lapho lithola imizuzu eyikhwana kwamatshumi amathathu, ukuthi liyofikha khona Umpuphu ongafakwanga emgodlweni owe plastic, klaumelo lilethe umgodla wenu ngokwenu.

Card 6



10kg bag of Mudzvurwa

Cost	:	$21,80
Colour	:	White

Available at a shop 5 minute walk from your home.
Packed in plastic bag.

10kg bhegi reMudzvurwa

Mutengo	:	$21,80
Ruvara	:	Huchena

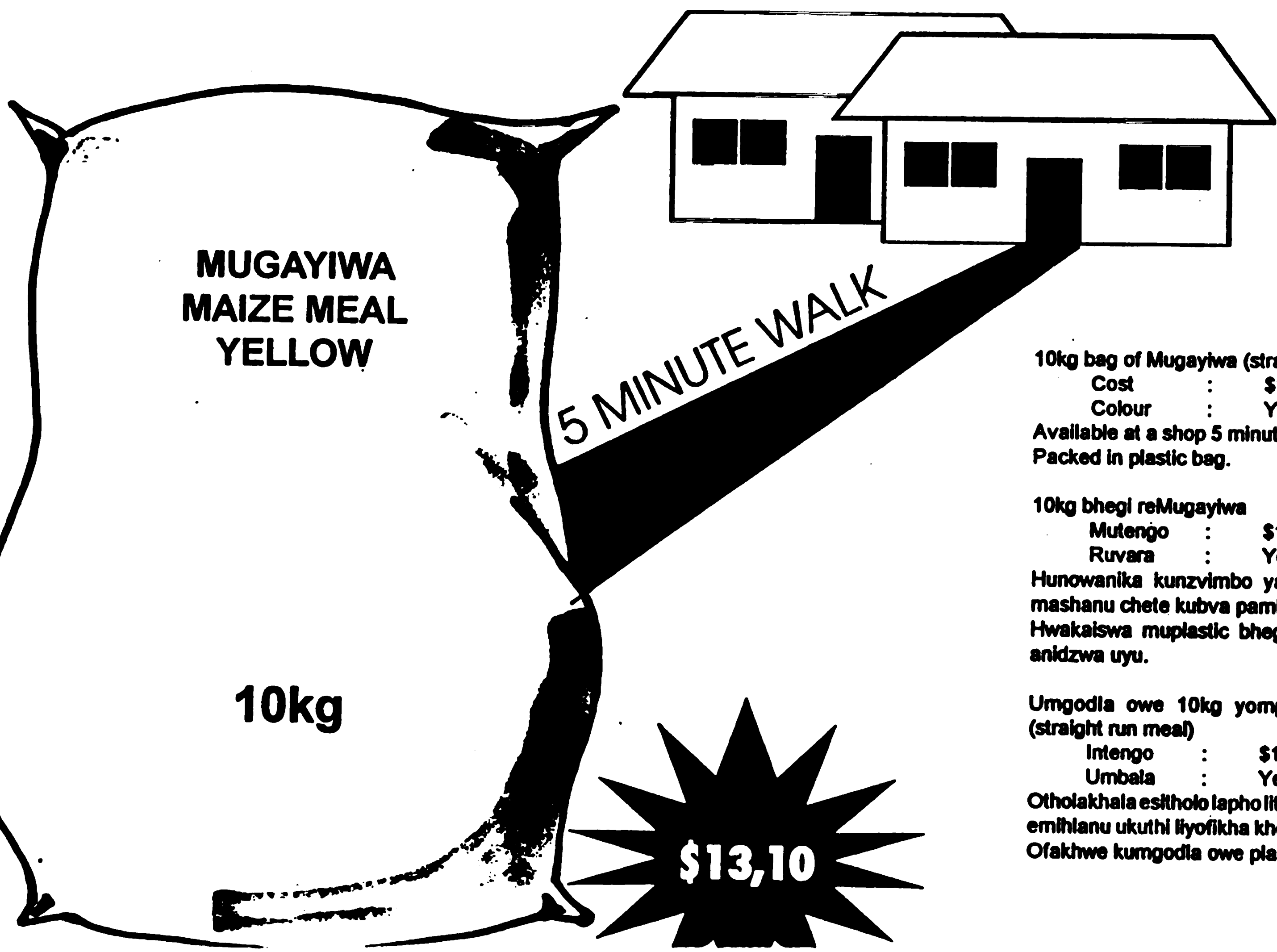
Hunowanika kunzvimbo yamunofamba maminitsi mashanu chete kubva pamba penyu.
Hwakaiswa muplastic bhegi.

Umgodla owe 10kg yompuphu owe Mudzvurwa

Intengo	:	$21,80
Umbala	:	Mhlophe

Otholakhala esitholo lapho lithola imizuzu eyikhwana emihlanu ukuthi liyofikha khona.
Ofakhwe kumgodla owe plastic.

Card 7



10kg bag of Mugayiwa (straight-run meal)

Cost : $13,10
Colour : Yellow

Available at a shop 5 minute walk from your home.
Packed in plastic bag.

10kg bhegi reMugayiwa

Mutengo : $13,10
Ruvara : Yellow

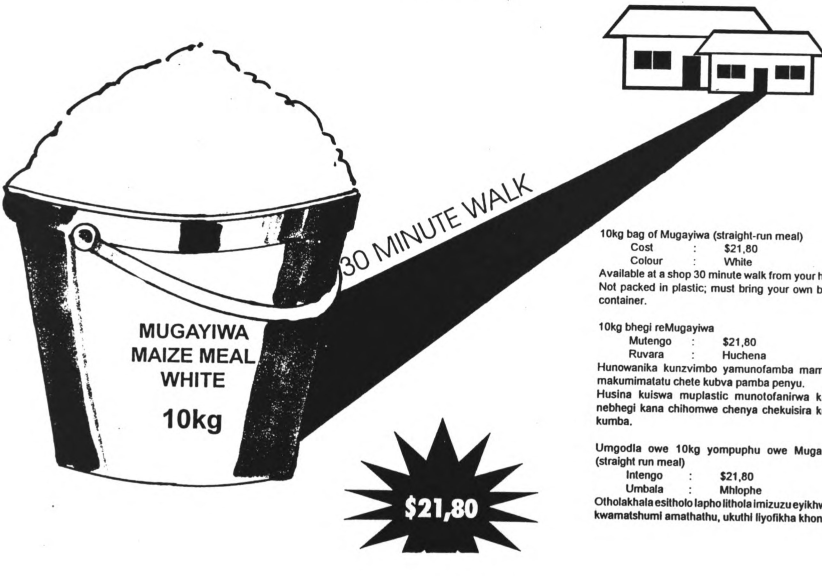
Hunowanika kunzvimbo yamunofamba maminitsi mashanu chete kubva pamba penyu.
Hwakaiswa muplastic bhegi.Munofungei nehubatanidzwa uyu.

Umgodla owe 10kg yompuphu owe Mugayiwa (straight run meal)

Intengo : $13,10
Umbala : Yellow

Otholakhala esitholo lapho lithola imizuzu eyikhwana emihlanu ukuthi liyofikha khona.
Ofakhwe kumgodla owe plastic.

Card 8



10kg bag of Mugayiwa (straight-run meal)

Cost	:	$21,80
Colour	:	White

Available at a shop 30 minute walk from your home. Not packed in plastic; must bring your own bag or container.

10kg bhegi reMugayiwa

Mutengo	:	$21,80
Ruvara	:	Huchena

Hunowanika kunzvimbo yamunofamba maminitsi makumimatatu chete kubva pamba penyu.
Husina kuiswa muplastic munotofanirwa kuuya nebhegi kana chihomwe chenya chekuisira kubva kumba.

Umgodla owe 10kg yompuphu owe Mugayiwa (straight run meal)

Intengo	:	$21,80
Umbala	:	Mhlophe

Otholakhala esitholo lapho lithola imizuzu eyikhwana kwamatshumi amathathu, ukuthi liyofikha khona.

MICHIGAN STATE UNIV. LIBRARIES
31293010240129