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The Economics of Smallholder Maize Production in Zimbabwe: Implications for Food Security

by

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THE ECONOMICS OF SMALLHOLDER MAIZE PRODUCTION IN ZIMBABWE: IMPLICATIONS FOR FOOD SECURITY

by

David D. Rohrbach

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IMPLICATIONS FOR FOOD SECURITY

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

PREFACE

The research discussed in this paper is one of many accomplishments that has resulted from a long-term collaborative research project between the Faculty of Agriculture of the University of Zimbabwe (UZ) and the Department of Agricultural Economics of the Michigan State University (MSU). The project has been financed by the United States Agency for International Development.

Dr. Rohrbach initially worked in Zimbabwe from August 1985 through March 1987 as a research associate under the collaborative UZ/MSU project. After completing his Ph.D. in agricultural economics at Michigan State University, he accepted a position with the International Food Policy Research Institute (IFPRI) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) based, again, in Zimbabwe. His current scope of work covers the Southern African Development Coordination Conference (SADCC) region. Readers interested in the topics covered in this paper are encouraged to write directly to Dr. Rohrbach (SADCC/ICRISAT, P.O. Box 776, Bulawayo, Zimbabwe) or to Dr. Michael Weber (Department of Agricultural Economics, Michigan State University, East Lansing, MI 48824-1039).

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THE ECONOMICS OF SMALLHOLDER MAIZE PRODUCTION IN ZIMBABWE: IMPLICATIONS FOR FOOD SECURITY

By

David D. Rohrbach

I. INTRODUCTION

Rapid growth in food production is essential to attain food security in Sub-Saharan Africa. Since 1970, African food production has been growing at roughly half the rate of growth of population. African food security strategies have primarily sought to increase per capita production levels. National food and agricultural policies have emphasized food self-sufficiency goals. Issues of household level food access have received secondary attention under the assumption that consumption deficits can only be resolved after adequate and stable supplies are assured.

Yet high, and even increasing national food supplies, however important, do not necessarily ensure food for all households or individuals in need.[1] Large segments of the population in many countries attaining high levels of per capita food supply still do not have reliable or nutritionally adequate food access. The most visible groups encompass the urban poor. But in many countries, the largest number of food insecure households reside in the rural areas. Farmers contributing to aggregate production growth have not necessarily been those suffering the greatest food security constraints. In many cases, supplementary strategies, in addition to increasing national food supplies, are required to extend food production and income gains to a majority of food insecure households.

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[1]See Sen (1984), World Bank (1986), Rukuni and Eicher (1987).

This study examines the relationship between food availability and food access in the context of the rapid post-1979 growth of smallholder maize production in Zimbabwe. The analysis is structured to answer three broad questions. It first assesses why smallholder maize production increased so rapidly and whether this growth is likely to continue. Second, it examines the distribution of the production gains and explains differential levels of participation. Third, the study evaluates how much national and household food security in Zimbabwe have improved. Finally, options are reviewed for further improving smallholder food availability and food access.

A. The Policy Context

Between 1977-79 and 1985, cereal production in Zimbabwe increased by 80 percent.[2] The production of maize, the country's principal cereal staple[3], more than doubled. Following the 1986 harvests, Zimbabwe held 1.8 million MT of maize in national stocks, 3.5 times the highest level achieved during the 1970s and almost three times the average annual level of grain marketing board sales for domestic consumption. As a result, following the 1986/87 drought, the government could mount a large domestic food for work program while still exporting approximately 500,000 MT of maize to other countries in the region. At the beginning of the 1988 harvest, Zimbabwe still held maize stocks equal to more than one year of domestic sales.

More importantly, the largest share of maize production gains were contributed by smallholders. These farmers had previously participated only marginally in producing maize for the market. During the 1970s, 5,000 to 6,000 large-scale commercial farmers delivered over 90 percent of the maize sold in formal sector markets. Approximately 750,000 smallholders[4]

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[2]See Appendix Table A.1. The sources of the major agricultural sector data employed in this analysis are in Appendix A.

[3]Maize accounts for 70 percent of the cereal calories in the average diet (UNFAO, 1981).

[4]Smallholders were identified before independence in 1980 as Tribal Trust Land (TTL) farmers and thereafter as communal farmers. In this paper, the terms smallholder and communal farmer are used interchangeably. Unless otherwise specified, the term commercial refers to the combined large and small-scale commercial sectors.

contributed five percent and 8,000 small-scale commercial farmers marketed the remaining five percent.

While commercial maize production increased by two-thirds, between 1979 and 1985, smallholder production more than tripled. Smallholders began harvesting over 50 percent of the nation's maize and delivering over one-third of the maize entering formal markets. These sales contributed substantially to the growth of national maize stocks. Despite the increase in smallholder maize sales, per capita smallholder maize retentions (for home consumption) rose almost 15 percent above the highest levels achieved during the 1970s.

For the first time, smallholders were recognized as an integral part of the national agricultural economy. In the 1986-90 five year development plan (MFEDP, 1986), smallholder crop production was optimistically projected to grow at an eight percent average annual rate. In order to reduce the national maize stocks, the government announced a discriminatory producer price policy designed to limit commercial production.[5] While this policy was later withdrawn[6], the simple announcement of the disincentive was adequate to cause a 50 percent reduction in maize area planted by the large-scale commercial farm sector. By contrast, smallholder maize area remained roughly constant. Smallholders had effectively been granted primary responsibility for the production and supply of the nation's main staple.

B. Smallholder Production and Food Security

This investigation traces the implications of the growth of smallholder maize production for food security in Zimbabwe. In the process, the analysis highlights an important distinction between food security at the national and household levels. Food security ultimately requires that "all individuals in a population possess the resources to assure access to enough food for an active and healthy life" (Weber and Jayne, 1988). This assumes adequate supplies of food are available for all individuals (food availability) and that all people have the ability to secure their food requirements (food

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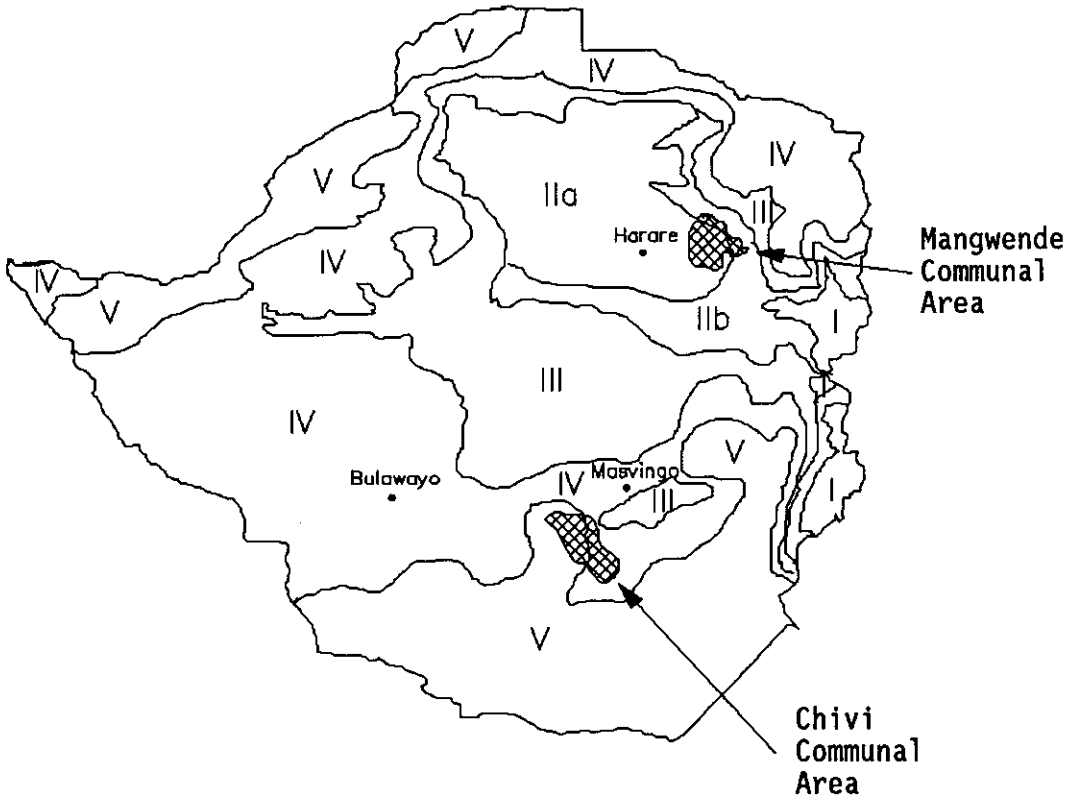
[5]In late 1986, the Zimbabwe government announced a pre-planting producer price cut of 35 percent for deliveries greater than 91 MT plus one-half each farmers' previous year's sales.

[6]Due to the severity of the 1986/87 drought.

farm surveys conducted in the smallholder sector was investigated. In view of the lack of detailed information on smallholder production and trade decision making, new surveys were planned in representative high and low rainfall regions of the country (Figure 1).



KEY TO NATURAL REGION CODES SHOWN ABOVE

I. SPECIALIZED AND DIVERSIFIED FARMING REGION
Production: forests, fruits, intensive livestock, planation crops
Rainfall: >900 mm/annum
Area: 7,000 sq km

II. INTENSIVE FARMING REGION
Production: intensive crop/livestock
Rainfall: 750-1,000 mm/annum
IIa Rainfall is reliable, infrequent drought
IIb Rainfall is less reliable, more severe dry spells, short rainy seasons
Area: 58,600 sq km

III. SEMI-INTENSIVE FARMING REGION
Production: livestock, fodder, cash crops Marginal for maize, tobacco, cotton
Rainfall: 650-800 mm/annum, severe midseason dry spells
Area: 72,900 sq km

IV. SEMI-EXTENSIVE FARMING REGION
Production: livestock, drought resistant crops
Rainfall: 450-650 mm/annum
Area: 147,800 sq km

V. EXTENSIVE FARMING REGION
Production: extensive cattle or game ranching
Rainfall: <650 mm/annum, too low/erratic for even drought resistant fodder, grain crops
Area: 104,400 sq km

Source: Whitsom Foundation, 1978.

FIGURE 1. MANGWENDE AND CHIVI SURVEY AREAS, ZIMBABWE

The survey encompassed six villages in Mangwende, a high potential smallholder farming region situated in the northeastern part of the country, and six villages in Chivi, a low potential smallholder farming region in south central Zimbabwe (Figure 1). Maize was the principal crop grown by all farmers in each area. Seventeen farmers were interviewed in each village for a total sample of 204 households.

Four major sets of interviews were conducted with each household covering the 1984/85 season (by recall), the 1985/86 season and the planting period for the 1986/87 season. Detailed information was collected on production practices, crop marketing, input and credit usage, incomes, major expenditures, crop storage and resource ownership. In addition, farmers were asked to recall major changes in their cropping patterns, technology use and marketing practices over the previous ten years. Interviews with input suppliers, transporters, crop buying agents and extension workers in each region provided additional insights on access to agricultural support services.[7]

D. Quality of Aggregate Production Data

The value of information obtained from the farm level surveys derives in part from questions regarding the accuracy of nationwide smallholder production estimates. While there seems little question that smallholder maize production increased significantly after 1979, published and unpublished statistics indicating the absolute size, location and timing of this gain can only be viewed as approximations.[8]

The magnitude of the potential error in the aggregate production data is indicated by comparing two 1985 estimates of national and provincial smallholder crop area and yield.[9] While the aggregate maize production

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[7]Further information about the survey composition and procedures can be obtained from Rohrbach (1987).

[8]These data were generally corroborated by the more accurate statistics for crop sales to the Grain Marketing Board. This parastatal acts as the sole buyer of maize moving beyond smallholder district boundaries. They are also supported by the results of farm level surveys.

[9]See Appendix Table A.3.

estimates for 1985 differ by only two percent, production estimates vary by more than 35 percent in five of Zimbabwe's eight provinces. Similar discrepancies characterize the provincial estimates of maize area and yield. Larger differences appear in the production estimates for more minor crops.

An additional problem is caused by the availability of multiple production estimates and difficulties in determining how the final official crop production estimates published by the Zimbabwe Central Statistical Office (CSO) are determined. The principal data used to compile these official estimates were reviewed.[10]

The use of official data is further complicated by the fact that these CSO estimates do not provide a complete breakdown of the production levels of each farm sector. Data on millet production, the second most important smallholder crop, remain unpublished.

Notwithstanding the above problems, the current analysis has generally employed the published national level CSO statistics. In the few circumstances where disaggregated statistics have been required, the original sources of CSO estimates are utilized. Aggregate millet production estimates were drawn from the FAO (1987) production tapes.

E. Chapter Overview

First, the 1970-1986 trends in Zimbabwe's maize production, sales, stocks and trade are briefly reviewed. Next, the major sources of growth in smallholder maize production are identified. Discussion of the food security implications of these findings begins with an assessment of the distribution of smallholder participation in the maize production and sales gains, and a review of factors helping explain this distribution. The food security gains are then more directly examined with a review of the benefits offered smallholders facing production and consumption deficits. Finally, the challenges facing Zimbabwe to further improve national and household food security are examined.

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[10]The principal historical source of smallholder production data has been the forecasts of extension workers. Beginning in 1985, these were supplemented by Central Statistical Office surveys. These estimates are reviewed and sometimes modified by a Central Statistical Office Crop Forecasting Committee.

II. TRENDS IN SMALLHOLDER MAIZE PRODUCTION AND MARKETING: 1970-1986

This chapter briefly examines the aggregate trends in commercial and smallholder maize production and market deliveries, and reviews the impact of these trends on national food supplies from 1970-1986. It assesses the breadth of smallholder participation in the growth of sector-wide production.

A. Maize Production Trends

Zimbabwe's maize production trends are characterized by a) extreme variability primarily associated with the incidence of mid-season dry spells and drought; b) declining harvests during the mid to late 1970s, followed by a sharp increase in production to record levels; c) a rising smallholder sector contribution to national production, particularly after 1979. Disaggregation of the commercial and smallholder production trends shows each farm sector had a unique maize supply response function (Figure 2). The differences in the respective trends merit comment.

During the 1970s, maize production in Zimbabwe reached record levels followed by a decline in output as the independence war intensified. In 1972, national maize production was over 2.3 million metric tons, more than twice the average level of production during the 1960s. Three-quarters of this was harvested by commercial farmers. While smallholders planted two-thirds of Zimbabwe's maize area (Figure 3), yields were only 16 percent of commercial sector levels (Figure 4).

Between 1972 and 1979, maize production declined at an average annual rate of ten percent. Commercial maize production declined by more than 55 percent as a result of a 35 percent decline in crop area and 30 percent decline in yields. In contrast, smallholder or communal maize production remained essentially stagnant.

Between 1979 and 1984, both commercial and communal production first sharply increased to record levels, then declined sharply during the 1982-84 drought. By 1981, commercial farmers had regained the levels of production achieved nine years previous. Commercial maize area had increased by

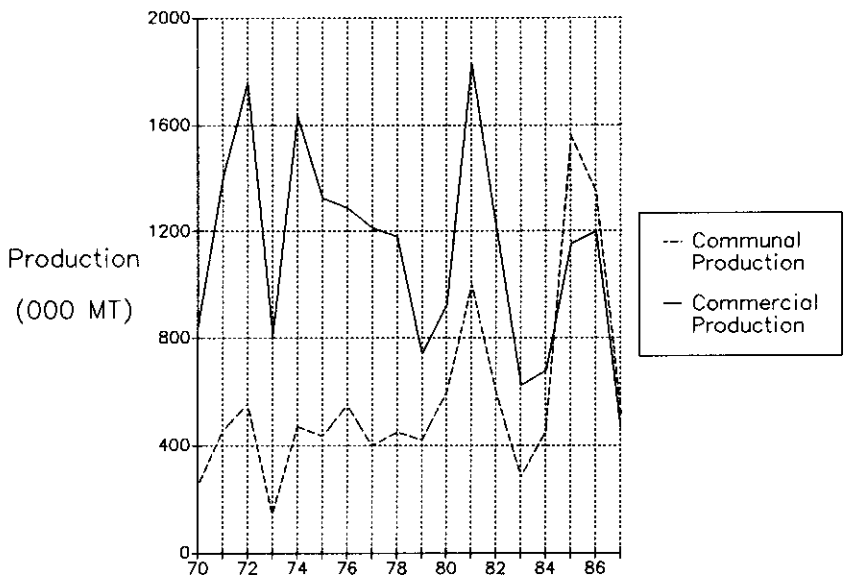

Figure 2. Zimbabwe Maize Production, 1970-1987

more than 50 percent. Commercial maize yields rose to their highest level since 1974. During the same two-year period, both communal maize area and yields reached record levels. Communal maize area increased almost 70 percent and communal maize yields increased almost 50 percent. As a result, smallholder maize production stood 80 percent above the largest estimated harvests of the 1970s. Smallholders maize yields remained only one-fifth of commercial levels, but these farmers were now responsible for over one-third of national maize production.

During the 1982-84 drought, commercial production declined to one-third of its 1981 record, in part, due to a 55 percent decline in maize yields. In addition, commercial maize area declined by almost 40 percent. Communal maize production similarly declined by more than 70 percent, largely as a result of a decline in crop yields.

Favorable rains in 1985 lifted commercial maize production back to levels achieved in 1978. The rebound in yields was not adequate to offset the sharp post-1981 decline in area planted. As a result, output remained 40 percent below 1981 levels. In contrast, smallholder maize production continued its

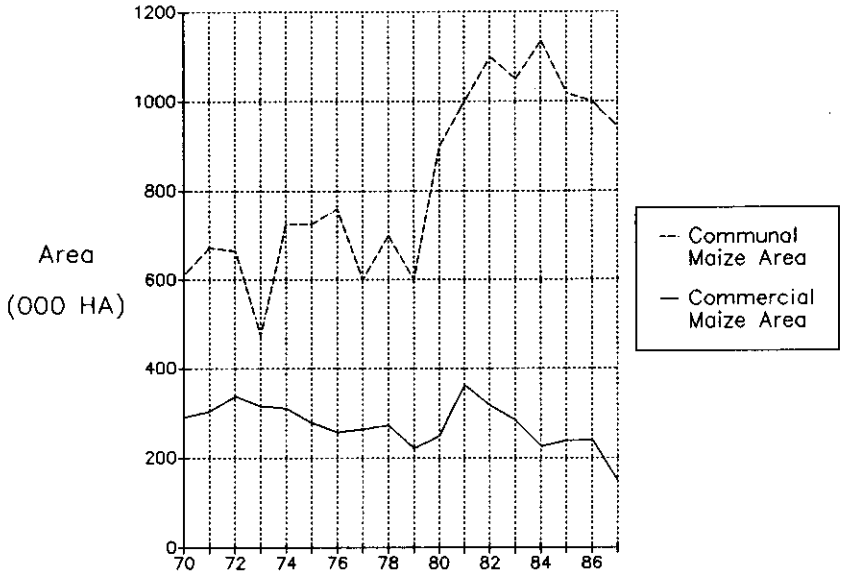

Figure 3. Zimbabwe Maize Area by Farm Sector, 1970-1987

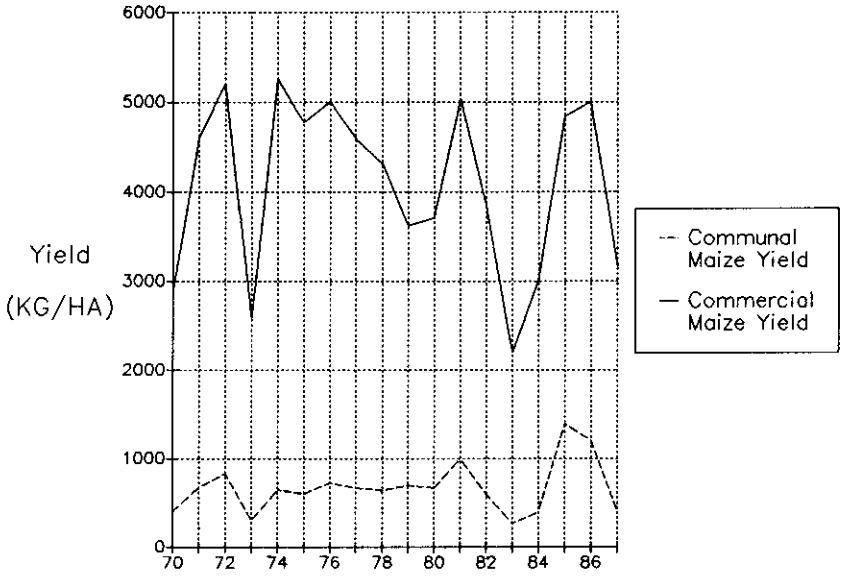

Figure 4. Zimbabwe Maize Yields by Farm Sector, 1970-1987

post-independence climb as estimated yields again increased to record levels. Total small farm maize production increased an additional 55 percent above 1981 levels, rising above commercial output for the first time. Smallholder now harvested almost 60 percent of Zimbabwe's total maize output.

In effect, the post-1979 surge in smallholder production transformed the communal sector from a relatively minor participant in the national maize economy to the principal source of national production growth. Small farm maize area had almost doubled and small farm maize yields had more than doubled from their average levels during the 1970s. Meanwhile, commercial sector maize production declined. National maize production reached record levels on the strength of communal sector gains. Government recognition of these advances in smallholder productivity led to a 1986 announcement of discriminatory producer prices designed to promote a further shift in commercial farmland out of maize.

B. Trends in Maize Sales

The communal and commercial sector maize production trends are reflected in their crop deliveries to the Grain Marketing Board[1] (Figure 5). During the 1970s, commercial farmers sold 70-75 percent of their production to the GMB, retaining the balance for animal feed and food for hired workers. After independence, commercial sector retentions declined as a result of an increase in real maize prices and imposition of a minimum wage for farm labor[2]. Deliveries reached record levels in 1981, but declined marginally through the full 1972 to 1986 period.

Until independence, communal maize sales averaged less than five percent of GMB intake. By the 1980 harvests, only three percent of smallholders were

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[1]The GMB legally acts as the sole buyer of all maize sold by the commercial sector and maize sold beyond communal land borders in the smallholder sector. A guaranteed producer price, set by cabinet, applies to maize, as graded, at each GMB delivery point. Transport to the GMB depots is provided, except under unusual circumstances, by the private sector at competitive prices. In several recent years when sales have been large, the government has provided farm-to-market transport assistance for late season deliveries.

[2]Some large-scale commercial farmers stopped giving their workers a maize ration when they were required to pay a minimum wage.

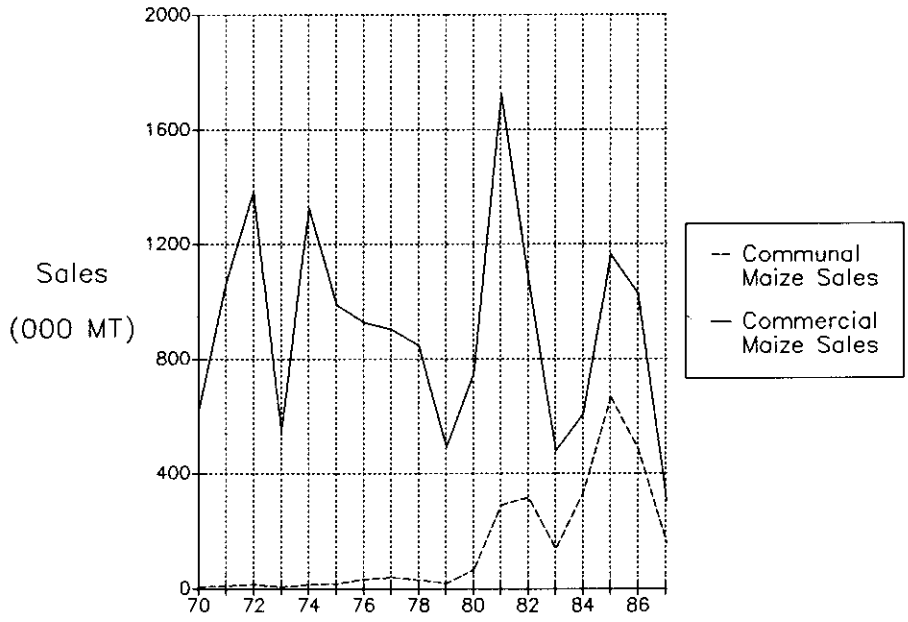

Figure 5. Zimbabwe Maize Sales by Farm Sector, 1970-1986

registered to sell crops directly to the marketing board. Sales by non-registered farmers could still be made through a limited number of cooperatives and GMB Approved Buyers. However, most such deliveries were small. Roughly 95 percent of smallholder production was retained for home consumption or localized inter-household sales.

Smallholder deliveries increased sharply with the growth of production levels after independence. By 1981, sales had increased ten times above the sector's average delivery levels during the 1970s. Despite the incidence of drought, smallholder maize sales continued increasing in 1982 and 1984. By 1985 smallholder sales had again more than doubled. Over one-quarter of all smallholders were now registered to sell crops directly to the GMB. These farmers now provided over one-third of the parastatal's maize intake.

Approximately 40 percent of smallholder maize production was sold in formal markets in 1985. In six years, communal maize sales had increased almost 35-fold, raising real small farm gross earnings from Z$1.2 million to

over Z$63.6 million.[3] Remarkably, at the same time, residual estimates of per capita smallholder retentions also increased to their highest level in more than 15 years.[4]

C. Maize Stocks

The growth in smallholder maize sales corresponded with a substantial increase GMB maize stocks (Figure 6). During the 1970s, the GMB's carry-over averaged 290 thousand metric tons or two-thirds the average level of domestic marketing board sales. GMB stocks peaked in 1977. By 1986, GMB stocks had increased to almost two million metric tons. This was almost three times the average level of GMB sales for domestic consumption. Because guaranteed producer prices were generally well above world market prices, exports were sold at a loss. The GMB found itself subsidizing export sales while incurring large and mounting domestic storage costs.

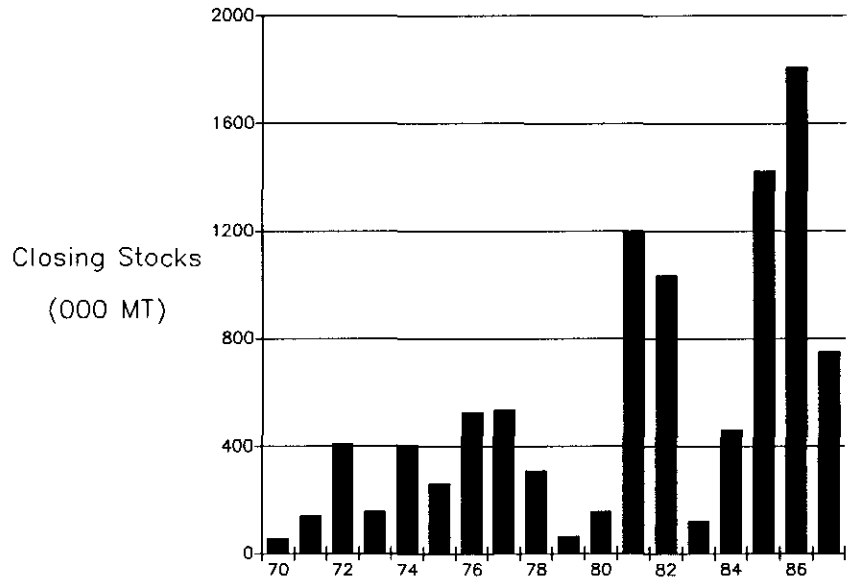

Figure 6. Zimbabwe Grain Marketing Board Maize Stocks, 1970-1987

[3]In 1980 dollars.

[4]An estimate of smallholder retentions was derived from the difference between official estimates of production and maize sales to the GMB.

The government responded to the buildup of maize stocks by announcing a reduction in official producer prices at the beginning of the 1986/87 cropping season. A guaranted price of Z$180 per metric ton was offered for the first 91 metric tons delivered plus one-half the level of each farmer's previous year's sales. Any additional maize would be priced at Z$80 per ton. This delivery quota effectively applied only to commercial farmers because virtually all smallholders produce less than the 91 metric ton limit.

The discriminatory price policy was later withdrawn due to the incidence of a severe nationwide drought. Yet the preplanting announcement was enough to stimulate a 50 percent reduction in large-scale commercial sector maize plantings. This carried over into the 1987/88 production season. Smallholder maize plantings declined only marginally.

Despite the drought, the GMB's maize stocks remained adequate to support 500,000 metric tons of exports during the 1987/88 marketing year. More than one-third of Zimbabwe's smallholders received drought relief assistance. Nevertheless, just prior to the 1988 harvest, the GMB still held enough maize to support an average year of domestic sales.

D. Location of Maize Growth

To begin evaluating the implications of these gains for household food security, it is necessary to examine which farmers participated in this success story. A provincial level breakdown of production trends provides an initial basis for this assessment.

Maize is the most important smallholder crop, in terms of area planted, in seven of Zimbabwe's eight provinces and in 80 percent of the nation's 163 communal farming areas (AGRITEX, various years). Between the 1977/78 and 1984/85 cropping seasons,[5] smallholder maize area increased in seven provinces (Table 1). The largest increases in maize area were in the higher rainfall regions of the country. Farmers in all eight provinces registered increases in average maize yields. Per hectare output more than doubled in four provinces, unexpectedly including three of the drier provinces in the country. As a result, smallholder maize production at least doubled in every province.

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[5]Both were relatively good rainfall seasons.

Table 1

Zimbabwe: Location of Growth of Smallholder Maize Production By Province, 1977/78 to 1984/85

Province	Percentage Increase in Maize			Proportion of Total Production
	Area	Yield	Production	
Midlands	27	249	342	30
Mashonaland East	96	77	246	15
Manicaland	99	26	130	14
Mashonaland West	146	35	230	13
Masvingo	-3	153	146	13
Mashonaland Central	83	87	243	10
Matabeleland North	23	182	223	3
Matabeleland South	2	117	142	3

Source: AGRITEX, various years.

Roughly two-thirds of the increase in production, since the late 1970s, was sold to the GMB. The remaining one-third was retained for local consumption. The largest absolute gains in both production and sales were in higher rainfall regions of the country. Nonetheless, farmers in all eight provinces experienced substantial production and market gains. Per capita maize retentions similarly appear to have increased throughout the communal farming areas.

E. Smallholder Crop Substitution

To infer consumption gains from these production trends we must assess the degree to which maize replaced the calories supplied by other crops. A review of limited evidence of crop area changes suggests that widespread substitution did not take place (Table 2). The largest increase in maize plantings was between 1979 and 1981. Data available for smallholder crop area in 1977/78 and 1980/81 indicate a 65 percent increase in total maize area. During the same period, estimates of the smallholder area planted to sorghum, a crop expected to be a close maize substitute, increased 65 percent. Groundnut crop area also increased. While both bulrush and finger millet area

Table 2

Zimbabwe: Smallholder Crop Area Trends 1977-1984
('000 Hectares)

Crop	1977/78	1980/81	1984/85
Maize	660	1086	1160
Bulrush millet	497(a)	401	303
Groundnuts	224	243	149
Finger millet	141(a)	118	154
Sorghum	129	214	247
Cotton	41	62	146
Sunflower	35(a)	24	31
Other	35(a)	61	28
TOTAL	1762	2209	2218

(a) Estimates based on data from Whitsun Foundation (1978) for 1976/77. Sunflower estimate does not include Manicaland Province.

Sources: AGRITEX, various years; Whitsun Foundation, 1978.

declined, these losses were small relative to the large aggregate gains in maize hecterage.

Limited provincial level data similarly show no consistent pattern of crop substitution. While maize appears to have been substituted for millet in some drier regions of the country, the increase in maize plantings was primarily associated with a 25 percent increase in total crop area. Since maize was the major grain staple, the largest proportion of new land was planted to this commodity.

F. Food Security Implications

The rough production estimates and market sales data currently available provide a reasonable basis for concluding that households experiencing chronic production deficits likely did not see their circumstances worsen.[6] For some,

[6]It is impossible to determine the extent of post-war improvements in household food security with much accuracy. The national database for the smallholder sector is insufficient to identify households with deficit consumption. While national consumption, health and income-expenditure

food availability probably improved. Production gains were widespread. Higher levels of regional supply increased the availability of maize in village markets. Further, the growth of smallholder incomes resulting particularly from the increase in formal sector sales increased local employment opportunities. Households not participating directly in the production gains probably faced lower food prices and greater income earning opportunities.

In spite of the likely reduction in chronic food insecurity, transitory food insecurity remains a major problem for Zimbabwe smallholders. The variability in national maize production levels has increased with the growth of smallholder maize production.[7] Zimbabwe faces some of the largest fluctuations in cereal grain production of any country in Africa. The government has responded by maintaining large and increasingly expensive maize stocks and by expanding its drought relief programs. In regions of severe production shortfall, farm families are provided food for work, and in some cases the cash with which to purchase food. While such programs prevent starvation, they do not prevent the severe dislocation associated with the selling off of farm assets and migration. Even with continuing growth in maize output, it appears that domestic drought relief programs will remain an important aspect of national food security strategies in the foreseeable future.

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surveys have recently been conducted, these do not provide a historical perspective. At the time of this investigation, these Central Statistical Office surveys had not yet been analyzed.

[7]The coefficient of variation for aggregate maize production over the 1970 to 1987 period is 0.36. Over the 1970 to 1979 period the coefficient of variation was 0.27.

III. SOURCES OF GROWTH OF SMALLHOLDER PRODUCTION AND SALES

The growth of smallholder maize production since the ending of the war in 1979 can largely be attributed to the rapid expansion of government and private sector support for smallholders after independence. The termination of the war provided an initial impetus to production. This was reinforced by major investments in market infrastructure, the expansion of a new smallholder credit program, improved extension assistance and higher maize prices. Rising farmgate prices and net maize profitability helped stimulate the expansion of crop area. The availability of improved technologies, derived from over forty years of agricultural research, provided the means to improve maize productivity. The purpose of this chapter is to review the contribution of these changes in institutions, technologies and prices to the growth of smallholder maize production.

A. Pre-Independence

Before independence in 1980, agricultural policy was largely geared toward meeting the needs of the large-scale commercial farmers. For example, by 1975, only one Grain Marketing Board depot had been established in the smallholder farming areas. At independence, only three of 34 GMB depots directly served small farmers. Input suppliers principally responded to large farm demand and made little effort to promote input sales in the communal areas. The national agricultural research service operated under the assumption that most of its work was scale neutral and agroecological zone rather than farm sector specific. Yet most technology testing was conducted in higher rainfall regions under conditions similar to large farm practices. While extension support was provided smallholders, this often represented a means of administrative control as much as a source of agricultural advice. In some regions, farmers explicitly ignored extension advice as a result of this tie. Also, smallholder extension programs emphasized training of the 'best' farmers for ownership of freehold small-scale commercial farms. A small credit program was developed for communal and small-scale commercial farmers in 1958. In practice, however, most loans were distributed to the

commercial farmers. A major objective of the independence war was the removal of this system of discrimination favoring large farmers.

B. Ending of the War

Only rough estimates are available of the magnitude of dislocation caused by the war. Data compiled for a refugee resettlement program run by AGRITEX in 1980 indicate almost one-third of communal families required post-war resettlement assistance (AGRITEX, 1980). Survey results[1] and inquiries of farm leaders in each survey region suggest this estimate may be high.[2] Yet the disruption of smallholder agriculture caused by the war was broader than the resettlement figures indicate. In areas of consistent fighting, families were moved into government camps. In regions of intermittent violence, farmers simply began to abandon distant fields. Toward the end of the war, when the probability of victory improved, enlistment in the guerrilla armies expanded. When men went off to war, women continued farming operations on smaller crop areas. This loss does not appear in the aggregate sector-wide production figures, probably because the extension workers responsible for making crop production estimates had been withdrawn from areas experiencing instability.

After the war, farmers returned to their holdings, abandoned fields were replanted and new fields were established. Young couples took advantage of the termination of rural violence to move off their parents holdings, and establish independent farmsteads. New holdings were also created by families seeking to expand their acreage and obtain better land. Farmers who did not move, replanted fields abandoned during the war and sought additional land allocations. Much of this expansion in crop area resulted from the cultivation of lands previously set aside for grazing.

The increase in both the number of holdings and in holding size helps explain why the maize area expanded in the context of an increase in total crop area. Since maize was the basic food staple in most parts of the

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[1]For Mangwende and Chibi Communal Areas.

[2]For example, refugee program estimates indicate over one-half of all Chibi households had to be resettled after the war. Chibi farmers and community leaders claimed refugee resettlement was limited.

country, the increase in area allocated to this crop was larger than the gain in area allocated to its alternatives. Survey results show 71 percent of Mangwende's increase in maize area, between 1975 and 1981, resulted from an increase in the number of households and 29 percent of the gain resulted from an increase in area per established household. In Chivi, 86 percent of the increase in maize area resulted from an increase in the number of farm households.

In contrast to national trends, Mangwende and Chivi farmers claimed crop area expansion continued after 1981. In the high potential region, most of this gain resulted from an increase in the average area cultivated by existing households. In low rainfall Chivi, most area growth continued to be associated with population gains.

C. Relative Maize Prices

Farmers take account of four major sets of prices when deciding on the quantity of land to plant to maize and the quantity of inputs to purchase: real maize producer prices, the relative producer price of maize in comparison with producer prices for substitute crops, the producer-to-input price ratio and the producer-to-consumer price ratio. The effect of each of these prices is examined.

1. Real Producer Prices

Between 1979 and 1981, real maize prices, deflated by the GDP deflator, increased by 60 percent (Figure 7). During this period, as noted above, smallholder maize area increased by more than 65 percent. Smallholder maize sales to the GMB rose fifteenfold. Commercial maize area similarly increased by almost 50 percent and commercial sales increased by 250 percent.

Between 1981 and 1983, real maize prices declined by 25 percent, although by 1985 they had recovered two-thirds of this loss. In response, commercial maize area and maize sales declined by almost 25 and 35 percent respectively. In contrast, aggregate estimates indicate communal maize area remained essentially unchanged. Yield gains lifted smallholder maize production by 65 percent between 1981 and 1985. Smallholder maize sales to the GMB increased

an additional 130 percent during the period. Communal production and marketings were growing despite the drop in real producer prices.

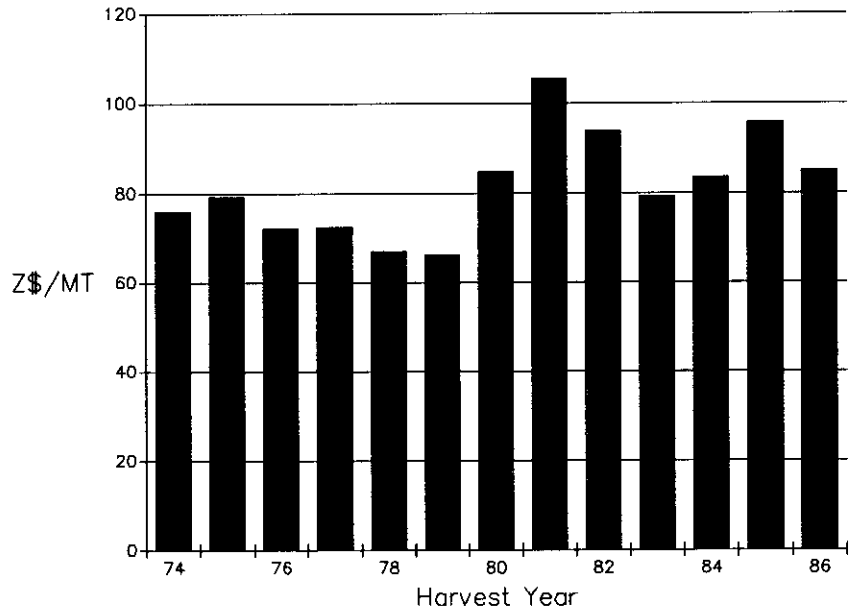

Figure 7. Zimbabwe: Real Maize Producer Prices, 1974-1986

2. Relative Producer Prices

There is limited evidence of price induced crop substitution in aggregate and provincial smallholder data for the 1979 to 1985 period. Between 1979 and 1981, when maize acreage is estimated to have increased the most, the largest shift in relative crop prices was reflected in the maize-to-cotton price ratio. This increased almost 75 percent. Yet smallholder cotton plantings almost tripled during this period. The maize-to-sorghum price ratio increased by 40 percent and sorghum area was estimated to have increased by 150 percent. The maize-to-groundnut price increased 60 percent, but groundnut area increased an estimated 25 percent.

The only significant decline in area came in the two major smallholder crops not purchased by the national marketing boards: finger millet and bulrush millet. Provincial level data does not indicate a consistent pattern of maize substitution for these crops, however. When the GMB began buying millet, in 1984, estimates of smallholder maize area remained unchanged.

The relatively sharp increase in maize prices, between 1979 and 1981, helps explain the relatively larger absolute gains in maize area. Nonetheless, the overall influence of relative producer prices for alternative smallholder crops appears to have been limited.

3. Producer-to-Consumer Price Ratio

The large increase in smallholder maize sales, between 1979 and 1981, has been attributed by several researchers to a sharp increase in the producer price relative to the consumer price of maize (Jansen, 1982; Buccola, 1987). Farmers were said to be selling maize normally retained for family consumption and later purchasing maize meal as required for consumption. During the period, the producer-to-consumer price ratio index more than doubled. Maize meal subsidies paid to millers increased from Z$1.9 million to Z$41.4 million (MFEDP, 1986). Consumer prices were sharply increased in 1982 and 1983 in order to reduce the size of maize subsidies. The producer-to-consumer price ratio then declined to levels only 10 percent above the 1970s average.

Yet there is no evidence in aggregate GMB sales data of a major increase in consumer purchases of maize or maize meal between 1979 and 1981. The 13 percent increase in GMB sales to the millers in 1980 can largely be explained by the 2.6 percent growth in formal sector employment and 11 percent real increase in national income (MFEDP, 1986; CSO, 1986). In 1981, the year of the largest increase in smallholder deliveries, GMB maize sales declined.

Survey evidence following the 1985 and 1986 harvests indicates smallholders pursue a consistent strategy of only selling maize in excess of family consumption requirements. While the producer-to-consumer price ratio had declined by this time, most farmers claimed to have followed this strategy throughout the post-independence period.

4. Producer-to-Input Price Ratios

Smallholder maize production levels may also have been influenced by the profitability of the enterprise as reflected in the ratio of the producer-to-input prices. The maize-to-fertilizer price ratio increased by 50 percent between 1979 and 1981. Fertilizer purchases more than tripled and average maize yields increased an estimated 23 percent. Although the maize-to-

fertilizer price ratio declined by 30 percent between 1981 and 1985, smallholder fertilizer purchases increased an additional 33 percent. Survey evidence indicates fertilizer purchases were more dependent on the availability of credit required to resolve a farm household capital constraint than the fertilizer price.

In summary, while the sharp increase in real producer prices may have helped stimulate production and market sales immediately after the war, the strength of this relationship appears limited. Other factors correlated with the price change probably contributed to the increase in production. These factors offset the impact of a decline in real producer prices after 1981.

D. Credit

Prior to 1978, smallholders had little access to formal agricultural credit. Private banks lent money to large-scale farmers. There were no rural moneylenders and only a few church groups provided small agricultural loans. A major new government small farm credit scheme was established on a pilot basis in 1978. By 1985, Agricultural Finance Corporation (AFC) credit reached approximately ten percent of small farmers (Table 3).

Table 3

Zimbabwe: Smallholder Credit Offered by the Agricultural Finance Corporation, 1979-1986

Cropping Season	Number of Loans	Value of Loans (Z$ million)
1979/80	2,850	0.48
1980/81	18,000	4.80
1981/82	30,150	9.05
1982/83	38,912	13.24
1983/84	50,000	25.29
1984/85	65,793	32.00
1985/86	77,526	38.90
1986/87	77,384	N/A

Source: AFC, various years.

Most AFC loans were for the purchase of designated input packages for a stipulated crop. All short term credit in the two survey areas was for maize. Farmers complained they could not obtain loans for other crops, though in parts of the country loans were granted for cotton and sorghum. The input packages included seed, fertilizer and insecticide. Repayment was made through a stoporder[3] on crop sales to the GMB. No payments were made to the farmer for crops sold to GMB depots and collection points until all loans were repaid.

In order to receive a loan, each farmer had to prove his or her ability to produce a marketable surplus by showing a history of previous sales. In regions without substantial marketings, potential credit recipients were identified with the help of local extension workers. In addition, farmers were required to be members of credit groups. As a result, the majority of credit recipients were based in high rainfall zones and owned relatively greater farm resources.[4]

E. Fertilizer and Seed Deliveries

Smallholder purchases of fertilizer and hybrid maize seed were relatively constant during the 1970s (Table 4). In 1980, sales of fertilizer more than tripled and sales of seed doubled. Roughly 60 percent of this increase in fertilizer sales and 30 percent of this increase in hybrid seed sales can be attributed to government funded distribution of free inputs under a one year refugee resettlement program. This program called for the free delivery of enterprise specific input packages and training in input use for farmers returning to the land.

Between 1980 and 1985, smallholder purchases of fertilizer increased an additional 45 percent and hybrid seed sales more than doubled. The growth in fertilizer deliveries corresponded with the growth in the number and size of smallholder loans granted by the AFC. While some small farmers were investing increasing amounts of their own resources in fertilizer, in parts of the

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[3]Before farmers were paid for crops sold directly to the GMB, loan repayments were automatically deducted.

[4]See Chapter four for a more detailed examination of this relationship.

Table 4

Zimbabwe: Hybrid Maize Seed and Fertilizer Deliveries to Smallholder Farmers, 1974-1985

Cropping Season	Fertilizer Deliveries (MT)	Seed Deliveries (MT)
1974/75	24,000	2,350
1975/76	19,000	3,950
1976/77	20,000	2,700
1977/78	25,000	3,700
1978/79	25,000	4,250
1979/80	27,000	4,300
1980/81	90,000	9,650
1981/82	96,000	13,950
1982/83	98,000	16,900
1983/84	106,000	17,300
1984/85	127,664	19,500
1985/86	130,000 (est)	20,250 (est)

Sources: Windmill, 1987; Seed Cooperative, 1987.

country, credit became the dominant source of investment capital. In Mangwende and Chivi, most fertilizer purchases were funded with credit and farmers were investing a declining proportion of their own cash in this input. By 1986, AFC loans funded 72 percent and 88 percent of total fertilizer purchases in Mangwende and Chivi respectively. Family cash resources were being invested largely in school fees and consumer goods.

F. Research and Extension

The adoption of improved technologies such as hybrid seed and fertilizer was made possible by large historical investments in agricultural research and extension. Before independence, research efforts were largely directed toward the needs of large-scale commercial farmers. Most research was conducted on experiment stations based in the high potential farming areas and adaptive trials were largely conducted on commercial farms. This orientation influenced the range of research issues considered and narrowed the applicability of resulting recommendations.

Nevertheless, certain research outputs were relevant to each of the farm sectors. One important example was the development of a series of maize hybrids. Seed sale records indicate smallholders widely adopted hybrid maize seed, particularly after independence. In 1979, an estimated 29 percent of smallholder maize area was planted to hybrids. This increased to approximately 70 percent of plantings by 1985. In the drier Chivi survey zone, virtually 100 percent of the farmers operating before 1980 claim to have adopted hybrid maize seed. According to farmers surveyed, improved seed represented a low cost input which provided higher yields, compared to open-pollinated varieties. The yield advantage, farmers said, was evident even without fertilizer and in years with poor rainfall. In Mangwende, 70 percent of farmers had adopted hybrid maize seed by 1980. Five years later, adoption was universal.

Fertilizer adoption and use has been concentrated in the nation's higher potential smallholder farming areas. In Chivi, only 17 percent of the farmers have tried fertilizer. Less than half this number consistently use the input. In Mangwende, almost all farmers have tried fertilizer, most initially testing the input before independence. In 1986, 80 percent of these farmers still used fertilizer, though most applied only small quantities. The minority of farmers applying fertilizer near recommended levels were credit recipients.

The adoption of recommendations governing the use of insecticide and herbicide has been more limited. Aggregate data on agrochemical sales to the smallholder sector are unavailable. Survey results indicate, however, that insecticide adoption and use for maize has been closely related to the receipt of this input in enterprise-specific credit packages. Before 1980, virtually no farmers in either area had tried maize insecticide.[5]

Herbicide testing has been linked with participation in post-independence research and agrochemical company extension trials. Twenty-two percent of Mangwende farmers tried herbicide by 1986. After the trials, however, adoption ended. No farmers continued using this input on their own. No herbicide trials were performed in Chivi and no farmers have tested this input.

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[5]Though smallholders were widely applying insecticide to grain in storage.

The relevance and adoption of technologies developed for communal sector enterprises other than maize and cotton has been limited. Recognizing this, the national research service attached greater priority to research geared specifically to smallholder needs after independence. This included the development of a large program of on-farm trials in the smallholder farming areas and expansion of research on more drought tolerant crops such as sorghum and sunflower. Thus far, there have been no direct returns to this investment. But a 10 to 15 year investment period may be required before significant payoffs appear.

During the war, agricultural extension agents were withdrawn from regions experiencing violence. In some areas, extension agent housing was destroyed in attacks against the Rhodesian government. After the war, these extension agents were replaced, provided with improved housing and granted subsidized loans for motor bikes. This increased the incentive to work in the rural areas and expanded extension worker mobility. New staff training programs were developed, and in 1986, regional extension officers initiated a program of on-farm technology verification and demonstration trials.

It is difficult to estimate the effects of these changes. The quality of local level extension support is still highly variable. Many recommendations, particularly those for semi-arid regions and secondary crops, remain of questionable appropriateness. Nevertheless, these services are improving.

G. Market Expansion

1. Product Markets

The number of communal area depots increased steadily after independence (Table 5). By 1986, 20 communal area depots had been established and by the end of 1988 the GMB plans to have created 66 depots. Most of the early depots were situated in high rainfall regions with the largest prospective maize sales. Since 1986, an increasing number of depots have been built in the semi-arid regions.

The GMB established a system of 135 temporary collection points in 1985 in order to expand market access further. Producers using these facilities were charged a nominal amount for transport from the collection point to the nearest depot. Ultimately, the Board planned to locate these buying points

Table 5

Zimbabwe: Expansion of Grain Marketing Board Buying Points, 1975-1986

Types of Buying Points	1975	1980	1981	1982	1983	1984	1985	1986
Commerical Depots	3	31	31	31	31	31	31	31
Communal Depots	1	3	6	10	12	13	14	20
Collection Points	0	0	0	0	0	0	135	56

Source: GMB (various years).

within 20 kilometers of each farmer. But the strong response to this infrastructure, particularly in regions more distant from major depots, created a concern that maize required for local consumption was being extracted from regions experiencing production shortfalls. In addition, the operation of collection points was costly. As a result, only 56 of these temporary facilities were opened in 1986 and only 17 were opened in 1987.

As product market facilities expanded, the number of small farmers registered to sell crops to the GMB increased (Table 6). At independence, only three percent of smallholders held GMB registration cards. Six years later, the proportion had increased to 37 percent. This included farmers who did not consistently use the depots or collection points. In 1986, roughly one-half of these farmers directly sold crops to the GMB.

Historically, communal producers have also been able to sell grain through cooperatives and GMB Approved Buyers. These purchasing agents are required to pay government set prices after deducting a small charge for handling and transport to the nearest depot. The actual level of this discount depends on the purchaser. The Approved Buyers are generally local shop keepers. Some pay for grain by establishing credit accounts for the purchase of goods from their stores. They also tend to price the grain at the lowest grade, regardless of quality. These practices cannot, however, be simply viewed as exploitative. The resulting margins help offset the risks of

Table 6

Zimbabwe: Number of Communal Farmers Registered to Sell Crops to the Grain Marketing Board, 1979-1986

Year	Farmers Registered	Percent Registered
1979	21,372	3
1980	23,914	3
1981	60,806	8
1982	121,508	15
1983	155,917	19
1984	176,311	22
1985	217,189	27
1986	295,981	37

Source: GMB Producer Registry, various years

spoilage during the limited holding period before delivery to the GMB depot. The reduced payments also compensate Approved Buyers for the extra costs associated with buying large numbers of small lots. Farmers complaining about the purchasing practices of these buyers also complained about high cooperative handling and transport cost deductions. Despite these constraints, the number of cooperative and Approved Buyer outlets similarly expanded rapidly after independence.

The causal relationship between the expansion of market infrastructure and production of maize surpluses likely worked in both directions. As markets expanded, increasing numbers of farmers began to view production of a surplus as profitable. This stimulated an expansion in production area and greater investment in improved technology. At the same time, the growth in maize sales prompted further expansion of market infrastructure. Additional depots were established in regions with larger sales. The number of transporters and private buying agents increased. In Mangwende, for example, the number of farm to market transporters serving survey participants increased from two in 1980 to 18 in 1986. This increase corresponds closely with the growth of Mangwende's maize sales. No locally based transporters initiated operations in drought prone Chivi due to the inconsistency and low

volume of the region's crop sales. There were significant sales of crops for the first and only time when a GMB collection point was temporarily established in the area in 1985.

The expansion of product market infrastructure reduced the gap between official and farm gate prices. Farm to market transport costs declined. Approved Buyers and cooperatives faced greater competition. Survey evidence indicates these gains were most significant in higher rainfall regions.

2. Input Markets

There were three major sources of input market expansion during the post-independence period. Private sector companies manufacturing and distributing inputs expanded their sales and extension forces in the communal areas. They promoted the stocking of company products by local retailers and established a program of direct farm sales in some high potential regions. In addition, the companies sponsored a series of demonstration trials in regions believed to have favorable market prospects.

Complementing this effort, urban based wholesalers branched out into the smallholder farming areas and numerous small locally owner retailers established new businesses. Frequently, these shopkeepers or shop managers were farmers themselves.

Finally the number of cooperatives selling inputs rapidly expanded. According the GMB records, the number of local cooperative branches increased by 75 percent between 1980 and 1985. Almost all of this gain came after 1981.

These measures led to a decline in input costs as transport costs declined and retailers faced greater competition. Farmers also gained timely access to inputs previously unavailable. Again, smallholders situated in higher rainfall zones seem to have benefited most.

H. Rainfall

Debate persists about the appropriate measure of agriculturally useful rainfall in Zimbabwe. Annual fluctuations differ widely across the nation's agroecological zones. Rains may be normal in Zimbabwe's high potential regions while long mid-season dry spells limit production in the low potential areas. Yields depend not simply on the aggregate quantity of a season's

rainfall, but also on the timing. Productivity will decline if rains begin late, end early or occur inconsistently.

Seventy-five percent of Zimbabwe's communal farming areas are situated in semi-arid regions (these receive less than 650 mm of average annual rainfall).[6] These areas are also subject to frequent mid-season dry spells and drought. Less than ten percent of the smallholder farming areas consistently receive enough rain for good maize harvests.[7] Nevertheless, maize is a major crop in all parts of the country. Production levels are, accordingly, strongly affected by both the level and distribution of rain.

Since 1979, the variability of Zimbabwe's rainfall has been extreme. A 1982 to 1984 drought was unusually long. In 1983 and 1987, nationwide rainfall declined to historically low levels. In 1981 and 1985, rains throughout the country were unusually good. These fluctuations largely explain the 75 percent decline in smallholder maize production between 1981 and 1983 and the fivefold increase in production between 1983 and 1985. Due in part to the dominance of higher rainfall regions in deliveries of maize to the GMB, rainfall fluctuations correspond less closely with smallholder sales trends.

I. Summary of Sources of Growth

A series of supply response equations (the quantity of maize deliveries to the GMB as the dependent variable) were estimated in an attempt to distinguish the relative importance of this range of alternative explanatory variables (Rohrbach, 1988). However, conclusions drawn were relatively weak because data was unavailable for certain key explanatory variables, such as population changes associated with the ending of the war and input market expansion. In addition, problems of multicollinearity limited the interpretation of the formal supply response coefficients.

Yet an indication of the relative strength of alternative explanatory variables does emerge by combining results of the descriptive analysis reviewed above with insights from interviews with policy makers and farmers.

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[6]Natural Regions IV and V.

[7]Natural Regions I and II.

These indicate that the growth of communal maize production cannot be attributed to any single factor such as favorable maize prices. In fact, the strength of the response to official prices appears substantially lower than expected. Farmgate prices, and thereby, smallholder maize sales, were more significantly influenced by the expansion of market access resulting from the growth of market infrastructure. Most farmers did not become active participants in national maize markets until the number of GMB buying outlets expanded and farm to market transport facilities improved. Though real and relative producer price of maize declined after 1981, smallholder maize sales continued increasing to record levels.

The sharp rise in smallholder maize area between 1979 and 1981, a gain frequently attributed to the coincident increase in real maize prices, can largely be explained by the ending of the war. Men and women who had joined the independence struggle returned to farming, new holdings were established and fields abandoned during the war were reclaimed. Survey evidence indicates this alone could account for over 70 percent of the immediate post-war area gain.

The growth of communal maize yields can be largely attributed to the availability of improved technologies and the expansion of access to these technologies. With the growth of input market infrastructure and establishment of credit programs, hybrid maize seed and fertilizer sales increased sharply. The purchase of maize inputs, in particular, was promoted.

IV. GROWTH OF SMALLHOLDER MAIZE PRODUCTION AND SALES BY REGION AND FARMER CHARACTERISTICS

This chapter examines the regional survey data in order to identify which smallholders contributed most to the aggregate trends and why. Conclusions are drawn about the distributive effects of policy, institutional and technological changes introduced to date. Insights begin to emerge from this analysis that inform the issue of stimulating more widespread food security gains among a broader cross section of smallholders.

A. Sector Stratification

Research funding constraints limited survey coverage to two communal areas in Zimbabwe. Yet the potential for drawing sector-wide generalizations has been tested by comparing the results of the location-specific research with the limited results of surveys conducted in other parts of the country.[1] In addition, aggregate survey region trends in production and sales have been compared with those for the smallholder sector as a whole. These tests of comparisons indicate Mangwende and Chivi are broadly representative of high and low rainfall agroecological zones in the country and of farm communities with variable market access. These key determinants of smallholder cropping strategies were the principal criteria used to select areas. Ultimately, however, the conclusions drawn from this analysis require broader confirmation through similar survey research in other parts of the country.

Mangwende Communal Area is situated 60-85 km east of Harare in a high rainfall zone classified as Natural Region II.[2] This agroecological zone

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[1]For example, ARDA, 1982; ARDA, 1983; CIMMYT, 1982; FMRS, 1984; MEU, 1983; MEU, 1984; PTA, 1982; Rukuni, 1985; Shumba, 1985.

[2]Zimbabwe is divided into five Natural Regions according to rainfall and farming potential. Natural Region I, a specialized and diversified farming region, consistently receives at least 900 mm of annual precipitation; Natural Region II, an intensive farming region, generally receives 750-1000 mm of rain; Natural Region III, a semi-intensive farming region, receives 650-800 mm of rainfall; Much of this is in infrequent heavy falls and the area is subject to mid-season dry spells. Natural Region IV, a semi-extensive farming region receives 450-650 mm, but is subject to severe mid-season dry spells and drought. Natural Region V, an extensive farming region, receives less than

encompasses nine percent of Zimbabwe's smallholder land and roughly 18 percent of the smallholder population. Chivi Communal Area is situated 350-400 km south of Harare and 50-100 km south of the nearest urban center of Masvingo. Chivi encompasses Natural Regions IV and V, though only the higher rainfall southern part of the communal area was included in the sample. Natural Region IV encompasses 47 percent of the smallholder sector and approximately 42 percent of the population.

Both Mangwende and Chivi are major maize production regions (Table 7). In each case, maize accounts for at least 60 percent of total cropped area. The second and third most important crops are groundnuts and finger millet. The largest proportion of land is similarly allocated to maize in approximately 80 percent of Zimbabwe communal areas.

Levels of resource access in the two survey regions reflect their differing agroecological potentials. The average size of farm holdings in each area is similar. Mangwende farmers own more draft animals than the smallholder average. Chivi farmers own fewer, in part, as a result of the 1982 to 1984 drought. Mangwende farmers have substantially greater access to credit than the average smallholder household. Chivi farmers have less. Mangwende farmers have relatively good access to input and product markets, while the access of Chivi farmers is fair to poor. Mangwende farmers are also more likely to receive extension assistance than those in Chivi.

Mangwende maize yields and per capita production levels average roughly twice the national mean. Per capita maize sales are more than three times the national average. In Chivi, maize yields, production and sales are generally lower than the smallholder means, substantially lower during the frequent years of drought. In both Mangwende and Chivi, the largest proportion of cash income earned by most households is derived from sources other than major crop sales.[3] Mangwende households earn approximately three times more cash income than Chivi households.

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650 mm of rainfall which is classified as too low and erratic for the production of crops.

[3]These include vegetable sales, wage labor, petty trade and remittances.

Table 7

Zimbabwe: Mangwende and Chivi Farming Systems

Characteristics	Mangwende	Chivi	Zimbabwe
Ave. Rainfall (mm)	750-1000	450-650	450-1000
Population Density Per Sq. Km. (1980)	52.7	41.2	25.2
Ave. Holding Size Ha. (1986)	2.8	2.4	2.4
Ave. Maize Ha. (1986)	1.5	1.3	1.3 a/
Ave. Maize Yields			
Mt/Ha. (1985)	2.7	1.7	1.4
Mt/Ha. (1986)	2.2	0.5	1.2
Ave. Maize Sales			
Mt. (1985)	3.0	0.6	0.8 a/
Mt. (1986)	2.5	0.2	0.6 a/
Ave. Household Size (No.)	7.0	7.3	6.1
Households Owning Draught Animals (%)	62.0	42.0	N/A b/
Households Receiving AFC Loan (1986) (%)	37.0	5.0	13.0
Receive Extension Assistance 1985/86 (%)	66.0	33.0	N/A
Ave. Cash Income ($Z)	1363.0	425.0	N/A

a/ Total for smallholder sector divided by 800,000 households.

b/ The national CSO survey (1986) estimated 41 percent of households had no cattle. The Mangwende and Chivi estimates are for the percentage of households with two or more draft animals, including donkeys in Chivi.

Sources: CSO (NDb), CSO (1985), CSO (1986), CSO (various years), Mangwende and Chivi Surveys.

In sum, the two survey regions approximate the diverse circumstances of high and low potential maize producers in the smallholder sector. Mangwende farmers hold better than average resource levels and achieve high levels of productivity. Institutional support for these farmers is substantially better than that received by most communal producers. Such advantages are reflected in the region's high levels of maize sales and income. The circumstances of Chivi farmers are more comparable to those faced by the majority of smallholders. Resource levels, institutional support, yields and crop sales are generally low. In addition, Chivi farmers experience much greater variability in production levels due to the frequent incidence of poor rains.

The limited accuracy of historical, official, production estimates for Mangwende and Chivi prevents detailed comparison of these respective production trends. According to the extension agency estimates, maize production increased sharply in both regions after the war, tripling in Mangwende and doubling in Chivi by 1981.

Historical maize sales trends provide an alternative summary measure distinguishing the two survey regions. Both communal areas experienced substantial growth in maize sales after independence. These trends correspond with the growth in sector-wide sales (Figure 8), though the relative timing and magnitude of each region's gain highlights differences in farm resources and market access.

In Mangwende, a GMB depot had been established in 1977 and several collection points were created in 1985. In contrast, Chivi had to wait until 1985 to receive its first GMB buying facilities. Whereas Mangwende farmers obtained good access to transport services immediately after independence, those in Chivi still had no access to local, private truckers during the 1986/87 marketing year. These infrastructural differences reinforced the distribution of agroecological advantages. As a result, maize sales increased earlier and on a more sustained basis in the high potential zone. In 1985, when Chivi's maize sales peaked, Mangwende's per capita deliveries were still almost four times those from Chivi communal area. In the following year, when Chivi experienced a long mid-season dry spell, Mangwende's average per capita sales were over fifty times greater.

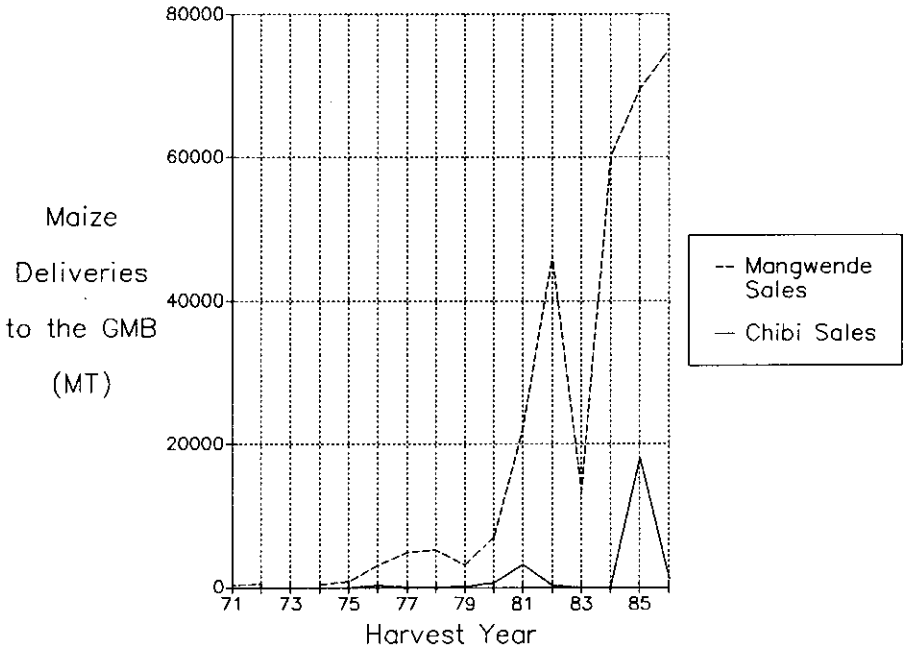

Figure 8. Mangwende and Chivi Maize Deliveries to the Grain Marketing Board, 1971-1986

B. Distribution of Production and Sales within Regions

The distribution of maize production and sales within Mangwende and Chivi is similar to that across the two agroecological zones. Table 8 shows the distribution of maize production and Table 9 displays the distribution of maize sales according to household maize production quintiles in the two survey zones. The correlation between production and sales is over 90 percent in Mangwende and equals 86 percent in Chivi in both sample years.[4] Households in each region follow a consistent strategy of only selling maize in surplus of family consumption requirements.

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[4]The correlations between historical aggregate estimates of production and sales in each region are lower than those derived from the survey sample estimates. This results, in part, from the inaccuracy of the aggregate production estimates. In 1984, for example, aggregate estimates of maize production in Mangwende were 20 percent lower than the actual level of sales to the GMB. In 1983, the aggregate estimate of Chibi maize harvests was zero.

In both Mangwende and Chivi, twenty percent of the farmers produce at least one-half of the region's maize. Depending on the quality of the season, they contribute a similar or higher proportion of each region's maize sales to the GMB. These are the smallholders who benefited most from the expansion of post-independence support for communal agriculture.

In sharp contrast, the poorest 40 percent of maize producing households in both Mangwende and Chivi are largely subsistence producers. These farmers account for less than 13 percent of each region's maize production and less than seven percent of maize sales. In Mangwende, almost one-third of these poorer households appear to be consistent net maize buyers. Even in high rainfall years such as 1984/85, these households seem not to produce adequate harvests to meet family consumption requirements. Following the marginally poorer 1985/86 season, 60 percent of these poorer farmers (14 percent of all farm households) were net maize purchasers.

In Chivi, roughly one-half of the farmers in the lowest two household maize production quintiles appear to be chronically production insecure and hence are net maize buyers. A severe mid-season dry spell in 1985/86 increased the proportion of net purchasers to over 60 percent of all farm households in the region.

The middle 40 percent of maize producing households in each region can be termed transitional. These harvest 25-40 percent of the maize in the two survey areas. In high rainfall Mangwende, most of these farmers generally sell small quantities of grain. In low rainfall Chivi, most of these farmers do not participate in formal grain markets. In years in which rainfall is favorable, these farmers generally satisfy their family consumption requirements through own-farm production. In drought years, many do not.

Farmers in each of these production quintile categories contributed to the growth of aggregate smallholder maize production over the 1979 to 1985 period. Though the relative size of the contributions of each group are difficult to estimate, survey evidence, reviewed in more detail below, indicates the top twenty percent of producers in each region experienced the largest production gains. These farmers similarly provided the principal source of increased grain deliveries to the GMB.

Table 8
Zimbabwe: Distribution of Maize Production in Mangwende and Chivi, 1984/85 and 1985/86 Cropping Seasons

Household Maize Production Quintiles:	Mangwende 1984/5 (%)	Mangwende 1985/6 (%)	Chivi[a/] 1984/5 (%)	Chivi[a/] 1985/6 (%)
	-----Proportion of Total Maize Harvest-----			
Surplus:				
Top Quintile	54	49	54	67
Transitory:				
Second Quintile	19	21	21	17
Third Quintile	15	20	14	9
Semi-subsistence:				
Fourth Quintile	9	7	8	5
Bottom Quintile	3	2	4	1

[a/] A mid-season dry spell reduced production in Chivi during the 1985/86 season.

Source: Mangwende and Chivi Surveys

Table 9
Zimbabwe: Distribution of Maize Sales in Mangwende and Chivi, 1984/85 and 1985/86 Cropping Seasons

Household Maize Production Quintiles:	Mangwende 1984/5 (%)	Mangwende 1985/6 (%)	Chivi 1984/5 (%)	Chivi 1985/6 (%)
	-----Proportion of Total Maize Sales-----			
Surplus:				
Top Quintile	54	60	72	92
Transitory:				
Second Quintile	25	22	21	3
Third Quintile	14	14	5	0
Semi-subsistence:				
Fourth Quintile	7	4	0	5
Bottom Quintile	0	0	1	0

Source: Mangwende and Chivi Surveys

C. Factors Distinguishing Alternative Smallholder Production Systems

Two major, interrelated factors differentiate larger and smaller communal maize producers and sellers in each agroecological zone: resource ownership and access to institutional support. Farmers in the upper maize production quintiles are better endowed and have obtained greater access to product and input markets, credit, extension support and improved technology (Table 10). The expansion of agricultural support has still only reached part of the smallholder sector. Additional programs of agricultural and other assistance are required to improve the food security of farmers still suffering from chronic and transitory supply shortfalls.

1. Land

There is a direct relationship between the size of a household's landholding and the quantity of land planted to maize. Farmers across the three surplus, transitory and semi-subsistence production system categories allocate roughly similar quantities of land to field crops other than maize. These are primarily grown for home consumption, though production surpluses of secondary crops are frequently offered for local sale. Most additional crop land on which farmers expect to produce a surplus is allocated to maize.

While smallholders in each production system category increased their cropping area after the war, many of the largest producers increased their area the most. Established producers sought additional land allocations specifically to expand maize production for the market. By 1985, surplus Mangwende producers had 30 percent more land than transitory producers and 80 percent more than semi-subsistence farmers. In Chivi, surplus producers had almost 50 percent more land than transitory producers and 90 percent more than semi-subsistence farmers.

2. Draft Power

Ownership of draft power, a complementary resource to land, also distinguishes farmers in each production system category. In Mangwende, the surplus producers own almost four times as many draft animals as the bottom 40 percent of semi-subsistence farmers. Most households in the lowest production system category do not own enough animals to field a two-animal team. In Chivi, the top 20 percent of producers own almost three times as many draft

animals as the poorest 40 percent. More than one-half of all households do not own enough draft animals to field a two animal ploughing team.

Farmers without draft power can generally borrow animals and equipment from neighbors. As a result, virtually all fields in both Mangwende and Chivi are ploughed by animals. Nevertheless, ownership allows more timely ploughing and planting in coordination with the often inconsistent rains at the beginning of the cropping season.

3. Farm Labor

There appear to be no major differences in the quality and quantity of full-time farm labor available to Mangwende households. This was unexpected given that Zimbabwe smallholders are frequently said to face severe labor constraints (Low, 1986; Shumba, 1985). Perceived labor shortages provided the major justification for on-farm herbicide trials conducted by both the agrochemical companies and a local farming systems research team. In Chivi, the top 20 percent of farmers have 20 percent more farm labor than the middle and bottom 80 percent (Table 10). In a production system based on low levels of purchased inputs, this may be relatively important, particularly in higher rainfall years when weed competition is greater.[5]

When survey respondents were asked to list their five greatest farming problems, few in either region cited labor constraints. A small number identified labor availability as a factor influencing their allocation of land among different crops, however. The high labor requirements of finger millet, in particular, were noted.

Few farmers in either Mangwende or Chivi appeared to hire additional agricultural labor. Farmers perceived labor hiring as expensive. High wage rates must be paid because of the availability of higher paying jobs in the non-farm sector. Participation in communal labor groups was common, particularly in Chivi. But this did not increase the net availability of labor to any particular household.

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[5]Labor availability did not significantly affect either the size of maize area or yield levels in estimated regression equations for Mangwende and Chibi. The plot specific data available for estimating Chibi's production function were collected, however, during a season with a long mid-season dry spell.

Table 10

Zimbabwe: Characteristics of Mangwende and Chivi Smallholders by Production System Category, 1984/85

Farmer Characteristics	Household Maize Production Quintile Categories*					
	Mangwende			Chivi		
	Top 20%	Middle 40%	Bottom 40%	Top 20%	Middle 40%	Bottom 40%
Land Holding (HA)	3.8	2.9	2.1	3.4	2.3	1.8
Maize Area (HA)	2.6	1.5	0.9	2.5	1.5	1.1
Other Crop Area (HA)	1.2	1.4	1.2	0.9	0.8	0.7
Maize Yield (MT/HA)	2.9	2.2	1.9	0.8	0.6	0.4
Maize Production (MT)	7.5	3.3	1.7	2.1	0.9	0.4
Draft Animals Owned (No)	7.6	4.4	1.6	4.1	2.3	1.5
Full Time Labor (No)	1.9	2.1	1.7	3.2	2.7	2.6
Households with Off-Farm Workers (%)	80	66	48	41	49	37
Education of Household Head (Years)	5	6	5	4	4	3
Farming Experience (Years)	19	14	16	16	13	10
Cash Income Level ($100)	26	13	6	9	4	3
Maize Input Investment ($100/HA)	2.8	2.5	1.6	0.4	0.2	0.2
Households Receiving Credit (%)	80	59	8	20	0	0
Households Receiving Extension Advice (%)	85	63	28	70	21	10
Quality of Market Access	good	good	fair	poor	poor	poor
Hybrid Maize Seed First Adopted (Year)	1974	1978	1980	1969	1975	1976
Fertilizer Year First Adopted (Year)	1974	1978	1979	1983	1985	1985
Households Adopting Fertilizer (%)	100	100	93	59	13	3
Maize Fertilizer Use (KG/HA)	590	360	230	60	10	0

Source: Mangwende and Chivi Surveys

*Production Quintile Categories: Top 20% = Surplus producers; Middle 40% = Transitional producers; and Bottom 40% Semi-subsistent producers.

Although household heads in Mangwende had an additional year or two of education than those in Chivi, there are no significant differences in the educational levels of the farmers across the three production classes within each region. The surplus producing farmers tend, however, to have more years of farming experience in their current farm location.

4. Cash Availability for Input Purchases

The various categories of producers in both Mangwende and Chivi are also differentiated by their relative access to cash for the purchase of agricultural inputs. Most households rely heavily on cash derived from sources other than crop production. The single largest income source was family wage remittances. Additional cash was obtained from such sources as poultry production, handicrafts, the provision of transport services and working for other households during the winter season. Only the top 20 percent of farmers in Mangwende earn the majority of their cash income from field crop sales. In both regions, surplus producers earn two to four times as much cash income as households in the transitory and semi-subsistence categories.

While all farmers view the availability of cash for input purchases as a constraining resource, this problem is most severe for semi-subsistence producers in Mangwende and both transitory and semi-subsistence farmers in Chivi. These households spend the most of their cash earnings on school fees. Many must also purchase food. After these expenses are paid, the resources left for farm investments are small.

5. Extension

The larger maize producers generally have substantially greater access to extension advice, though the significance of this interaction is difficult to determine. Most such meetings are in a group context. Extension advice tends to cover a wide range of crops and production techniques. Yet few farmers implement the full range of maize recommendations and the advice received for other crops is generally ignored. Nevertheless, attendance at public meetings suggests larger farmers view the advice as useful.

6. Credit

The distribution of agricultural credit favors larger producers in the higher rainfall zone. Eighty percent of the largest producers in Mangwende received credit during the 1985/86 season, whereas only eight percent of the semi-subsistence producers obtained loans. Further, larger producers received loans averaging twice the level of those received by the medium and small producers. In Chivi, less than five percent of all farmers received loans. These were among the largest producers in the region.

7. Input and Product Markets

Intra-regional differences in market access within the Mangwende and Chivi survey zones were more limited than originally anticipated when the survey samples were chosen. Distinctions appearing were more closely related to a household's relative level of market activity and proximity to a maintained dirt road, than the actual distance to major input and product market outlets. Farmers buying larger quantities of inputs and selling larger quantities of crops were more likely to be served by local transporters on a timely basis. This is because truckers sought to carry full loads and limit the number of stops required for pick-up and delivery. Transporters also preferred to travel graded roads. A statistically significant relationship was estimated between proximity to a maintained road and maize sales.[6] This link was only partially offset by the organization of group deliveries.

The location and services offered by localized input retailers depends on the demand for input supplies. Fertilizer and insecticide were more readily available to farmers in areas containing many users.

D. Complementarity of Resources and Institutions

Both the aggregate analysis outlined in Chapter 3 and the location-specific review of survey data in this chapter highlight the complementary relationship between farm resource levels, access to markets, the coverage of agricultural support institutions such as credit and extension systems, and the availability of improved technology. Smallholders situated in better

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[6]See Rohrbach, 1988:255-257.

agroecological zones with higher potential levels of productivity have benefited from public and private investments in agricultural infrastructure. Government pricing policies more directly influenced the cropping strategies of major market participants similarly concentrated in the high potential zones.

Prior to independence, public policy makers and private businessmen viewed Zimbabwe's agricultural development in terms of the need to expand support for the large-scale commercial farm sector. Investments targeted toward these commercial farmers were believed to yield the highest returns. Only at independence were major programs initiated in direct support of smallholder agriculture. Yet the same objective of seeking the highest investment returns oriented the expansion of infrastructural, institutional and technological support in favor of small farmers in higher rainfall zones and to farmers who had already proven themselves most productive. Most Mangwende farmers received access to credit, whereas only a few of the largest farmers in Chivi received loans. Mangwende received a GMB depot, three GMB collection points and experienced a large increase in the number of local transporters. Chivi obtained two collection points and no transport support. Mangwende farmers were visited by sales representatives from the major input supply companies and participated in privately run demonstration trials. Chivi farmers received no such assistance. Mangwende farmers were twice as likely to see an extension agent and more likely to view a similar set of recommendations as relevant.

Within each agroecological zone, the largest smallholders received the most credit, extension and market support. Programs, policies and technologies initially defined as scale neutral, in practice, were not. Again, the distribution of benefits from public and private sector investments undertaken to date strongly favored smallholders with the largest farm resources. At least initially, ownership of farm resources was complemented by the opening of access to institutional resources.

There was not enough price variability in the survey regions to test the localized effects of maize price policy. Administered prices stood above

those in informal local markets.[7] Yet it appears that the complementary relationship between institutional, agroecological and farm resources similarly characterizes the breadth of responsiveness to official prices. Farmers with access to more resources will always be most responsive. Those with fewer resources will be little affected by government producer price policy.[8] This conclusion corresponds with the results of the aggregate analysis.

The post-independence expansion of smallholder maize production and market sales resulted from an explicit government policy of assisting smallholder agriculture. This provided infrastructural and institutional resources essential for taking advantage of available technology and favorable formal sector prices. It also provided a stimulus to a complementary set of private sector investments on the part of major input suppliers, small-scale retailers and locally based transporters. At least initially, better endowed farmers benefited most.

E. Initial and Secondary Gains

A major question for future government policy is how to sustain smallholder production growth in the nation's high potential regions while constructing additional strategies to stimulate productivity growth among households that are still food production and/or consumption insecure. Much of the growth in smallholder maize production resulted from the expansion of area planted. Constraints on the further expansion of land holdings, while not as severe as suggested at independence, are becoming more difficult. Farmers have been expanding their crop area into grazing lands previously set aside as a means to limit environmental degradation and to ensure grazing resources for existing herds. These lands tend to have poorer soils and are subject to greater erosion. A villagization program initiated by the government in 1986 attempts to restrict the cropping of grazing lands and reclaim some lands already cleared.

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[7] During the main post-harvest marketing season.

[8] They are more likely to be affected by consumer price policies.

Most of the area expansion immediately following the war resulted from the return of soldiers and refugees to farming and the termination of rural violence. This was a one-time gain. The growth of area per established producer, particularly after 1981, marked a response to expanding product markets, improved access to credit and an initial relative decline in input costs. Though product markets are still expanding, the growth of credit has slowed and input costs have substantially increased relative to product prices.

Yield gains resulted from the adoption of hybrid seed and application of higher rates of fertilizer. The expansion of hybrid seed use can largely be attributed to the expansion of input markets. Larger smallholders tended to adopt new seed earlier than smaller ones, most likely due to their greater willingness to accept risks. Yet the lag in adoption between the two groups was not long. Both Mangwende and Chivi producers seem to have adopted hybrids earlier than the majority of Zimbabwe smallholders, most likely due to their proximity to major roads linking urban market centers. Between 1979 and 1986, as the seed companies laid greater emphasis on expanding sales in the smallholder farming areas, national rates of small farmer adoption increased from an estimated 19 percent of maize hectareage in 1979 to 80 percent of hectares planted in 1986. Future gains associated with the adoption of existing varieties of hybrid maize seed will be more limited.

Production function analysis in both Mangwende and Chivi identifies fertilizer as the largest single determinant of maize yields (Rohrbach, 1988: 181-192). The survey analysis also indicates that fertilizer purchases were closely related to credit access. Though most Mangwende farmers adopted fertilizer before independence, rates of application were low. When credit became available, rates of application among credit recipients increased. In 1986, 72 percent of fertilizer purchases in Mangwende were funded with credit, and credit recipients purchased 92 percent of total deliveries. In Chivi, fertilizer adoption followed the receipt of loans. Eighty-eight percent of fertilizer purchases in 1986 were funded by credit and only credit recipients purchased this input.

Credit recipients were generally larger smallholders who had proven their ability to produce enough surplus to repay their loans. Despite continuing

expansion in the proportion of smallholders registered to sell crops to the GMB during the 1980s, the growth of credit deliveries has slowed. Over two-thirds of Mangwende farmers obtained loans between 1980 and 1986. By the end of this period, only 37 percent of these farmers still received agricultural credit. The proportion of recipients was declining. Only larger smallholders, most of whom had off-farm jobs, seemed to be consistently receiving loans. In Chivi, credit was only granted to some of the largest producers in the region and even these faced severe repayment difficulties.[9]

The largest prospect for future gains in smallholder crop production lies in the development of improved location-specific technologies and increases in the efficiency of current technology use. Smallholders have proven their interest in adopting new seed varieties and hybrids. Most recognize the value of fertilizer, though investment costs are viewed as high relative to expected returns and the alternative demands on family resources. This implies that the most promising new technologies will be low cost inputs such as new varieties and hybrids, and practices which help reduce production costs. The justification for highly variable rates of fertilizer application and similarly variable responses needs investigation. Enterprise budget analysis (Rohrbach, 1988) shows that rates of application recommended by extension services need reexamination.[10] In higher rainfall zones, different sets of recommendations may be justified for credit recipients and non-recipients. In semi-arid regions such as Chivi, the development of improved low cost input recommendations is essential.

F. Distribution of Aggregate Production and Sales Growth

The combination of aggregate and regional survey data provide a basis for estimating the sector-wide distribution of smallholder maize production and market growth over the 1979 to 1986 period. Both aggregate and location-specific data reveal that the increase in maize area was widely distributed, particularly during the immediate post-war period. Much of this gain resulted

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[9]In 1984, 38.5 percent of the AFC's short term loans were in arrears (AFC, 1985).

[10]Recommended rates of application are too high.

from an increase in the number of households and the reclamation of fields abandoned during the war. The Mangwende and Chivi survey data indicate, in contrast to national trends, that at least in these regions, smallholder maize area continued expanding after 1982. This growth resulted, in part, from continuing population growth. In addition, established farmers were still expanding their production for the market.

The aggregate smallholder sector data similarly indicate yields increased throughout the country. A major justification for these gains was the expansion of area under hybrid seed. Research trials indicate the adoption of hybrid seed, without fertilizer, could increase yields by 30 to 45 percent (Tattersfield, 1982; Olver, 1986). In addition, smallholders, particularly in the higher rainfall zones, were adopting and purchasing larger quantities of fertilizer. The use of fertilizer at rates close to recommended levels was estimated in research trials to increase maize yields up to 200 percent.

The field survey data collected during this investigation primarily depict the current distribution of smallholder maize production. In 1985 and 1986, the top 20 percent of producers in Mangwende and Chivi accounted for at least 50 percent of each region's total maize production. In 1985, average maize yields in Mangwende were 60 percent higher than those in Chivi, and in 1986 they were more than four times greater. If the two survey regions are roughly representative of Zimbabwe's high and low rainfall agroecological zones, one can infer that, depending on the quality of the rainy season, 20 percent of all smallholders produce 65 to 80 percent of the sector's total maize harvests.

These data also provide a basis for inferring that the largest smallholder maize producers were the primary beneficiaries of government investments in credit, market infrastructure and high producer prices. The majority of smallholders classified as "transitory" or "semi-subsistence" producers likely did not see their circumstances worsen. This is an important accomplishment. Yet these households still experience varying degrees of food production and consumption insecurity.

Roughly 57 percent of the estimated growth in smallholder maize production was delivered to the GMB. Most of this came from the larger

smallholders in the higher rainfall farming regions. If the distribution of maize sales in Mangwende and Chivi is roughly representative of the distribution of deliveries from high and low rainfall maize production regions of the country, then as few as 10 percent of smallholders may be responsible for at least three-quarters of the sector's sales. In poor rainfall years, the skew is even greater.

Less than 27 percent of smallholders were registered to sell crops to the GMB following the record maize harvests of 1985. While unregistered farmers could still sell crops through GMB Approved Buyers, survey evidence shows all consistent maize sellers and most occasional sellers were registered. This evidence supports the results of the survey data. The growth of maize sales increased the skew in smallholder incomes obtained from agricultural production.

The sharp increase in GMB maize stocks, after 1980, reflects the production gains of a limited though significant proportion of the smallholder population. It does not necessarily imply a general improvement in smallholder food security. Many of those households with the most limited farm resources contributed little to the sector-wide maize production gains. These households still have substantial need for expanded technological and institutional support. Zimbabwe's challenge is to sustain production advances of the best endowed smallholders, while designing viable additional support services to improve both on-farm and off-farm production and employment potential for relatively low resource smallholders.

V. HOUSEHOLD FOOD SECURITY

The principal objective guiding government policies promoting the development of the smallholder sector in Zimbabwe was to encourage the growth of crop production (especially maize) and family incomes. This chapter takes a closer look at the effect of aggregate maize production growth on household food security. It evaluates the degree to which smallholder food security actually improved.

A. Incidence of Smallholder Development Policy

Government policy aiming to promote smallholder development largely treated the smallholder sector as a homogeneous group of farms. Most policies were established with the intention of expanding support for all farmers irrespective of their resource levels, location or capacity to respond. These policies did not explicitly aim to maximize the productivity and growth of the largest or most efficient smallholders. Nor did they directly aim to improve the production and income levels of the poorest, or those households subject to production and consumption deficits. Rather, a single set of government actions were broadly directed toward all smallholders throughout the country.

As can be seen from this analysis, the implementation of government policies was very successful among better endowed smallholders, particularly those situated in higher rainfall zones. Extension recommendations were most appropriate to farmers prepared to invest in modern inputs and these expenditures had the greatest payoff in the high potential regions. In low rainfall regions, the value of these recommendations was questionable due to the risks of drought and more severe cash constraints. Agroecological and farm resource limitations influenced the distribution of smallholder credit. Agricultural loans reached ten percent of the country's most productive small farmers. Despite this, there were still repayment difficulties. There was also substantial growth in market infrastructure in the high potential zones. Expansion into regions of low productivity required significant additional public sector operational subsidies. Official product and input pricing policies have primarily affected the minority of producers selling grain to the GMB.

For logical economic reasons, private sector investment by input suppliers, retailers and transporters followed and reinforced public sector contributions. National vendors of fertilizer, seed and agrochemicals expanded sales in regions receiving the largest quantities of credit. Local retailers similarly expanded their stocks of inputs in response to rising market demand. Local farmers and small retailers invested in trucks to provide farm-to-market transport as production and sales to the GMB increased. While these private sector investments increased rapidly in high potential Mangwende, investments in low potential Chivi remained severely limited.

Both public sector agencies and private sector agents sought to expand their services to smallholders while maximizing the returns on their investments.[1] In order to offset this tendency, the Zimbabwe government placed pressure on public agencies to expand the coverage of their services in the low potential regions. The same types of assistance (e.g. credit terms and market infrastructure) were demanded in all regions of the country. In effect, public agencies were being asked to subsidize the provision of services to farmers in the low rainfall zones. Meanwhile, a government commission was established to identify measures necessary to reduce parastatal debts.[2] The GMB's 1986/87 marketing year trading deficit on maize alone was Z$57.3 million (AMA, 1987). Agency administrators logically argued against measures likely to increase their liabilities.[3]

The net effect of these actions is revealed in the distribution of the growth of maize production and market sales. Factoring out the increases in production associated with the expansion in crop area due to the ending of the war, only a minority of producers appear responsible for most of the growth in smallholder maize supplies. Most broadly, they encompass the 27 percent of

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[1]Even in the national agricultural research service, scientists interviewed sought to concentrate their efforts on crops and in regions with the highest potential payoffs. These were defined in terms of the probability of aggregate production gains and professional advancement.

[2]Though some of the largest of these debts were held by parastatals outside the agricultural sector.

[3]The AFC was under pressure to increase the number of loans in semi-arid smallholder farming regions despite repayment risks. The GMB similarly faced pressure to expand the number of permanent depots in these areas.

smallholders registered to sell crops to the GMB in 1985. Within this group, the ten percent of smallholders receiving AFC loans encompassed most of the largest maize producers. Future efforts to broaden these gains may require better targeting of support toward the specific needs of poorer, food insecure households.

B. Per Capita Coarse Grain Retentions

Roughly 40 percent of the estimated increase in communal sector maize production, over the 1979 to 1985 period, was retained for family consumption and inter-household sales at the village level.[4] Approximately two-thirds of the increase in these household retentions came before 1981. This gain corresponds with the widespread expansion of cropped maize area following the ending of the war. The growth of maize retentions after 1981 corresponds with continuing rural population growth and the substitution of maize for alternative coarse grains in consumption.

Using the official population growth estimate for the smallholder sector of 2.8 percent (CSO, 1980), estimated per capita maize retentions increased 13 percent between the two unusually favorable smallholder harvests of 1972 and 1985. If, as seems to be commonly believed,[5] the population growth rate was actually over three percent, the increase in per capita retentions was still more than five percent.

The impact of the increase in maize retentions depends on the degree of crop substitution in consumption over the period. As discussed earlier, estimates by extension workers of crop area do not show a consistent pattern of substitution in production. Smallholder sorghum area more than tripled between 1979 and 1983, the principal period of maize area gains. In contrast, estimated millet plantings declined by 30 percent during this period. This loss equalled the estimated increase in smallholder sorghum area, though some of the millet acreage was likely also reallocated to maize.

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[4]Retentions in 1979 and 1985 were calculated by subtracting formal market deliveries to the GMB from estimated production.

[5]The World Bank (1985), for example, estimates Zimbabwe's population growth rate was 3.2 percent per annum (1973-1983).

Estimates of the longer run trends in per capita coarse grain retentions are more revealing (Figure 9).[6] Although smallholder sorghum production more than doubled between 1979 and 1985, this growth did not fully compensate for the 80 percent decline in production over the previous five years.[7] Longer run trends in smallholder millet production were also declining. Meanwhile, market deliveries of sorghum and millet were increasing. The resulting decline in small grain retentions was largely the effect of the post-war growth in smallholder maize production.

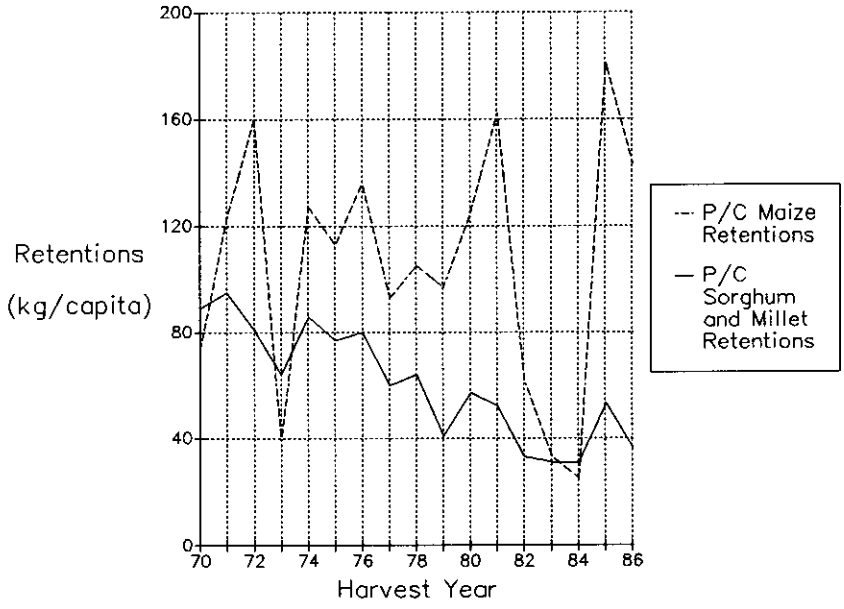

Figure 9. Zimbabwe: Smallholder Per Capita Coarse Grain Retentions, 1970-1986

While per capita retentions of all coarse grains increased sharply between 1979 and 1985, these gains appear to have simply returned household food supplies to levels obtained in 1972. Losses corresponding with the

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[6]Based on available aggregate estimates of coarse grain production, GMB deliveries and smallholder population growth.

[7]Associated with rural unstability during the war.

buildup of wartime instability were resolved. In the process, coarse grain consumption patterns shifted in favor of maize.

If smallholder population growth rates were higher than official Zimbabwe estimates, per capita coarse grain retentions may have declined. Yet, communal sector grain supplies were substantially larger than they would have been without the sharp post-independence maize production growth. The maize production gains were geographically widespread, encompassing all major producing regions of the country. The larger relative gains in the high potential regions and among larger smallholders allowed the expansion of market sales and helped build national stocks. Production advances in the semi-arid regions and among more marginal producers were largely retained for home utilization. This is where there was the most substitution of maize for alternative small grains in the diets of smallholder households.

C. Households with Continuing Production Deficits

Survey results on the proportion of Mangwende and Chivi households who remain net grain purchasers provide a basis for roughly estimating the proportion of smallholders experiencing persisting food production insecurity despite the post-independence maize production gains. Mangwende and Chivi smallholders pursue a relatively consistent strategy of retaining grain required for household consumption and selling the remainder. Few households sell grain shortly after harvest and repurchase their food requirements later in the season. When this was done, only a small portion of the harvest was sold to meet immediate cash requirements.[8] In most cases, significant grain purchases indicate a household did not produce enough to meet family consumption requirements.

In 1985, despite favorable rains, roughly 12 percent of Mangwende households did not produce enough maize to meet their family requirements.[9] In Chivi, though maize harvests reached record levels, almost one-quarter of all households did not produce enough for their consumption needs. In both

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[8]This strategy is also apparent in survey results from other parts of the country (e.g. Stanning, 1987).

[9]This observation is based on each household's estimate of its consumption requirements.

regions, local maize surpluses from net seller households amply covered the respective shortfalls of deficit producers. Quantities of grain available for village level sales were adequate to meet local market demand.

In 1986, due to poorer rains, 24 percent of Mangwende farm households and almost 60 percent of Chivi households claimed they needed to purchase additional grain to meet family consumption requirements before the next season's harvests. While the needs of Mangwende's net purchasing households could still be met locally, estimated purchases in Chivi were more than twice the total level of forecast maize sales. Hence, the Chivi region was a net maize importer. Seven months after the 1986 harvests, the government began distributing food aid in the area.

The principal result of product market expansion was to establish a floor price effective in years of good harvests. Survey results for Mangwende and Chivi indicate that in years of favorable rainfall, official producer prices offered by the GMB roughly equalled local market prices less farm-to-market transport costs. In drought years, local maize prices increased above official levels in net importing regions. The higher production levels induced by the expansion of support for smallholder agriculture helped limit this rise in farmgate prices.

This relationship was particularly evident in drought prone Chivi. The average price of inter-household maize sales following the good 1985 harvests was about Z$0.14 per kilogram. In comparison, the price offered at local GMB collection points averaged Z$0.17 per kilogram. The difference roughly covered transport costs from farm to the collection point. Most sales were made to the GMB. In contrast, following the poor 1986 harvest, the price of inter-household transactions increased 30 percent above the GMB price.[10] The only sales made to the GMB were to repay credit obligations. If local production levels had not increased since independence, this price increase might have been substantially greater.

The persistence of large groups of rural households with production deficits highlights a fundamental issue: increasing aggregate grain production will not automatically solve hunger and family food insecurity.

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[10]Two months before the beginning of the 1986/87 season harvest.

While estimated household maize retentions increased, a substantial portion of the smallholder sector still experience both transitory and chronic food production and consumption insecurity. Unexpectedly, this includes farmers in high as well as low rainfall regions of the country. The broadly focused national programs to increase smallholder production improved smallholder food supplies. Yet the results of a disaggregated analysis show additional targeting of development assistance may be required to ensure that households still facing production deficits have adequate food access.

D. Income and Employment Generation

Between 1979 and 1985, the value of smallholder maize sales to the GMB increased by more than Z$62 million in real terms. The real cost of additional fertilizer and hybrid seed purchases, the principal variable cash input of maize producers, increased roughly $20 million. Even accounting for increases in the costs of other production inputs, the infusion of capital into the smallholder economy was substantial.

The effects of this income growth were felt in numerous ways. Mangwende and Chivi results indicate farmers invested a large portion of this gain in childrens' schooling. As local incomes increased, investments in school fees also rose. In addition, farmers sought to send their children to more expensive, higher quality schools. Interviews with local merchants and transporters revealed that smallholders also invested in the expansion of market services. A small number of households opened small retail stores selling agricultural inputs and consumer goods. A few purchased lorries to transport goods to market and inputs to the farm. Many invested in improving their housing, purchased furniture and other consumer items. The limited expenditure data collected in 1985 and 1986 indicates investments in cattle and production equipment were relatively small.

While most market earnings were received by net maize sellers, the portion of income reinvested in local industry served to increase rural employment. Net maize purchasing households earn most of their cash income required to purchase food from farm enterprises other than grain and oilseed production. These include poultry sales, transporting goods, handicrafts, vegetable sales and working for others. Data is unavailable to measure the

increase in these earnings over the post-independence period. It is reasonable to assume, however, that the substantial growth in maize production and sales increased cash income earning opportunities.

Unexpectably, despite the broad expansion of smallholder maize production, there was little evidence that farmers were hiring more field labor. The labor demands of the high input maize enterprise are more than double those of low input maize in high potential Mangwende.[11] Additional labor was also required as a result of the expansion of cropped area. Yet the survey revealed these additional requirements were largely met from within the family.[12]

The growth of smallholder maize production can be linked, however, with an expansion in the nation's aggregate off-farm employment opportunities. Agriculture accounts for about 14 percent of GDP and is the second largest single sector of the economy behind manufacturing (23 percent of GDP). Agriculture provides 30 to 40 percent of the nation's foreign exchange earnings. The foreign exchange earnings are of critical importance to the manufacturing sector which imports roughly 25 percent of its inputs (Morna, 1987). The substantial contribution of smallholder agriculture to the growth of the agricultural sector as a whole, in 1980, 1981 and 1985, clearly contributed to an increase in total GDP and to a corresponding increase in formal sector employment (Table 11).

In Mangwende and Chivi, respectively 44 percent and 36 percent of male household heads hold off-farm jobs. Many families have sons and daughters working off the farm. The remittances provided by these family members provide a source of investment capital for the farming system and a source of cash to purchase food in periods of drought. Remittances both fund school fees and provide a major incentive for educational investments.

One of the most difficult problems Zimbabwe faces over the next twenty years is the expansion of off-farm employment opportunities for secondary school graduates. In recent years, the expansion of formal sector employment

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[11]See Rohrbach (1988) Appendix B.

[12]The justification for this discrepancy requires further investigation. Though relatively few plots received high input applications, the sources of additional family labor are unknown.

Table 11

Zimbabwe: Contribution of Agriculture to GDP and Employment Growth, 1979-1985.

	Real Agricultural GDP	Real Total GDP	Formal Sector Employment
1979	0.0	+1.5	-0.2
1980	+3.2	+11.3	+2.6
1981	+8.3	+13.0	+2.8
1982	+1.0	0.0	+0.8
1983	-6.4	-3.4	-1.2
1984	+1.7	-0.1	+0.3
1985	+30.8	+10.3	+1.4

Source: MFEDP (1986), CSO (1986).

has not kept pace with the growth in the number of job seekers. Educational qualifications have become increasingly important for job access. Recognizing this, rural communities have invested heavily in building new secondary schools and farm families are spending larger amounts on secondary school fees.[13] Ultimately, these investments compete with the resources required for crop production.

E. Household and National Food Security Stocks

Smallholder food supplies are primarily obtained from three major sources: own household grain production, market purchases and food aid.[14] The food security strategies of Mangwende households were relatively simple. Mangwende farmers consistently produce a regional maize surplus. Net buying households (assuming sufficient effective demand) could generally purchase grain from their neighbors. Net selling households only saved enough grain to

[13]The number of secondary schools in Zimbabwe increased from 177 in 1979 to 1215 in 1985. Enrollment increased by more than 600 percent (CSO, 1987).

[14]Food supplies may also be obtained from borrowing grain and gifts, but few such transations were recorded in Mangwende and Chibi.

last until the next harvest.[15] If village supplies were limited, Mangwende farmers could readily purchase maize meal in local retail outlets.

Food security strategies in Chivi were more complicated, especially in drought years when the region was a net importer. While maize is the preferred food grain in this low rainfall region, sorghum and finger millet were recognized as more drought tolerant crops. Maize-finger millet intercrops were common. Farmers reasoned that if rains were good, maize supplies would be adequate and finger millet could be placed in storage and used for beer brewing.[16] If rains were poor, finger millet supplies could be used for food. If a large quantity of finger millet remained in household stocks, the proportion of land allocated to finger millet would be reduced.

Farmers in Chivi also depended on access to food available under drought relief programs. These were particularly important for households with limited cash to purchase maize meal in local shops. This included most Chivi households experiencing production deficits. The implementation of national drought relief programs was made possible by the high post-independence levels of national maize stocks. By contributing to the build up of GMB stocks, surplus producers were contributing indirectly to the food security of deficit producers such as those in Chivi. These programs may also have increased the willingness of farmers to risk the allocation of a larger proportion of their land to maize.

Between 1982 and 1984, roughly one-third of the smallholder sector received drought relief assistance. Approximately Z$100 million was allocated to the drought relief program and another Z$10 million was allocated to an associated set of public works projects (MFEDP, 1986). Concern over the possibility of continued drought during the 1984/85 cropping season forced Zimbabwe to import maize in 1984. Yet these were the first, and last maize imports since independence. Record smallholder maize production and sales in 1985 again increased stocks to record levels. This allowed Zimbabwe to export grain while mounting a large domestic drought relief program in 1987.

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[15]Farmers did not pursue a strategy of stocking maize across years because of the limited storage life of hybrid grain.

[16]Bulrush and finger millet could be stored, according to farmers in both Mangwende and Chibi, for up to ten years.

F. National and Household Food Security

Smallholder food security undoubtedly improved as a result of the massive post-independence growth of communal maize production and market sales. The extent of this improvement appears less, however, than the aggregate supply trends broadly indicate. This seeming contradiction highlights some important differences between the growth of food availability and food access. A related set of distinctions characterize the relationship between national or aggregate food security and household food security.

While maize production increased throughout the smallholder sector, the largest proportion of these gains were concentrated among larger smallholders producing for the market. Estimated per capita maize retentions increased above levels achieved in the early 1970s. But per capita retentions of alternative coarse grains were declining. Total per capita grain availability in the communal areas was constant or could have fallen.

Households experiencing production shortfalls could offset these deficits by purchasing grain. Besides production, food access is, accordingly, contingent on family income levels and food prices. Survey evidence indicates that most net food purchasing households were among the poorest in their respective regions. The allocation of family resources to the purchase of food limited the availability of cash for investment in crop production. Further, the multiplier effects of the aggregate increase in smallholder maize sales appear to have been limited. The largest increases in income were in high rainfall regions containing fewer households experiencing food insecurity. Further, much of this additional income seems to have been invested in manufactured goods produced outside the rural areas.

The expansion of access to GMB delivery points appears to have increased local grain prices in favorable rainfall years. This provided an incentive to expand crop area and production for outside markets. In effect, the GMB became a competitor with households consistently facing production deficits for surplus grain. In years of drought, however, the growth of regional production helped limit the rise in local food prices.

Smallholder food security is clearly better than it would have been without the large post-independence maize production and income gains. Yet a significant proportion of these farmers face persisting transitory and chronic

insecurity. These are farmers unable to produce enough grain to meet family consumption requirements and, due to cash income constraints, have a limited capacity to purchase additional grain. In Mangwende, a communal area situated in one of Zimbabwe's most favorable agroecological regions, few households experience chronic consumption deficits, though upwards to 25 percent may experience transitory insecurity.[17] In Chivi, a region agroecologically representative of the majority of the communal sector, up to 20 percent of households face continuing difficulties obtaining adequate calorie supplies. At least 60 percent of Chivi households experience transitory shortfalls. Food insecurity persists throughout Zimbabwe's communal farming areas despite massive maize stocks.

Smallholder food security policies must ultimately be judged in terms of their effect on the production and consumption levels of households experiencing transitory and chronic consumption deficits. This analysis has shown that record levels of smallholder maize production and national maize stocks have not resolved the food security constraints faced by many, if not most, small farm households. Aggregate national food security is not automatically equivalent with household food security. The growth of grain production by high potential smallholders is required to increase aggregate food supplies. This contributes to household food security. Yet additional actions are required to further aid families still experiencing persistent production and consumption constraints. Future smallholder development strategies may need to be more targeted.

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[17]These estimates of the proportion of households experiencing food insecurity are only rough orders of magnitude based on survey data identifying households with production deficits and general information regarding income constraints.

VI. SUMMARY AND DISCUSSION OF ON-GOING FOOD SECURITY CHALLENGES

The post-war tripling of smallholder maize production in Zimbabwe is remarkable. Average household food supplies sharply increased and rising crop sales improved average small farm incomes. Higher smallholder incomes fueled expanded investment in rural small-scale trade and commerce. Farmers invested more in their childrens' education. Most significantly, small farmers came to be recognized as important actors in the nation's agricultural economy.

In Zimbabwe's First Five Year National Development Plan covering the period 1986 to 1990, smallholder crop production was forecast to grow at an eight percent average annual rate (MFEDP, 1986). This optimism was based on the dramatic production record of the previous six years, and the belief that a strong institutional foundation for continuing growth had been laid. The expectation was that use and further expansion of these institutions would promote growth across a widening cross-section of the communal farm sector.

This study's analysis of factors underlying the post-war growth of smallholder production indicates that a new, supplementary set of investment strategies are required to broaden the scope of past production advances. These new investments must build upon an understanding of the strengths and limitations of past efforts, particularly considering the distinct needs of farmers still experiencing chronic and transitory food deficits. While the optimism of the latest development plan is partially warranted, the extension of post-independence production gains across a wider cross-section of the smallholder population will undoubtedly be more difficult. Before discussing these challenges, let's review findings from previous chapters about the factors associated with Zimbabwe's success story.

A. The Sources of Growth of Maize Production

This study has shown that no single factor explains the growth of smallholder maize production and sales during the post-war period. Rather, most of this growth must be attributed to a complementary set of changes in agricultural policies, institutions and technologies. Public sector actions were reinforced by private sector investments. The relative effect of these

programs was influenced by the level and quality of production resources available to various types of smallholder households.

The six most important causes of smallholder maize production growth were: a) the ending of the independence war, b) the expansion of product markets, c) the expansion of smallholder credit, d) the expansion of input markets, e) the maintenance of favorable producer prices and f) strong research and extension support.

1. Ending of the Independence War

One of the most significant explanatory factors for the growth of smallholder production was simply the ending of the independence war. This struggle had widely disrupted communal sector agriculture, particularly during the mid to late 1970s. Post-war estimates indicate up to one-third of all smallholders required resettlement assistance. Fields had been abandoned, farmers had left their homes and fewer new holdings had been created. In addition, significant portions of the limited agricultural infrastructure available to small farmers had been destroyed. In many parts of the country, extension workers themselves had been withdrawn.

Most of the estimated 85 percent increase in smallholder maize area, between 1979 and 1981, can be attributed to the ending of the war. Survey evidence from Mangwende and Chivi indicates substantial growth in producer numbers and widespread replanting of abandoned fields. Communal area and provincial level data show similar area growth throughout the country. Maize area expanded in the context of a 25 percent expansion in total cropped area in the smallholder sector. The amount of land planted to all other major smallholder sector crops, except millet, similarly increased. The larger relative growth in maize area corresponds with this crop's status as the principal smallholder food staple. The majority of the associated increases in production were retained for household consumption.

2. Expanded Access to Product Markets

Prior to independence most smallholders faced low farm gate prices because they had limited access to GMB buying outlets. By 1980, only three GMB depots had been established in the communal areas. Only three percent of

smallholders were registered to use these depots. While farmers could sell to GMB Approved Buyers, officially mandated prices were not enforced. Few transporters were available to provide farm-to-market deliveries.

By 1985, the GMB had established 14 communal area depots and 135 temporary collection points. Approved Buyers faced increased competition for their services. The number of locally based transporters rapidly expanded, particularly in regions with large and consistent marketable surpluses. At the time of 1985 harvests, 27 percent of the nation's smallholders were registered to sell crops to the GMB. The initial growth of maize sales corresponds closely with the expansion of market infrastructure.

3. Smallholder Credit

Smallholders first gained wide access to agricultural credit with the establishment of a major small farm credit program in 1978. By 1985, roughly 10 percent of communal farmers received agricultural loans. The expansion of credit access corresponds closely with the growth of fertilizer sales after independence. In Mangwende, three-quarters of all fertilizer purchases were funded with loans in 1986. Almost 90 percent of the fertilizer purchased in Chivi was funded by credit. Fertilizer adoption, in this low rainfall zone, corresponds with the initial receipt of AFC loans.

4. Input Suppliers

Private sector input suppliers rapidly expanded their services in the smallholder farming areas as the demand for their products increased. Fertilizer and agrochemical companies began promoting use of their inputs with village based sales and demonstration trials. Urban input wholesalers established branch outlets in rural growth points and the number of retail outlets expanded. Private sector investments expanded most in areas receiving the largest government investments in product market infrastucture credit.

5. Favorable Producer Prices

The influence of administered prices on smallholder production and sales depended on the distribution of access to GMB buying points. The sharp producer price increases in 1980 and 1981 primarily affected the small

proportion of farmers with good market access. When official producer prices declined (in real terms) after 1981, sales continued increasing as market infrastructure expanded. Between 1981 and 1984, real maize prices declined by more than 20 percent. Although drought reduced smallholder production levels during this period, maize sales increased a further 15 percent. In fact, maize sales in high potential Mangwende increased throughout the 1979 to 1985 period. In low rainfall Chivi, deliveries remained marginal except when several GMB collection points were temporarily established in 1985.

6. Research and Extension

The doubling of smallholder maize yields, between 1979 and 1985, was possible because improved production technologies were available. Decades of breeding research had produced maize hybrids broadly adapted to both high and low rainfall zones. Fertilizer trials had provided recommendations broadly attuned to communal area conditions, particularly to regions with better rains. A major portion of the payoff to this research only came after farmers obtained improved access to these inputs, and once the production of a marketable surplus became profitable.

Between 1979 and 1985, hybrid seed sales increased roughly fivefold. Smallholder sales of fertilizer increased by more than 400 percent. New interest in improved technologies sparked trials with herbicides and insecticides.

B. The Limits on Future Maize Output Growth

Much of the growth in smallholder maize production can be directly or indirectly attributed to the ending of the independence war and establishment of majority rule. These gains exemplify the economic losses resulting from restricting the scope of government and private sector agricultural initiatives. Yet the time has now come to reassess how best to capitalize upon these advances. The pronouncements of the National Development Plan notwithstanding, the recent growth in smallholder maize production is unlikely to continue. The limits facing each of the above factors supporting growth should be recognized. As discussed below, new policies and programs need to

be defined that extend and expand the post-war gains in smallholder productivity and food security.

From a macro perspective, the sudden and substantial growth in maize area associated with the ending of the war will not be repeated. While population growth may stimulate further increases in crop area planted, this expansion will not approach the magnitude of the immediate post-war gain. The capacity for continuing expansion of smallholder crop land is unclear. The perception of severe communal sector land constraints has provided a major justification for government investments in the resettlement of small farmers onto large-scale farms. The extension service is now actively restricting the expansion of smallholder crops onto lands previously set aside for grazing. And the overall pace of resettlement has slowed. This implies that most future gains in smallholder crop production will need to be derived primarily from technological change.

Likewise, the coincidence of large national coarse grain stocks, downward pressure on coarse grain prices, mounting input costs, and a large and rising government budget deficit, calls for improved productivity in the use of farm and government resources. There have been major benefits for domestic consumers (both rural and urban) of having large national maize stocks from which drought relief programs could be mounted. There are, however, very high costs associated with creating and maintaining such large maize stocks.

Ultimately, the further expansion of these stocks will not prove viable unless maize can be exported at an economic profit. Much of Zimbabwe's maize exports since independence have been made at a financial loss. A major objective of programs aiming to further expand smallholder maize production, destined for the national as well as international market, must be to improve farmer profitability while reducing production costs. To the extent that national maize output increases with constant or even declining real costs, food security of poor households purchasing maize can be more easily improved.

A major part of the post-war growth in smallholder maize yields resulted from the widespread adoption of hybrid seed. Rapid adoption by farmers in both high and low rainfall zones is attributable to the large yield advantage over the old open pollinated varieties, with or without fertilizer. Correspondingly, by 1986, roughly 80 percent of smallholder maize land was

planted to these hybrids. Extension of this coverage may require the development of new shorter season hybrids suitable to the country's drought prone regions. Yet the national maize breeding program is concentrating on the development of improved medium season hybrids more suitable to the higher rainfall zones (Olver, 1986).

Based on the current study, it does appear that there is considerable scope for increasing the technical and allocative efficiency with which current cropping technologies are employed. For example, the wide variability in rates of fertilizer application does not simply correspond with the quantities of fertilizer each household can purchase, nor with different soil conditions. And the causes of widely variable responses to similar rates of application requires further investigation. One reason for the latter results found in the current study is that many farmers are applying basal fertilizer to maize long after the period of optimal response.

Similarly, extension recommendations must be more closely tied with the changing profitability of input investments. The effect of rising fertilizer costs on maize profitability has not been reflected in extension advice. In fact, little economic evaluation of extension recommendations for the smallholder sector was even conducted during the immediate post-independence period. This study has shown that most farmers were rejecting most extension worker advice, particularly for crops other than maize. Both the research and extension services need to be asking why.

Maize yield gains also resulted from the adoption and higher rates of application of fertilizer. Capital constraints and the risks of losses resulting from drought have limited adoption of fertilizer in the smallholder sector's dominant low potential zones. Further, as fertilizer prices increased relative to maize product prices during the mid-1980s, the profitability of fertilizer investments declined. Correspondingly, the rate of growth in fertilizer purchases has substantially slowed.

These problems are mirrored in the limited coverage of national credit programs, the slowing of credit dispersement and rising repayment arrears. Based on farm survey evidence, rates of fertilizer application in both high and low rainfall areas are closely linked with the receipt of credit. While two-thirds of the small farmers in high potential Mangwende have received

credit, fewer than ten percent of those in low rainfall Chivi have received loans. More significantly, over half of the farmers in Mangwende who received credit between 1980 and 1985, no longer received loans in 1986. Yet credit recipients in Mangwende and Chivi account for 72 percent and 88 percent of fertilizer purchases, respectively. Limits in credit allocation translate into limits in the growth of fertilizer usage. And despite the slowing in credit dispersement, the AFC has encountered a growing level of arrears.

Agricultural services and infrastructure require strengthening, in part, through better targeting. Recognizing these problems, the AFC has already begun to decentralize its operations in order to improve responsiveness to farmers' needs. The goal is to better identify credit worthy households, improve the tailoring of credit packages to location-specific needs and resolve repayment constraints in a more timely fashion. In the past, the AFC has faced pressure to rapidly increase the number and value of loans provided to the smallholder sector. The decentralization exercise should aim to improve the efficient use of borrowed funds. Overall, capital shortages appear to be among the most significant constraints limiting crop production investments. Besides improving existing operations, the AFC must actively seek new measures, such as group lending and local savings mobilization, to help promote agricultural investment.

While the number of GMB depots continues to expand, financial constraints have limited the establishment of seasonal collection points. In 1985, many regions sold grain to the GMB for the first time, because of the establishment of a nearby collection point. Most of these temporary buying centers have not been reconstructed. Questions remain how best to assist the majority of smallholder farming areas which are characterized by generally low and variable crop sales.

The GMB has recognized the need to assess the economic viability of depots and collection points, particularly those placed in lower rainfall areas. If marketing services are to expand, in both high and low potential zones, public sector initiatives may be required to stimulate investments by the private sector. For example, high GMB stockholding costs argue for the abolition of pan-seasonal producer prices so as to provide incentives for private traders to carry inventories. Also in some regions, investments in

transport infrastructure, including loans for trucks, may be more appropriate than the establishment of additional buying points.

C. Strategies for Improving Household Food Security

Evidence reviewed throughout this report testifies to the importance of the distinction between the growth in aggregate, national maize supplies and improvements in household food security. While maize production growth has contributed importantly to national food security, significant portions of the smallholder population continue to face production and consumption deficits. Large maize stocks have provided the basis for the almost perennial domestic drought relief programs instituted in Zimbabwe since independence. Yet greater and more consistent improvements in household food security require special attention to the needs of the 40 percent of Mangwende and Chivi farmers identified as transitional, and the 40 percent classified as semi-subsistence producers.[1]

Much more needs to be learned about viable ways to raise incomes of this target population. The evidence derived from this study indicates at least 60 percent of small farm households suffer transitory food production insecurity during the frequent years of widespread mid-season dry spells and drought. These are farmers who have little or no involvement selling grain in national markets.[2] Roughly, 15 percent of all smallholders, concentrated in the semi-arid regions, appear to suffer chronic food deficits.[3] These farmers consistently do not produce adequate grain to meet household consumption requirements and have difficulty purchasing enough food to make up their production deficits.

The Mangwende and Chivi farm surveys reveal that most households experiencing production deficits earn the dominant share of their cash income

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[1]See Table 10.

[2]As of March 1986, only 37 percent of smallholders were registered to sell crops directly to the GMB.

[3]This estimate takes account of the results of Chibi farm surveys, Chibi's relative agroecological conditions and the limited results of nutritional surveys conducted in the smallholder farming regions (World Bank, 1984).

from enterprises other than crop production. These include the manufacture of handicrafts, beer brewing, working for others during the winter season and, most significantly, wage remittances. These cash sources provide the means to purchase (or earn) food necessary to make up production shortfalls.

Thus it is clear that small farm food insecurity cannot simply be considered a production problem. It is also an income problem. In low rainfall regions, food security of some households may be more easily obtained from the expansion of off-farm employment and non-farm income generation opportunities than from efforts to expand crop production. Interventions facilitating petty commerce and the flow of remittances back to farm households can provide a more steady stream of household income and food. And most smallholder households experiencing food insecurity are based in these low rainfall regions.

Even so, most of Zimbabwe's smallholders will continue to rely on their own crop production for their principal source of food for the foreseeable future. In this context, agricultural research and technical assistance must aim to promote higher and more consistent crop yields derivable from technologies requiring relatively little capital investment.

It is important to note that even poor farmers have shown a ready willingness to adopt improved technologies, such as hybrid maize seed. While farmers complained that the cost of this seed limits the area they can plant, virtually 100 percent of the maize area in both Mangwende and Chivi was planted with new seed. Though concerned about costs, these farmers also recognized the opportunity to obtain substantial yield gains.

Most households facing continuing or frequent production deficits will not, in the short run, benefit from the further expansion of product market infrastructure. Rising official product prices could be detrimental (at least in the short run) to the food security of this population. Instead, greater benefits may be achieved by improving rural consumer markets and to reducing grain selling prices in rural areas. Likewise, food insecure households do not represent good credit risks, and will likely not benefit from expanded AFC programs, unless, perhaps, these are restructured to facilitate the recovery of resources lost during drought years.

The majority of smallholders based in the nation's semi-arid areas are growing maize. Many have allocated an increasing proportion of their land to this crop, despite extension worker advice to plant more drought tolerant sorghum and millet. A major reason for this is the lack of improved sorghum and millet varieties. Research on these crops has lagged, and has only received serious research attention in recent years. Until improved varieties are available, farmers in the low rainfall regions will likely continue growing more maize.

Priority should also be placed on developing improved water harvesting technologies that do not require substantial capital investments. Such research is difficult given the variability of rainfall in the majority of smallholder farming regions, and its payoff may not be seen in a larger flow of grain to the market. The longer-run returns, however, may be reflected in less dependence on drought relief programs or in the improvement of child nutrition.

Food security payoffs may also be achieved through research investments to improve crop processing and storage. One justification advanced for the preference for maize over more drought tolerant small grains is the difficulty of small grain processing. Whereas maize can be brought to the ubiquitous hammermill in rural areas, small grains must be hand pounded. Sorghum dehullers are being introduced to reduce this labor burden. For still unknown reasons, the dehullers have experienced quite variable and limited success.

The limited storage life of hybrid maize is well known. Farmers commonly acknowledge this to be eight to nine months, just enough to bring the household to the next green maize harvest. Too little research has been conducted to identify measures to improve maize storage practices.

Finally, much more attention should be paid to the integration of crop and livestock systems. Seventy-five percent of smallholder farming areas in semi-arid zones are classified as agroecologically most suited to livestock production. Yet efforts to improve the livestock production systems of smallholders have been limited. A few grazing schemes have been established, although with heavy public sector subsidies. These farmers have periodically been called upon to increase their livestock marketing, although little effort

has been made to investigate and improve upon traditional grazing and marketing systems.

D. Concluding Observations

This investigation sought primarily to identify the sources of the rapid growth in smallholder maize production and sales during the post-independence period. Although the relationship between production growth and food security was examined, most observations regarding household consumption levels and food security strategies are indirect, and some should be considered as preliminary. Nonetheless, important observations about the link between smallholder maize production growth and food security can be drawn.

Most importantly, while rapid growth in maize production may be a necessary condition for food security in Zimbabwe, it is not a sufficient condition. The ultimate objective of food security is to ensure all households have consistent access to enough food for a healthy life. Zimbabwe's rapid maize production growth and the build up of national maize stocks contributed to this objective, but did not ensure its fulfillment. While maize production grew or increased throughout the smallholder sector, these gains were largest among the better endowed households. Most income gains derived from the increasing maize sales went to households facing few, if any, food consumption constraints.

Households experiencing food production insecurity were undoubtedly better off as a result of these production gains. First, maize production of many of these households increased. Perhaps as important, when production fell short, they could more readily rely on maize markets and maize based drought relief. Average consumption levels may have even improved. Yet it appears that many, if not the majority, of smallholder households continue to experience both short term and chronic food production deficits.

Rapid growth in aggregate smallholder production ought to be pursued, especially if done through cost reducing technology that can keep maize prices for rural and urban consumers at affordable levels. In addition, special assistance may need to be targeted toward households, in both high and low potential zones, facing persisting food consumption deficits. Broadly focussed agricultural development programs may have the best chance of

reaching small farmers who are relatively well endowed. Targeted food security programs can be correspondingly aimed at poorer households less likely to benefit from more generalized efforts to maximize the growth in marketed production.

Most Zimbabwean smallholders live in relatively low potential agroecological zones. A significant proportion of these farm households are net food buyers in any given year. A much higher proportion are net food purchasers following Zimbabwe's frequent years of drought. And most households facing production deficits also suffer severe income constraints. The limited available evidence indicates that these families derive the largest share of the cash with which to purchase food from off-farm and non-farm sources.

Food security policies should therefore encompass development strategies affecting food access as well as food supply. They must distinguish the advantages of high GMB stocks to be used for drought relief and market stabilization, from the gains associated with making individual households more self-reliant. Such policies should not promote continuing dependence on a perennial series of drought relief programs. Rather, the aim should be to promote better use of severely limited resources, and perhaps ultimately facilitate reliance on enterprises other than maize production.

Finally, this investigation highlights the importance of a wide range of interrelated factors influencing smallholder production opportunities and incentives. No single factor alone can stimulate expansion of food output and impovements in food security. Where access to formal sector markets was constrained, the effect of higher official prices was limited. When market infrastructure expanded, farmers responded despite declining real product prices. Fertilizer use was more closely tied to the availability of credit than fertilizer prices. The majority of post-war maize production gains would not have been possible without improved technologies. Likewise, public and private sector investments were complementary.

Food security in Zimbabwe improved as a result of the dramatic growth of smallholder maize production at independence. Exploitation of the production potential of the small farm sector brought the rapid expansion of domestic food supplies and national grain stocks. Many of Zimbabwe's small farmers

still face transitory and even chronic production shortfalls, and new programs of assistance will be required to extend the recent production and income gains. Yet the potential smallholder response to improved production opportunities and incentives has clearly been shown. Such bodes well for Zimbabwe's agricultural future.

APPENDICES

APPENDIX A: ZIMBABWE AGRICULTURAL SECTOR DATA

Table A.1 Zimbabwe: Cereal Production, 1970-1986

Harvest Year	Cereal Production (000 MT)
1970	1439
1971	2274
1972	2705
1973	1295
1974	2530
1975	2197
1976	2316
1977	2049
1978	2124
1979	1517
1980	1949
1981	3310
1982	2205
1983	1219
1984	1588
1985	3562
1986	3096

Source: FAO Production Tapes (1987).

Table A.2 Zimbabwe: Distribution of Farm Land, 1980

	Large Scale Commercial	Small Scale Commercial	Communal
Total Area (%)	46.9	4.2	48.9
Number of Farms	6000	8500	800000
Average Farm Size (HA)	2200	125	23[a/]
Area Under Cultivation(%)	3.5	5.3	10.5(est)

[a/] Includes grazing land owned and used by the community.

Sources: CSO (1985a); CSO (1985b).

Table A.3 Zimbabwe: Smallholder Maize Production Data, 1984/85

Province	Maize Area (000 HA)		Maize Yield (MT/HA)		Maize Production (000 MT)	
	AGRITEX	CSO	AGRITEX	CSO	AGRITEX	CSO
Midlands	361	192	1.3	1.8	465	342
Masvingo	250	165	0.8	1.9	200	312
Manicaland	165	169	1.6	1.8	259	306
Mash. East	127	97	1.8	1.8	235	173
Mash. West	88	84	2.3	2.6	206	219
Mash. Central	66	80	2.4	2.9	157	233
Matab. North	61	62	1.0	1.0	60	63
Matab. South	58	39	1.4	1.5	83	58
TOTAL	1175	887	1.4	1.9	1666	1706

Note: Numbers may not add up due to rounding.

Sources: AGRITEX (various years); CSO (1985).

Table A.4 Zimbabwe: Maize Production, 1970-1986 (1000 MT)

Harvest Year	Large and Small-Scale Commercial	Communal	Communal as % of Total a/
1970	839.6	245.7	22.6
1971	1400.5	455.0	24.5
1972	1762.1	555.1	24.0
1973	810.4	145.0	15.2
1974	1634.4	470.0	22.3
1975	1328.1	435.0	24.7
1976	1287.8	550.0	29.9
1977	1213.3	400.0	24.8
1978	1178.2	450.0	27.6
1979	740.0	420.0	36.2
1980	925.0	600.0	39.3
1981	1833.4	1000.0	35.3
1982	1213.4	595.0	32.9
1983	624.8	285.0	31.3
1984	678.4	454.4	40.1
1985	1153.0	1558.0	57.5
1986	1197.6	1200.0	50.1
1987(est)	461.4	360.0	43.8

a/ These totals do not include resettlement sector production.

Sources: Data for 1970-85 - CSO (1987); AMA (1985); AMA (1986). [The AMA reports provided estimates of small-scale commercial production missing from the CSO data.]

Data for 1986-7 - CSO (various years).

Table A.5 Zimbabwe: Maize Area, 1970-1987 ('000 HA)

Harvest Year	Large and Small-Scale Commercial	Communal	Communal as % of Total a/
1970	292.0	610.8	67.7
1971	304.0	672.0	68.9
1972	338.0	664.7	66.3
1973	315.3	475.0	60.1
1974	311.1	725.0	70.0
1975	278.2	725.0	72.3
1976	257.3	760.0	74.7
1977	264.4	600.0	69.4
1978	273.1	700.0	71.9
1979	221.0	600.0	73.1
1980	249.0	900.0	78.3
1981	363.4	1000.0	73.3
1982	316.4	1100.0	77.7
1983	283.9	1050.0	78.7
1984	224.6	1136.0	83.5
1985	238.0	1018.0	81.1
1986	240.0	1000.0	80.6
1987(est)	145.7	900.0	86.1

a/ These totals do not include resettlement sector production.

Sources: Data for 1970-85 - CSO (1987); AMA (1985); AMA (1986). [The AMA reports provided estimates of small-scale commercial production missing from the CSO data.]

Data for 1986-7 - CSO (various years).

Table A.6 Zimbabwe: Maize Yields, 1970-1986 (KG/HA)

Harvest Year	Large and Small-Scale Commercial	Communal	Communal as % of Commercial
1970	2875	402	14.0
1971	4607	677	14.7
1972	5213	835	16.0
1973	2570	305	11.9
1974	5254	648	12.3
1975	4774	600	12.6
1976	5005	724	14.5
1977	4590	667	14.5
1978	4314	643	14.9
1979	3699	700	18.9
1980	4066	667	16.4
1981	5044	1000	19.8
1982	3835	595	15.5
1983	2201	271	12.3
1984	3021	400	13.2
1985	4844	1394	28.7
1986	4990	1200	24.0
1987(est)	3167	400	12.6

a/ These totals do not include resettlement sector production.

Sources: Data for 1970-85 - CSO (1987); AMA (1985); AMA (1986). The AMA reports provided estimates of small-scale commercial production missing from the CSO data.]

Data for 1986-7 - CSO (various years).

Table A.7 Zimbabwe: Maize Sales to GMB, 1970-1987 ('000 MT)

Harv. Year	Large Scale Commercial	Small Scale Commercial	Reset-tlement	Communal	Communal as % of Total
1970	616.0	a	-	12.0	
1971	1061.0	a	-	51.0	
1972	1340.0	44.2	-	14.8	1.1
1973	540.0	a	-	11.0	
1974	1290.0	33.2	-	13.8	1.0
1975	958.0	31.3	-	17.7	1.8
1976	875.0	50.7	-	33.3	3.5
1977	856.8	45.1	-	39.2	4.2
1978	813.4	33.2	-	30.4	3.5
1979	473.7	18.8	-	19.4	3.8
1980	728.6	19.7	-	66.6	8.2
1981	1650.6	72.8	b	290.5	14.4
1982	1021.9	53.0	b	316.4	22.7
1983	464.5	15.4	b	137.0	22.2
1984	552.0	55.7	b	334.3	36.7
1985	1009.0	152.1	b	666.9	36.5
1986(est)	983.6	39.0	105.0	557.5	33.1
1987(est)	290.0	15.4	56.3	134.8	27.2

a = included in communal estimates
b = included in small scale commercial estimates

Sources: LSC data 1970-76: Muir-Leresche (1985).
1977-85: AMA (various years).
1986-87: CSO (various years).

SSC data 1970-76: Muir-Leresche (1985) minus communal data from GMB files.
1977-85: AMA (various years) minus communal data from GMB files.
1986-87: CSO (various years).

Communal data 1970-87: [except 1970, 71, 73] from GMB files; 1970, 1971 and 1973 from Muir-Leresche (1985).

Table A.8 Zimbabwe: Maize Stocks, Purchases and Sales, 1970-86 ('000 MT)

Harvest Year	Purchases		Sales		Closing Stocks
	Local	Imports	Local	Exports	
1970	628.0	-	410.0	243.0	59.0
1971	1112.3	-	310.5	716.5	142.0
1972	1400.2	-	213.9	891.2	412.0
1973	550.4	-	446.5	356.8	158.0
1974	1336.9	169.0	371.4	710.0	408.0
1975	1006.9	-	386.5	758.2	263.0
1976	958.5	-	392.7	297.3	530.0
1977	941.1	-	503.9	419.7	538.0
1978	877.0	-	545.3	553.5	310.0
1979	511.9	149.0	635.1	265.2	64.8
1980	814.8	83.4	716.1	86.3	157.9
1981	2013.8	-	664.9	305.1	1200.7
1982	1391.3	-	1046.2	492.0	1035.1
1983	616.9	-	1273.2	252.3	122.7
1984	942.0	269.0	860.0	-	462.0
1985	1828.0	-	560.0	285.0	1445.0
1986(est)	1678.0	-	650.0	480.0	1993.0

Source: AMA (various years).

Table A.9 Zimbabwe: Maize Prices, 1970-1986

Harvest Year	Pre-planting Price	Prescribed Price a/	Final Price	Selling Price
1970	-	32.97	38.43	46.33
1971	-	30.05	32.51	46.33
1972	-	25.88	30.38	46.56
1973	-	36.37	38.17	46.56
1974	-	40.11	43.51	43.24
1975	-	37.00	48.25	51.54
1976	42.00	44.00	48.00	51.54
1977	46.00	52.00	52.00	51.54
1978	48.00	53.00	53.00	57.07
1979	56.00	60.50	60.50	63.00
1980	75.00	85.00b/	85.00	89.00
1981	120.00	120.00	120.00	137.00
1982	-	120.00	120.00	137.00
1983	-	120.00	120.00	157.00d/
1984	140.00	140.00c/	140.00	177.00e/
1985	180.00	180.00	180.00	222.00f/
1986	-	180.00	180.00	222.00
1987	-	180.00	180.00	222.00

a/ = grade A maize
b/ = $5/tonne bonus for 15% incr in area planted; early delivery bonus: $10/tonne to 30 April; $5/tonne to 31 May.
c/ = early delivery bonus: $20 to 30 April; $15 for May; $10 for June.
d/ = with effect from 5 Sept 83.
e/ = with effect from 20 July 84.
f/ = with effect from 1 Aug 85.

Sources: AMA (1985), AMA (various years).

Table A.10 Zimbabwe: Fertilizer Prices, 1971-1986 (Z$/tonne ex-Harare)

Cropping Season	Comp D	AN
1971/72	55.40	63.20
1972/73	55.40	63.20
1973/74	55.40	63.20
1974/75	66.60	74.20
1975/76	91.40	127.40
1976/77	99.40	116.40
1977/78	106.00	129.40
1978/79	114.20	138.80
1979/80	128.20	141.60
1980/81	154.00	168.20
1981/82	168.00	187.20
1982/83	189.40	206.80
1983/84	189.40	206.80
1984/85	331.00	347.21
1985/86	355.60	406.00
1986/87	355.60	406.00

Source: Windmill (1986)

Table A.11 Zimbabwe: Population, 1970-86. ('000)

Year	Population	Year	Population
1970	5400	1979	7240
1971	5590	1980	7480
1972	5780	1981	7730
1973	5980	1982	7600
1974	6180	1983	7820
1975	6390	1984	8047
1976	6600	1985	8280
1977	6810	1986	8520
1978	7020	1987	8767

a = based on projection from 1982 census estimate of 2.9% annual population growth rate.

Source: CSO (1986b)

Table A.12 Zimbabwe: Land Distribution by Natural Region, 1980 ('000 HA)

Natural Region		Large Scale Commercial		Small Scale Commercial		Communal	
		HA	%	HA	%	HA	%
I:	Specialized and diversified	430	2.7	10	0.7	140	0.9
II:	Intensive	4330	27.6	250	17.6	1270	7.8
III:	Semi-intensive	3240	20.7	540	38.0	2820	17.2
IV:	Semi-extensive	4020	25.7	520	36.6	7340	44.9
V:	Extensive	3650	23.3	100	7.0	4780	29.2
TOTAL		15670	100.0	1420	99.9	16350	100.0

Source: CSO (1985a).

Table A.13 Zimbabwe Rainfall, 1969-1986 (mm)

Year	Belvedere Meterological Station			Chivi Central Station		
	January	February	Total	January	February	Total
1969	187.6	61.0	248.6	117.3	24.5	141.8
1970	83.6	37.3	120.9	2.0	46.0	48.0
1971	132.6	129.8	262.4	275.8	17.5	293.3
1972	352.3	149.6	501.9	302.4	130.1	432.5
1973	193.4	22.8	216.2	94.0	18.5	112.5
1974	141.8	324.0	465.8	97.6	103.7	201.3
1975	115.2	348.4	463.6	94.8	160.4	255.2
1976	265.0	107.8	372.8	66.1	164.6	230.7
1977	101.8	385.4	487.2	54.5	350.2	404.7
1978	280.7	246.3	527.0	178.0	54.5	232.5
1979	161.7	67.0	228.7	101.0	90.5	191.5
1980	102.5	93.7	196.2	74.5	175.0	249.5
1981	140.8	394.5	535.3	254.1	105.0	359.1
1982	138.2	185.2	323.4	169.5	74.5	244.0
1983	115.9	57.0	172.4	27.0	34.6	61.6
1984	115.8	124.8	240.6	26.5	107.0	133.5
1985	379.1	107.8	486.9	277.0	84.2	361.2
1986				70.0	0.0	70.0

Sources: 1969-85 Meterological Service.
1986 FSRU (personal communication).

ABBREVIATIONS

AFC	Agricultural Finance Corporation
AGRITEX	Agricultural, Technical and Extension Services
AMA	Agricultural Marketing Authority
ARDA	Agricultural and Rural development Authority
CSO	Central Statistical Office
DR&SS	Department of Research and Specialist Services (also R&SS)
FAO	United Nations Food and Agricultural Organization
FMRS	Farm Management REsearch Section, Economics and Markets Branch, Ministry of Agriculture, Lands and Rural Resettlement
FSRU	Farming Systems Research Unit, Department of Research and Specialist Services
GMB	Grain Marketing Board
GRZ	Government of the Republic of Zimbabwe
MEU	Monitoring and Evaluation Unit, Agricultural, Technical and Extension Services
MFEDP	Ministry of Finance, Economic Development and Planning

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