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Areas of Zimbabwe: Household Food Security Implications

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Charles John Chopak

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Richard N. Bernsten
Major professor

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DETERMINANTS OF RURAL INCOMES IN COMMUNAL AREAS OF ZIMBABWE:
HOUSEHOLD FOOD SECURITY IMPLICATIONS

By

Charles John Chopak

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Department of Agricultural Economics

1991

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ABSTRACT

DETERMINANTS OF RURAL INCOMES IN COMMUNAL AREAS OF ZIMBABWE: HOUSEHOLD FOOD SECURITY IMPLICATIONS

BY

Charles John Chopak

At least 100 million people live in absolute poverty in Sub-Saharan Africa. Although Zimbabwe is a grain surplus nation, a large portion of their population is food insecure. Furthermore, a lack of reliable data about the rural population has made it difficult for government to design policies to expand economic opportunities for the rural poor.

This thesis analyzes the structure, level, and determinants of incomes in low rainfall areas of Zimbabwe to suggest alternative development strategies to expand income-earning opportunities for poor, rural households. The data were collected in twelve villages in Natural Regions IV (Mutoko and Mudzi Districts) and V (Buhera District) during the 1988/89 agricultural season, using a three-stage stratified-random sample procedure.

Household incomes were higher in Mutoko and Mudzi than in Buhera. Although the distribution of incomes was highly unequal across districts, it was more unequal in Buhera.

Households access to land, labor, and capital was greater in Buhera than in Mutoko/Mudzi. Although the distribution of land and labor was relatively equal across districts, oxen ownership was highly unequal.

The environmental milieu was more favorable in Mutoko/Mudzi, where rainfall was substantially higher and less variable than in Buhera. Although government has made major investments to strengthen rural

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services, the survey villages have benefitted minimally.

Inter-household variability in total and agricultural income was largely due to differential access to physical resources. In contrast, labor characteristics determined whether households participated in local labor markets.

Finally, policies that have driven Zimbabwe's agricultural revolution have had minimal (or negative) impact on resource-poor households. While government has limited ability to increase the agricultural productivity of the resource-poor households in the short run, government can help the rural poor by expanding food distribution schemes, public employment schemes, and human capital development. In the longer run, new technologies are required to reduce environment-related production risk, including soil and water conservation, crop improvement, and small-scale irrigation. Yet, to assist resource-poor households, future rural development programs must both increase agricultural productivity and expanding access to land (land resettlement), social services, and rural employment opportunities.

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Honey, Mom, Dad, this is for you!

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[illegible]	Coefficient
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ABBREVIATIONS

Organizations

AFC	Agricultural Finance Corporation
AGRITEX	Agricultural, Technical and Extension Services
AMA	Agricultural Marketing Authority
ARDA	Agricultural and Rural Development Authority
CMB	Cotton Marketing Board
CSC	Cold Storage Commission
CSO	Central Statistics Office
DMB	Dairy Marketing Board
DR&SS	Department of Research and Specialist Services
ENDA	Environment and Development Agency
FAO	Food and Agricultural Organization (U.N.)
GMB	Grain Marketing Authority
IFPRI	International Food Policy Research Institute
ROZ	Republic of Zimbabwe
SADCC	Southern Africa Development Coordination Conference
SEDCO	Small Enterprise Development Corporation

Technical terms

Income and expenditures

AEE	Expenditures per adult equivalent
CIGA	Cash income generating activities
CX	Consumption expenditures
HC	Home consumption
IGS	Intermediate goods
INV	Investment
INVNT	Inventory (ending)
NCR	Net credit receipts
NHI	Net household income
NHR	Net household receipts
NR	Natural Region
PCE	Per capita expenditures
PHC	Production for home consumption
TAE	Total annual expenditures
TRI	Transfer received (in)
TRO	Transfers given (out)

Inequality

CV	Coefficient of variation
SDL	Standard deviation of the natural log of income

[illegible]

[illegible]	Hectares
[illegible]	Kilocalories
[illegible]	Millimeters
[illegible]	Metric tons

Measurement

HA	Hectares
KCALS	Kilocalories
MM	Millimeters
MT	Metric tons

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CHAPTER I

INTRODUCTION

1.1 Who are the world's poor?

There are at least 100 million people living in absolute poverty in Sub-Saharan Africa (FAO, 1986). They lack access to sufficient resources to acquire their basic food, clothing, and shelter requirements needed to lead a healthy and active life[1].

Although the world's poor are a heterogeneous group, they have many similarities. The rural poor typically live in marginal agricultural areas, have poor access to institutions, and have limited voice in the policy process. First, the poor typically reside in deserts, coastal wetlands, mountainous areas, and other areas of the world with insufficient environmental stability (e.g., rainfall, soil quality, and landscape) to sustain the existing population (Leonard, 1989 and Chenery, 1974).

Second, the poor have had limited access to education, and are employed on the fringe of the market economy as small farmers, shifting cultivators, artisanal fisherman, small livestock keepers, nomadic herdsman, landless laborers, or small artisans (FAO, 1986).

Third, the poor have limited access to services such as credit, extension, and marketing outlets. Given their poor resource base and skill level, these limitations restrict their ability to break the poverty cycle.

Finally, the poor are often politically and socially disenfranchised, and live in rural areas (Al-Sudeary, 1983).

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[1]This definition combines aspects of Sen's concept of entitlement (1985) and the World Bank's of food security (1986).

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These characteristics of the rural poor make it both difficult and costly to collect the necessary data to understand their situation. Consequentially, policies are often designed with insufficient understanding of the poor's aspirations, abilities, and constraints. Policies built on such misunderstandings are likely to produce uncertain results. In order to design policies that effectively increase rural incomes, it is imperative to study the economic, environmental, and cultural realities of the poor.

1.2 Problem statement

1.2.1 Zimbabwe's development objectives

The Government of Zimbabwe's *First Five-Year National Development Plan* (1986-1990) clearly outlined the government's aspirations as:

> "the establishment and development of a democratic, egalitarian and socialist society whose main aim is the development and enhancement of the mental and cultural faculties, as well as efficient production and distribution of goods and services in order to raise the living standards of all Zimbabweans (Republic of Zimbabwe, 1986)."

The plan highlighted the following six broad objectives for the overall economic development of Zimbabwe: (1) transformation and expansion of the economy, (2) land reform and increasing the efficiency of land usage, (3) higher living standards for the entire population, especially the rural population; (4) employment creation and manpower development; (5) development of science and technology and (6) the need to incorporate environmental concerns into development programs. Of these six broad objectives, four impact directly on the well-being of the rural population: land reform, enlargement of employment opportunities and manpower development, higher rural living standards, and incorporating environmental concerns into development programs.

First, land reform, a major objective in the countries struggle for Independence, continues to be an important issue. At independence, land ownership was highly skewed. Although communal farmer-households [illegible] 40 percent

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represent 40 percent of the population, 74 percent of their land is in Natural Regions IV and V (CSO, 1986), agroclimatic regions considered marginal for agricultural production. Under the *Lancaster Agreement*, government agreed not to appropriate land from commercial farmers, but that land would be sold on a willing seller and willing buyer basis. Little land has been redistributed since Independence[2]. To date, primarily only commercial farmers in more marginal areas have offered land for sale. Also, budget constraints have prevented the government from purchasing all of the land offered for sale.

Second, the government has had varied success in improving employment opportunities and manpower development. Although constrained by a shortage of resources, the government greatly improved rural access to primary and secondary education. Between 1980 and 1985, the enrollment in primary and secondary schools increased by 171 percent and 628 percent, respectively. Although government education expenditures increased by 130% during this period (CSO, 1986), additional investment is needed to improve the quality of both primary and secondary education, especially in rural areas. On the other hand, the government has had less success at improving employment opportunities in both rural and urban areas of the country. For example, between 1980 and 1985, only one in ten school-leavers found work in the formal sector (CSO, 1986).

Third, to increase the economic and social well-being of the rural population, the government has sought to raise rural incomes by increasing agricultural productivity, and extending social and economic services to all rural areas (Republic of Zimbabwe, 1982). Between 1980 and 1985, government greatly increased expenditures to improve social services such as health (103 percent) and education (130 percent); and

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[2]Although the government intended to resettle 162,000 families by 1984, only 52,000 families had been resettled by 1989 (Palmer, 1990).

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agricultural services such as extension (453 percent) and veterinary services (303 percent) (CSO, 1986).

Finally, the government has sought to repair the damage done to the environment as a result of deforestation, over-population, and overgrazing. The most extensive and severe soil degradation in Zimbabwe occurs in communal areas, representing approximately 3.8 million acres (Whitlow, 1988). Although the government currently promotes several environmental programs--including rural reforestation, land resettlement, and more emphasis on agricultural and conservation in schools--these programs have fallen short, given the enormity of the task.

1.2.2 Constraints in achieving the development objectives

Government has experienced difficulty in achieving its objectives for two reasons. First, macroeconomic constraints have limited the number of interventions that the government has been able to initiate to improve rural living standards. Shortages of foreign exchange, budgetary shortfalls, inability to import foreign goods, foreign and domestic trade restrictions, and a large external debt (Zvinavashe, 1990) have been severe constraints since Independence. These problems are the consequence of both internal policies (interest rate, exchange rate, budget deficit, and trade policies) and external shocks (global recession, strong U.S. dollar, and foreign trade policies).

Second, a lack of reliable data about the rural population's characteristics and household objectives has made it difficult for government to design and target policies to increase access to economic opportunities for lower income households. Many researchers have highlighted the need to gain a better understanding of the structure, level, and distribution of rural incomes as a precondition for effective policy design (Eicher and Baker, 1982 and World Bank, 1983).

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1.2.3 Zimbabwe's agricultural sector and food security

Compared with other African countries, Zimbabwe has been relatively successful in increasing food production; and creating large stocks of maize, millets, and sorghums. Policies adopted since 1980 that have stimulated agricultural sector include guaranteed prices for small grains, increased producer prices for grain and cash crops, improved access to output markets, increased availability of credit, and the expansion of extension services (Rukuni, forthcoming)[3].

Every year since Independence (except 1984), Zimbabwe produced enough coarse grains (aggregate calories) needed to meet recommended energy requirements. For example, in 1982 and 1987 the energy equivalent value (kcals) of total domestic grain production (maize, millets, and sorghums)[4] equalled 118 percent and 149 percent, respectively, of the total recommended annual domestic energy requirements (kcals)[5]. Further evidence that Zimbabwe produces enough coarse grains to meet aggregate energy needs is the fact that between 1985 and 1987, the closing stocks of maize, millets, and sorghums held by the Grain Marketing Board (GMB) rose from 462,000 to 1,806,000 metric tons, 4,360 to 89,000 metric tons, and 11,000 to 101,000 metric tons, respectively (GMB, various years).

Yet, caloric equivalents and stock surpluses mask the prevalence of household food insecurity. National food availability does not guarantee individual household food security--defined "as a situation in

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[3]For more details see Chapter 2.

[4] The energy equivalent of domestic grain production was calculated as the summation of the energy composition of the edible portion of annual domestic grain production (Republic of Zimbabwe, 1987).

[5] The total recommended annual energy intake for Zimbabwe (kcals) was calculated as a summation of the recommended annual caloric intake needs given its age-sex distribution (World Health Organization, 1985 and Republic of Zimbabwe, 1986).

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which all individuals in a population have access to a nutritionally adequate diet" (Eicher and Staatz, 1985). Recent micro-level studies suggest that even though Zimbabwe is a net grain surplus nation, a large portion of their population is food insecure. A World Bank task force on food security reported that 50 percent of Zimbabwe's population was malnourished (1983). Furthermore, Berg reported that although Zimbabwe exported grain, over 20 percent of children under the age of five suffered from second or third degree malnutrition; and that in as many as 30 percent of these children, growth was stunted (1987).

The geographical incidence of food insecurity in rural Zimbabwe is largely determined by agro-ecological factors. Of the country's five Natural Regions, Natural Region I has the best, and Natural Region V has the poorest quality soil and lowest rainfall. The largest numbers of food insecure households live in Natural Regions IV and V because these two natural regions have the highest population density (relative to their resource base), lowest productivity, and highest incidence of agricultural-production risk (Waddington and Kunjeku, 1988).

Because households in Natural Regions IV and V are most at risk, this study focuses on analyzing their food security status, and identifying alternative strategies for expanding access to food in these areas.

1.2.4 Food security equation

There are two sides to the food security equation: food availability and food access (Rukuni and Eicher, 1985). Food availability refers to an adequate amount of food being available to households--whether through domestic production, storage, or trade. Food access refers to a household's ability to acquire food--whether through own production, market transactions (cash or in-kind), transfers. Since the objective of this research is to reduce poverty through increasing incomes, this study focuses on the food access side of the equation.

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1.3 Research objectives

The general objective of this study is to provide a better understanding of the structure, level, and determinants of rural incomes in low-rainfall areas of Zimbabwe in order to identify alternative policy interventions to increase incomes of the rural poor. This study will address this general objective through five specific objectives.

1. Describe the level, distribution, and composition of household incomes and expenditures, including the contribution of the major sources of incomes (home-used production, cash income-generating activities, and transfers) and expenditures (consumption, investment, and transfers).
2. Describe the resource endowment of households in low rainfall areas and how they allocate these resources between alternative uses.
3. Identify the factors associated with the inter-household variability of incomes; especially for poor households.
4. Examine components of rural development strategies (short, medium, and long term) to increase incomes and expand opportunities of the rural poor.

1.4 Research hypotheses

The hypotheses that guide the research are noted below.

The <u>first</u> set of hypotheses examine the level, distribution, and composition of household incomes and expenditures. It is hypothesized that with respect to:

(1) The level of incomes and expenditures:

a) Households in Mutoko/Mudzi Districts (Natural Region IV) have higher per capita incomes than households in Buhera (Natural Region V).

b) The levels of incomes and expenditures differ significantly between villages.

c) The differences in income and expenditure levels between villages in Buhera are greater than between villages in Mutoko/Mudzi.

(2) The distribution of incomes and expenditures:

a) Income is highly unequal within villages, between villages within districts, and for the entire sample.

(3) The composition of incomes and expenditures:

a) Lower income households earn a larger proportion of their incomes from home-production, than higher income households.

b) Lower income households earn a smaller proportion of income from crop and livestock sales, than higher income households.

c) Lower income households earn a smaller proportion of their income from non-agricultural product sales, than higher income households.

d) Lower income households earn a larger proportion of their income from labor sales, than higher income households.

e) Lower income households obtain a larger proportion of their income from transfers, primarily remittances, than higher income households.

f) Lower income households are net grain buyers; while higher income households are net grain sellers.

g) Lower income households spend a larger proportion of their income on consumption, than higher income households.

h) Lower income households spend a smaller proportion of their income on investments and purchases of intermediate goods, than higher income households.

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The <u>second</u> set of hypotheses examine household resource endowment and use in low rainfall areas. It is hypothesized that with respect to:

(1) Labor endowment and use:

a) In Buhera District, households have more resident members than Mutoko/Mudzi Districts.

b) Households with more labor engage in more diverse agricultural and non-agricultural activities.

(2) Land endowment and use:

a) In Buhera District, households own more land per capita than in Mutoko/Mudzi Districts.

b) In both districts, the distribution of land is unequal; with a higher degree of inequality in Buhera District.

c) Farmers' cropping patterns are more diversified in Mutoko/Mudzi Districts.

d) In Buhera District, farmers allocate a higher proportion of land to small grain production, while in Mutoko/Mudzi Districts farmers allocate more area to maize.

(3) Capital endowment and use:

a) In Buhera District, households own more traction animals per capita than in Mutoko/Mudzi Districts.

b) In both Districts, the distribution of traction animals and agricultural equipment is unequal; with a higher degree of inequality in Buhera.

The <u>third</u> set of hypotheses examine the intra-household variability of incomes and expenditures. It is hypothesized that with respect to:

(1) Resource ownership and per capita household income are positively correlated.

a) Households with more land per capita have higher per capita incomes.

b) Households with more traction animals and agricultural equipment have higher per capita income.

c) Households with more resident household members have higher per capita income.

(2) Household head characteristics and per capita household income are highly correlated.

a) Households with more-educated household heads have higher per capita income.

b) Female-headed households with the male working away from the household have the highest per capita income, followed by male-headed households, and finally female-headed households without a spouse.

c) Households with older household heads have higher per capita incomes.

The final set of hypotheses examine the effect of agricultural development policies and services on the income of rural households. It is hypothesized that with:

(1) Agricultural development policies--eg., price policies--have affected low and high income households differently.

a) In absolute terms, agricultural development policies have raised the income of higher income households, but not affected those of lower income households.

b) In relative terms, agricultural development policies have raised the share of total income going to higher income households and decreased the share going to lower income households.

(2) Low and high income households have different access to agricultural services.

a) Lower income households participate in output markets less than higher income households.

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c) Lower income households send a smaller proportion of their children to both primary and secondary school than higher income households.

1.5 Organisation of the dissertation

This dissertation is divided into nine chapters. Chapter II reviews the literature necessary to evaluate the structure, level, and determinants of rural incomes in low rainfall areas of Zimbabwe. First, the definitions, incidence, and determinants of rural poverty are presented. Second, theoretical and methodological concepts--such as income definitions, measurement, distribution, monetization, and modelling issues--are presented. Finally, characteristics and rural development policies that impact communal farmers are presented.

Chapter III presents the survey methods employed in the research; including ward/village selection, sampling procedures, questionnaire design, data collection procedures, and data limitations.

Chapter IV examines the level, distribution, and composition of household incomes and expenditures. First, the definitions, structure, and approach used to evaluate incomes and expenditures are presented. Then, the level, distribution, and composition of incomes by sample, district, and village are described. Finally, the level and composition of expenditures by sample, district, and village are described.

Chapter V analyzes the resource endowment and external environment of households in low rainfall areas. First, definitions and measures of distribution used to evaluate resource endowment are presented. Second, the level and distribution of resources are described. Then, resource endowment by per capita income (net household receipts) is examined. Next, the income level and source by resource endowment is evaluated. Finally, the external environment facing households is presented.

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Chapter VI examines factors that explain the inter-household variation in per capita incomes. First, the determinants of net household receipts (per capita) are evaluated. Then, the determinants of net household receipt components are evaluated, including the value of agricultural production, labor sales, and transfers (received).

Chapter VII assesses the effects current policies on different income quartiles; and propose short, medium, and long term rural development strategies to increase incomes and expand opportunities of the rural poor.

Chapter VIII presents a summary of the research results, and identifies future research needs.

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CHAPTER II

Literature Review and Theoretical Considerations

This chapter reviews the literature that directly relates to the subsequent evaluation of the structure, level, and determinants of rural incomes in low rainfall areas of Zimbabwe. The first two sections focus on the general literature on rural poverty, incomes, and expenditures; and the third section develops these topics in the context of Zimbabwe's communal sector.

2.1 Rural poverty

Poverty exists in all countries and in all geographic and agro-ecological settings. In developing countries--and particularly in Sub-Saharan Africa--the incidence of poverty is highest in rural areas (World Bank, 1983), even after allowing for differences in consumption and living costs between rural and urban areas.

2.1.1 Definitions of poverty

Definitions of rural poverty vary in terms of scope (general versus specific), how it is measured (relative versus absolute), and time (chronic versus transitory).

2.1.1.1 Scope: general versus specific

Poverty definitions range from general to specific. ***General definitions*** of poverty emphasize deprivation with respect to basic needs--primarily food, but also clothing, and shelter (FAO, 1986). ***Specific definitions*** emphasize deprivation with respect to indicators uch as calor

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Glewwe and van der Gaag (1988) argue that poverty should be defined in terms of the actual measure used to draw (ie., calories) the poverty line; and define the poor as those households below this line.

Poverty definitions range from general to specific:

1.) Basic needs: This approach is the most general, and attempts to determine whether households' basic needs--food, clothing, education, health, and other needs--are being met. Households are defined as poor if these needs are not met. There are three criticisms of this measure. First, it is difficult to aggregate these needs into a single poverty measure. Second, the determining acceptable minimum levels is subjective. Finally, it is difficult to measure these needs (FAO, 1986).

2.) Per capita income: Per capita income is less general, and is the most commonly cited measure of poverty in the literature. This measure is constructed by adjusting household income by family size. There are three criticisms of this measure. First, it fails to take into account inter-seasonal variation of incomes, and therefore fails to take into account how households save/dissave depending on the year[1]. Second, recall errors affect the accuracy of transactions data[2]. Finally, households have other objectives besides maximizing income[3].

3.) Per capita consumption: This poverty measure is more specific that per capita income, because it is constructed using what households actually spend on consumption, adjusted for household size. Critics argue that since this measure includes all consumption goods, not just food, more households than those identified by this measure are actually living in poverty.

4.) Per capita food consumption: This measure is more specific than per capita consumption, and only requires information about food consumption. The advantages of this measure are that: 1.) it requires less data, 2.) recall is easier for food than for other consumption items, and 3.) food price indices are easier to construct than non-food price indices. Although less data are required for this measure, one criticism is that because other non-food necessities are not included; it provides a less comprehensive understanding of poverty. The accuracy of this method depends on having an estimation of a households' propensities to consume (Anand and Harris, 1985).

5.) Food ratio: This measure estimates the share of a household's budget that is spent on food. This measure stems from two observations made by Engel: the share of the budget for food

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[2]For example see Scott and Amenuvegbe (1990) and Lynch (1980).

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decreases as incomes increase and the share increases as family size increases. Therefore, the proportion of income spent on food is a good proxy of a household's welfare (Samuelson, 1980). On the other hand, Thomas (1986) questions whether Engel's first observation holds for the poorest households.

6.) Calories: Some researchers measure actual household and/or individual caloric intake, and compare the estimated levels against standard requirements. Households below some level are classified as in poverty. This measure is constructed from typical diets of the studied population, and tries to assess if an adequate amount calories are being consumed. Sen (1981) and Lipton (1980) challenge the objectivity of this measure.

6.) Medical indicators: Medical indicators of health and nutrition--such as height-for-weight, height-for-age, arm circumference, and so on--are the most specific measures of poverty. These measures assume that poor households are not healthy or nutritionally well. For example, anthropometric measures are widely used for mass screening. Problems with these measures are unreliability--due to intra-observer and inter-observer imprecision--and population specificity--because the standard is not necessarily relevant to the studied population (Lohman, 1988; Lukaski, 1987; and Christakis, 1984).

2.1.1.2 Measurement

The distinction whether poverty is defined as those households below some specific level, or in relation to other households is important. *Relative poverty* measures are concerned with the relative ranking of households with respect to income and consumption levels (FAO, 1986). Conversely, *absolute poverty* measures attempt to determine if a household has sufficient income to meet it's basic consumption--mainly food--needs (FAO, 1986). A major problem with estimating absolute poverty levels is that one must first define a minimum level, against which households are evaluated.

2.1.1.3 Temporal dimension: chronic versus transitory

The literature highlights the importance of the temporal dimension in analyzing the incidence of poverty (Glewwe and van der Gaag, 1988 and Poleman, 1984). Households in *chronic poverty* are unable to produce or acquire enough food from year to year (Glewwe and van der Gaag, 1988). Normally, these households are resource poor, and live in unfavorable environments (ie. low rainfall, poor quality soil). Households in

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transitory poverty are generally able to meet their food needs, but are unable to produce or acquire enough food in a given year (Glewwe and van der Gaag, 1988). This is usually a result of seasonal fluctuations in rainfall or an unusual event (eg. a death of a family member).

2.1.2 Incidence

Although poverty estimates are relatively inaccurate and employ a variety of definitions, the incidence of poverty is pervasive.

World-wide

Although specific estimates vary considerably, available data indicates that poverty is a major worldwide problem. In the early 1970s, researchers estimated that, on the basis of available cross-section and cross-country observations, between 370 and 800 million people lived in absolute poverty (Fields, 1980). These studies estimated the numbers of absolute poor, but not their geographic dispersion.

In the late 1970s, FAO's Fourth World Food Survey (1977) reported that in 1972-74, based on estimates of food available for consumption, approximately 445 million people (25 percent of the total population of developing countries, excluding centrally planned Asian countries) were judged poor.

In 1985, the World Bank estimated that more than 1 billion people lived in poverty throughout the world. Of this total, 520 million were in South Asia, 275 million in East Asia, 175 in Sub-Saharan Africa, 60 million in Europe, Middle East, and North Africa; and 70 million in Latin America and the Caribbean (World Bank, 1990). There is a disproportionate concentration of the world's poor in Sub-Saharan Africa. Although Sub-Saharan Africans accounted for only eleven percent of the world's population, sixteen percent of the world's poor lived there.

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by the year 2000 the numbers of the world's poor will decrease, this optimistic projection doesn't apply to all regions of the world. For example, the numbers of individuals living in poverty in Sub-Saharan Africa is estimated to increase to 260 million (Table 2.1).

Poverty is largely concentrated in rural areas. FAO (1986) estimated that in 1975-1982 (based on data from 60 developing countries with populations of one million and over), for the countries considered, the percentage of the rural population in absolute poverty varied from 11 to 90 percent. In Sub-Saharan African countries, between 35 and 90 percent of the rural population lives in absolute poverty.

Zimbabwe

The Zimbabwe Government's *Transitional National Development Plan* (1982) stated that poverty in Zimbabwe is concentrated in the rural communal areas. About half of these households had few or no cattle, and that about 20 percent had no land rights. Furthermore, in rural areas the average cash income was one-third of the agricultural workers' minimum wage, and one-sixth the cash income of mining and industrial workers. The widespread incidence of poverty in Zimbabwe is highlighted by the fact that over 70 percent of the population live in rural areas (CSO, 1988).

Yet, little is known about the characteristics and geographical dispersion of the rural poor in Zimbabwe because of the limited availability of rural income and expenditure data (World Bank, 1983). Rohrbach (1988) and Stanning (1985) have investigated related issues which are discussed in later sections.

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Table 2.1. Poverty in the developing world, 1985 and 2000

Geographic region[4]	Geographic distribution of poor					
	Number (millions)	% of population (1985)	% of world poor	Number (millions)	% of population (2000)	% of world poor
South Asia	520	51	47	360	26	45
Sub-Saharan Africa	175	47	16	260	39	32
East Africa	275	20	25	65	4	8
Europe, Middle East, and North Africa	60	31	5	70	12	7
Latin America and the Caribbean	70	19	6	50	12	7
TOTAL	1110	33	100	805	16	100

Source: World Development Report (1990).

2.1.3 Determinants of poverty

Numerous studies provide insights on the determinants of poverty.

General determinants

Rural poor households are very heterogeneous, but they typically lack access to sufficient land, labor, physical capital, and human capital to acquire sufficient food--whether through own production, market transactions, or transfers (World Bank (1990) and FAO (1986)). For most rural households, agriculture is the single largest income source. Furthermore, the rural poor 1.) are vulnerable to inter-seasonal climatic changes, 2.) are ignored by agricultural policy makers, and 3.) have poor access to public services.

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(endogenous) and external (exogenous) factors[5]. A household's internal environment consists of the level and quality of resources--land, labor, physical capital, and human capital, and decision-making ability of household members to efficiently allocate them.

Land

Own production is the major source of income in agricultural-based communities. Thus, access to land is critical to enable households to meet their food needs. Several studies show that small farmers and the landless have a higher incidence of poverty in South Asia, Southern Africa, and much of Latin America (World Bank, 1990; FAO, 1986; and de Janvry, 1981). As population increases, household access to land will decline even more.

Household production is not only influenced by the quantity of land farmed, but also tenure arrangements. De Janvry (1981) argues that without clear user rights, farmers 1.) can not use land as collateral and 2.) inter-seasonal access is uncertain. When user rights are unclear, as is the case in many rural areas of Africa, farmers may lack the incentive to invest in land improvement because of the uncertainty of reaping the returns, resulting in eventual environmental degradation.

Labor

Labor availability is also an important determinant of whether a household has the ability to produce enough food. In Africa, large households are desired because of the importance of children's contribution to household activities (ie. herding and weeding). Also, large families are needed to insure that the household has enough labor (World Bank, 1990). Household types that have a high incidence of poverty include the elderly (who have inadequate labor and capital) and younger households (which haven't accumulated enough resources).

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[5] The household's external environment consists of the agroclimatic, services, technological, and cultural environment; all of which influence household decisions, but over which the household has little control.

Human capital

Poor households generally have minimal access to education and health services. The quality of human capital is a shifter of the household's production function.

Some studies have demonstrated a negative correlation between education and poverty. For example, education improves technical efficiency in agriculture by increasing farmer access to extension literature (Bernsten, 1978); and provides greater access to off-farm employment opportunities (Chuta and Liedholm, 1979).

Furthermore, Schultz (1990) states that:

> "The decisive factor of production in improving the welfare of the poor are not space, energy, and cropland; the decisive factor are *the improvement in population quality and advances in knowledge.*"

Physical capital

Finally, access to physical capital enables farm households to fully use their land and labor resources. In Sub-Saharan Africa, traction equipment and animals are key capital inputs required to increase labor productivity. Several studies (World Bank, 1990) show that poor households lack access to these capital inputs which permit extensification (labor extending) when labor is scarce, and intensification (land extending) when land is scarce.

Poverty in Zimbabwe

To date, there is limited empirical analysis of the determinants of poverty in the communal areas of Zimbabwe (World Bank, 1990). Available evidence suggests that poverty is primarily associated with inadequate land availability, weak agricultural infrastructure development, and specific family characteristics.

Access to land in Zimbabwe is highly skewed (ROZ, 1982). About 6,000 commercial farmers own 44 percent of the total agricultural land, located predominately in the better agro-ecological zones (I, II, and

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III). Conversely, 700,000 communal farmers occupy 42 percent of total land, mainly in poorer agro-ecological zones (IV and V). The Government estimated that given the current levels of available technology, infrastructure, and management systems, the carrying capacity of the communal areas is only 325,000 families, about half of the existing communal population (ROZ, 1982).

In addition, the distribution of agricultural infrastructure development is highly skewed. During the colonial period, Government underinvested in extension, marketing, education, and credit services in communal areas, which has affected agricultural productivity (ROZ, 1982). This poor access to services has contributed to impoverishing the rural population.

With respect to family characteristics, a study in Gutu and Gwanda identified a positive correlation between poverty and family size, access to capital and draft power; and a negative correlation with land ownership (Economist Intelligence Unit, 1981).

2.2 Incomes and expenditures

This section presents theoretical and methodological concepts relevant to the analysis of income and expenditure data; and reviews past studies.

2.2.1 Theoretical and methodological concepts

This section 1.) presents various definitions of incomes; 2.) evaluates alternative income distribution measures; 3.) presents techniques to test statistical significance, and 4.) discusses issues related to the monetization of households.

2.2.1.1 Income definitions

Many definitions of incomes are found in the literature. Most definitions only include some of the components of income, and therefore nly partia

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only partially describe the household's opportunity set. Partial income definitions are useful to evaluate returns to resources used to produce agricultural goods and to compare returns to alternative enterprise combinations, but they provide a misleading assessment of absolute and relative income levels.

More inclusive definitions measure income as earned income--computed as the sum of cash or in-kind income--from both agricultural and non-agricultural sources (Matlon, 1977; King and Byerlee (1977)). This definition of household income is more complete because it permits the estimation of the returns to available resources.

Hayami (1978), Atkinson (1983), and Sen (1987) define total income in a more comprehensive manner, including transfers[6]. This definition provides the most accurate measure of the total income available to the household for expenditures. For poor households in Zimbabwe, transfers (remittances) are an important income source (Stanning, 1985, World Bank, 1983). Thus, it is necessary to use this comprehensive definition to assess the adequacy of incomes to meet consumption needs. Analysis that uses expenditures as an income proxy tacitly uses this comprehensive income definition--including transfers and credit receipts (net)--because it is impossible to identify the income source used for a particular expenditure, so all income is included.

This study uses both the earned income and total income concepts for the descriptive analysis; and uses the total income concept to identify determinants of income (Chapter 6) and in the policy analysis (Chapter 7).

2.2.1.2 Income distribution

Eicher and Baker (1982), in their critical review of agricultural research in Sub-Saharan Africa, stated that research on income

[6]This is the definition (net household receipts) that is used in the subsequent analysis.

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distribution in rural areas is a high priority topic for the 1980s. This section presents the theoretical considerations concerning the estimation of income and its distribution.

2.2.1.2.1 Alternative measures of central tendency

In order to select the most appropriate descriptive statistic to measure central tendency, it is necessary to determine whether the data are symmetrical. Two measures of symmetry are skewness and kurtosis.

Measures of central tendency are values that represent the average value, when the data are arranged according to magnitude, of a set of data (Bhattacharyya and Johnson, 1977). The most commonly reported measures of central tendency are the mean and the median. If data are normally distributed, the mean is usually reported; the mean and the median are exactly the same when the distribution is perfectly normal. If the data are skewed, as is often the case with income data, the mean is a misleading indicator of central tendency because the mean is more sensitive than the median to extreme values (large degree of skewness) (Alreck and Settle, 1985; Steel and Torrie, 1980; and Bhattacharyya and Johnson, 1977).

Skewness measures the degree of asymmetry, or departure from symmetry, of a distribution (Bhattacharyya and Johnson, 1977). If a distribution is positively skewed, then there is a longer "tail" to the right of the central maximum; if it is negatively skewed, then there is a longer "tail" to the left of the central maximum[7].

Kurtosis is the degree of peakedness of the distribution, usually with relation to a normal distribution (Bhattacharyya and Johnson, 1977). The higher the statistic, the more peaked the data distribution.

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[7] Skewness is the mean subtracted from the mode, divided by the standard deviation.

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2.2.1.2.2 Alternative measures of income equality

This section evaluates potential income inequality measures. First, a discussion of desirable properties of potential measures of inequality is presented, followed by a survey of potential measures. Finally, the measures used in this analysis are presented.

Desirable properties of inequality measures

Three desirable properties for income inequality measures are: income scale independence, principle of population, and the principle of transfers (Sen, 1973).

Income scale independence means that the income distribution should not depend on the level of total income (Cowell, 1977). In other words, as everyone's income changes (increase or decrease) proportionately, there shouldn't be a change in the inequality measure.

The *principle of population* states that the measurement of inequality should not depend on the size of the population (Cowell, 1977). For example, if two identical economies (therefore, with identical measures of inequality) were added together, the inequality measure satisfies this principle if it is the same for the aggregated economy as for the individual ones.

The *principle of transfers* examines the impact on inequality measures of a hypothetical transfer of income between two individuals. Their criteria can be satisfied in either weak or strong terms (Sen, 1973). The weaker condition is satisfied when the income transfer is from a richer individual to a poorer one, and is less than 1/2 the difference of the income between the two individuals; and when the transfer of income is made, inequality is decreased. The stronger condition is satisfied when the amount of the reduction in inequality depends only on the distance between incomes, not which individuals are chosen. The distance concept measures the difference in incomes between individuals. The stronger property is more desirable because it measures the ifference betwee

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difference between income shares, and the inequality measure is derived directly.

Alternative income inequality measures

The literature identifies six measures of income inequality: 1.) range, 2.) relative mean deviation, 3.) variance, 4.) coefficient of variation, 5.) standard deviation of the natural logarithm of incomes, 6.) Gini coefficient. Table 2.2 presents the formulas and properties of the six inequality measures.

The **range** (R), the simplest measure of equality, measures the difference between the highest and lowest income observations as a ratio of mean income. The range[8] is calculated as:

$$R = (MAX_i y_i - MIN_i y_i)/\overline{y}$$

The value of R falls between zero (income is divided equally between all individuals) and n (one individual receives all of the income). This measure ignores the distribution of incomes between the extreme values, and is sensitive to outliers.

The **relative mean deviation** (M) is a more complete measure than R because it looks at the entire distribution, not just the extremes. The relative mean deviation is calculated as:

$$M = \sum_{1}^{n} |\overline{y}-y_i| /n\overline{y}$$

The value of M falls between zero (perfectly equality) and 2(n-1)/n (all income to one individual). The main disadvantage is that similar

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[8]For all income inequality measures,
y_i = income of observation i
y = mean income
n = number of observations

Table 2.2. Properties

MEASURE OF INEQUALITY	
1. RANGE (R)	
2. RELATIVE MEAN DEVIATION (M)	
3. VARIANCE (V)	
4. COEFFICIENT OF VARIATION (C)	
5. STANDARD DEVIATION OF THE NATURAL LOG OF INCOME (SDL)	
6. GINI COEFFICIENT (G)	

Source: Cowell, 19

Table 2.2. Properties of alternative income inequality measures

MEASURE OF INEQUALITY	PRINCIPLE OF TRANSFERS	DISTANCE CONCEPT	INDEPENDENT OF PROPORTIONAL INCREASES IN INCOMES AND POPULATION	RANGE IN INTERVAL [0,1]?
1. RANGE (R)	FAILS	ABSOLUTE DIFFERENCES	NO (INCREASES)	NO (UNBOUNDED ABOVE)
2. RELATIVE MEAN DEVIATION (M)	FAILS	ABSOLUTE DIFFERENCES	NO (INCREASES)	NO (UNBOUNDED ABOVE)
3. VARIANCE (V)	STRONG	ABSOLUTE DIFFERENCES	NO (INCREASES)	NO (UNBOUNDED ABOVE)
4. COEFFICIENT OF VARIATION (CV)	WEAK	DIFFERENCES IN THE LOG OF INCOME DIVIDED BY THE INCOMES THEMSELVES	YES	NO (UNBOUNDED ABOVE)
5. STANDARD DEVIATION OF THE NATURAL LOG OF INCOME (SDL)	FAILS	DEPENDS ON THE RANK ORDER OF INDIVIDUALS IN A POPULATION	YES	NO (UNBOUNDED ABOVE)
6. GINI COEFFICIENT (G)	WEAK	ABSOLUTE DIFFERENCES	YES	YES

Source: Cowell, 1977.

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The **variance** (V) is similar to the relative mean deviation, but is more complete because it squares the differences of observations from the mean, thus accentuating the differences. The variance is calculated as:

$$V = \sum_{1}^{n} (\overline{y} - y_i)^2 / n$$

This measure has two advantages. First, it is sensitive to differences from the mean for all observations (called the Pigou-Dalton condition). Second, larger deviations from the mean are "penalized" more, resulting in a higher value for V. The disadvantage of this measure is that a distribution could have a larger relative variation than another and still have a lower variance, if the variation around the mean income level is smaller than with the other distribution.

The **coefficient of variation** (CV) is a more complete measure than V because it is both sensitive to differences from the mean like V and independent of the mean income level. The CV is the square root of the variance divided by the mean income level. The CV is calculated as:

$$CV = (V/\overline{y})^2$$

The CV has the advantage that it: 1.) discriminates between distributions where weight is given to income differentials in the high income range, 2.) is independent of proportional changes in income or population, and 3.) it weakly satisfies the principle of transfers. This measure has two weaknesses: 1.) the squaring procedure is arbitrary and 2.) it weighs differences equally. There is no *a priori* reason to use either of these procedures (Sen, 1973).

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The **standard deviation of the natural logarithm of incomes** (SDL) is the most useful income inequality measure if one is interested in attaching greater weight to differences in income between lower income individuals. The SDL is calculated as:

$$SDL = [\sum_{1}^{n} (\log(\bar{y}) - \log(y_i))/n]^{1/2}$$

The SDL: 1.) eliminates the arbitrariness of the units used, 2.) gives greater weights to incomes in the lower range (more appropriate when interested in measuring extreme poverty), and 3.) is independent of proportional changes in income and population. The weaknesses of this measure are that: 1.) it uses an arbitrary squaring procedure (same as the CV), 2.) it fails the principle of transfers, and 3.) it is seldom reported, so it is difficult to compare this measure with results from other studies.

The **gini coefficient** is the ratio of the area below the line of perfect equality and above the line representing the actual distribution of incomes, to the entire area below the line of perfect equality (if income equally distributed). The gini coefficient is calculated as:

$$GINI = 1 + \frac{1}{n} - 2/n^2y\ [\ y_1 + 2y_2 + \ldots + ny_n\ ]$$

where: $y_1 > y_2 > \ldots > y_n$

The gini coefficient: 1.) is more sensitive to income differentials in the middle income range, 2.) is independent of proportional changes in income and population, 3.) has an appropriate distance concept, given the skewness usually found in income data, 4.) it avoids the arbitrary squaring procedure, 5.) it satisfies the weak condition of the principle of transfers, 6.) it is a direct measure of the income differences (ie., it looks at each pair of incomes), and 7.) the measure is frequently reported sc

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These first three measures are not used to measure inequality in this study because they give misleading insights about the inequality of incomes. The range only looks at the highest and lowest incomes relationship to the mean. Both the relative mean deviation and the variance are dependent on the mean income level, and therefore don't examine the relationship of each pair of incomes in the sample.

This study uses the coefficient of variation, the standard deviation of the natural log of income, and the Gini coefficient to measure inequality because they each give a slightly different view of the inequality of incomes.

2.2.1.3 Significance testing

This section presents the statistical techniques used to test the null hypothesis that group means--between Districts and per capita income quartiles--are equal[9]. Student's t-test is used to compare District means (two independent groups).

For multiple group comparisons, oneway analysis of variance is used to test the null hypothesis that means across income quartiles are equal. Duncan's multiple range test is used to obtain multiple comparisons between quartiles. This test identifies pairs of group means that are significantly different (five percent level).

2.2.1.4 Monetization

As rural economies develop, rural households increasingly rely on the cash economies to met their production and consumption requirements. Thus, monetization, measured by the degree households participate in the cash economy, is an indicator of rural economic development (Von Braun

[9]These tests are also used to compare household resource ownership across groups.

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Factors that contribute to the monetarization of rural economies include rapid urbanization, growth in the rural nonagricultural sector, and technological changes in agricultural production. First, rapid urbanization creates pressure to change food policy, either to import more food or to design marketing and production policies to extract marketed surplus from rural areas. Second, the growth of the rural sector is closely tied to the growth in food production, and households participation in markets (Mellor and Johnston, 1984). Third, technological change in agriculture usually requires farmers to apply purchased inputs and encourages enterprise specialization, both of which result in an increase in the monetization of households.

The literature identifies both positive and negative impacts resulting from increased participation of semi-subsistence households into the cash economy. Studies by Pinstrup-Andersen (1988), Dewey (1979), and Gudeman (1978) conclude that increased commercialization has a negative impact on nutrition and income; while studies in Kenya (Kennedy and Cogill, 1987 and Fleuret and Fleuret, 1983), Papua New Guinea (Harvey and Heywood, 1983), and Tanzania (Lev, 1981) suggest positive impacts; Alderman (1987) examined data from 15 countries and observed little impact; and studies in Kenya (Hitchings, 1982) show mixed results depending on crops studied. In Zimbabwe, Jackson and Collier (1988) found that as the percentage of income from cash sources increased, total per capita household-income increased.

This study examines the impact of monetarization in Zimbabwe, the relationship between the percent of a households' income received from cash sources, and the household's level of per capita income.

2.2.2 Past income and expenditure studies

This section first reviews income and expenditure studies conducted throughout the world; and then reviews studies conducted in Zimbabwe.

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2.2.2.1 World

A literature search identified 29 major income and/or expenditure studies conducted since the early 1970s--10 in Asia, 7 in Latin America and the Caribbean, 5 in North Africa and the Middle East, and 7 in Sub-Saharan Africa (Wahab, 1980 and Glewwe, 1990). These studies are compared with respect to[10]:

1.) Income definition: Only twenty-one of the twenty-nine surveys provided a definition of income[11]. The vast majority (86 percent) defined income as total household income, which included the value of home production, farm product sales, wages, off-farm activities, and transfers received. Two surveys--Botswana and Pakistan--reported total available household income, with transfer and credit outflows removed. The Reunion survey only collected cash income received by the household.

2.) Implementing agency: In all cases, except in Sri Lanka, the implementing agency was the government statistics office.

3.) Geographical coverage: In 74 percent of the studies, the coverage was national; while 17 percent included only rural areas, and 9 percent only urban areas.

4.) Time period: All studies used a one year reference period, with different starting times. The recall period for the studies was not reported.

5.) Sample size: The sample size of the studies ranged from 131 to 56,000 households. The national surveys interviewed between 1,000 and 56,000 respondents, between 131 and 1,700 respondents for the rural surveys, and 4,000 (only one reported sample size) for the urban study.

6.) Field staff: The skill level of the field staff employed to collect the data varied considerably between surveys. Of the sixteen studies that reported specifics about field staff, about 56% hired temporary enumerators and 44 percent used permanent staff. For the eight country studies that reported both the sample size and the number of enumerators, the enumerator to respondent ratio varied between 1:4 and 1:150, the median being 1:55.

7.) Sample design: All studies used a two or more stage stratified sample design.

[10]There isn't complete information for all surveys to compare all aspects of design and implementation.

[11]Six were household consumption and expenditure surveys, and two that did collect income data--Fiji and Sudan--didn't provide a definition of income.

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This study used a total household income definition, covered rural households, used a one year reference period (with a one month recall period), had a sample size of 285 households, employed enumerators for the length of the study, and used a three stage stratified sample design (see Chapter 3).

2.2.2.2 Zimbabwe

Since Independence (1980), researchers have conducted four studies designed to estimate household incomes: MLARR (1988-89), Central Statistics Office (1984-85)[12], Stack (1985-87), Amin (1986-87), and Govaerts (1984-85)[13]. CSO conducted the most comprehensive survey, which estimated household incomes and expenditures in all provinces in Zimbabwe (Table 2.3). The estimates for Mashonaland East and Manicaland provinces serve as useful benchmarks to compare results from Mutoko/Mudzi and Buhera Districts--even though our study villages are in the poorest agro-ecological portions of these provinces. The CSO study used three income definitions developed by the United Nations: total household income (an earned cash-income concept), available household income (total household income plus net transfers and cash remittances), and income available for consumption (available household income plus in-kind income).

Results from Stanning's income and expenditure study are most comparable to the Mutoko/Mudzi and Buhera District study because she collected data in similar agro-ecological zones; used the same length of recall period; and used the same income definition (including transfers and the valuation of home production). Stanning's study is particularly important because data were collected over two years, thus

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[12]J. Jackson's research used the data collected by the CSO.

[13]For specific details about these studies' results, and how they compare to this study's estimates, see Chapter 4.

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Jackson's analysis, based on data collected by the CSO, used a total household income definition (including transfers and valued home production). Because this study used a long (annual) recall period and aggregated observations across Natural Regions, results may incorporate considerable measurement error, and are not comparable to the Mutoko/Mudzi and Buhera District study.

The other two studies, Amin and Govaerts, only collected cash income transactions data--farm product sales, non-agricultural sales, wages, and remittances. This limited definition of income restricts the usefulness of these studies for comparative purposes.

2.3 Zimbabwe's communal sector

Although communal households account for a majority of Zimbabwe's population (CSO, 1987), little is known about the internal and external factors they face. This section describes the characteristics, institutions, and policies that influence communal household behavior in order to provide the necessary context to understand and interpret this study's results.

2.3.1 Characteristics of communal households

This section presents the geographic dispersion, administrative structure, agricultural production, marketing, and consumption preferences of communal households.

2.3.1.1 Geographic dispersion

Communal households accounted for 57 percent of the total population, they occupy only 42 percent of Zimbabwe's total land area (CSO, 1987). This disproportionate allocation of land is exacerbated by its poor

Table 2.3. Summary of pas

Researcher	District
NLARR	eight including Mutoko Buhera
Stack	Murungwe Shamva Binga
[illegible]	Chirau Magondo
Central Statistics Office	All
Jackson	All
Sowerts	Mutoko

Data: NLARR (1990); St
(1987).

Table 2.3. Summary of past income and expenditure studies in Zimbabwe

Researcher	District	Province	Natural Region	Sample Size	Interview Frequency	Income Definition	Mean Income Levels (Z$)
MLARR	eight including			414			
	Mutoko	Mashonaland West	IV	48	Two Visits	Earned income definition	934/hh
	Buhera	Manicaland	IV	58			713/hh
Stack	Hurungwe	Mashonaland West	IIa, III	80	Monthly	Total income definition; including transfer and the valuation of home production	372/pc
	Shamva	Mashonaland Central	IIb, III	69	Monthly		260/pc
	Binga	Matabelelan North	V	20	Monthly		108/pc
Amin	Chirau	Mashonaland West	II	614	Single Visit	Cash income only; doesn't include home production	428/hh
	Magondi	Mashonaland West	III				
Central Statistics Office	All	All	I - V	7000	Every 4 months	Total avail. income definition; including transfers (net) and the valuation of home production	Manica. 1237/hh Mash East 2992/hh
Jackson	All	All	I - V	600	Every 4 months	Same as Stack	700/hh
Govaerts	Mutoko	Mashonaland East	III, IV	200	Single Visit	Cash income only; doesn't include home production	442/hh

Source: MLARR (1990); Stack and Chopak (1990); Amin (1990); CSO (1988); Jackson (1987); and Govaerts (1987).

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quality, classified as semi-intensive[14] (17 percent of farms), semi-extensive[15] (45 percent), and extensive[16] (29 percent) farming (CSO, 1988).

2.3.1.2 Agricultural production

Crop and livestock production account for a large portion of both total household income[17] (43 to 85 percent) and cash income[18] (approximately 50 percent).

Crops

Despite government's restrictive recommendations about the appropriate crop choices for each Natural Region, communal farmers grow a diverse mix of crops. Rainfall and individual preferences determine the relative importance of different crops to household income and consumption. In the aggregate, maize is the most important crop in terms of area planted (55 percent); followed by bulrush millet (9 percent), sorghum (8 percent), groundnuts (7 percent), finger millet (6

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[14]The semi-intensive farming area (Natural Region III) has an annual rainfall of 650-800 mm, is subject to fairly severe mid-season dry spells; and is recommended for livestock, fodder, and cash crops. Production of maize, tobacco, and cotton is considered marginal.

[15]The semi-extensive farming area (Natural Region IV) has an annual rainfall of 540-650 mm, is subject to periodic seasonal drought and severe dry spells during the rainy season; and is recommended for livestock and drought-resistance crop production.

[16]The extensive farming area (Natural Region V) receives insufficient rainfall to even produce drought-resistant fodder and grain crops; and is recommended for extensive cattle and game farming.

[17]Stack (Stack and Chopak, 1990), based on data from the 1986/87 agricultural season.

[18]Govaerts (1987), based on data from the 1984/85 agricultural season.

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percent), cotton (6 percent), and sunflower (2 percent) (CSO, various years). Additional crops grown include bambara nuts, beans, cowpeas, soybeans, rice, as well as various fruits and vegetables. In Natural Region III, maize is most important, but small grains are also grown widely for consumption and cultural reasons. In Natural Region V, small grains are more important than maize, but most households still grow some maize.

Livestock

Livestock play an important role in insuring food security of rural households (Ndlovu, 1990). They provide draft power and manure for agricultural production; a source of cash-income (animal and product sales), a food source, and a store of wealth. Cattle dominates the number of ruminants owned by communal households (64 percent); followed by goats (29 percent), sheep (5 percent), and pigs (2 percent). Households also raise chickens, ducks, and guinea fowl.

2.3.1.3 Consumption preferences

There is a debate, with important policy implications, of whether households prefer maize or small grains. Rohrbach (1988) argues that communal households prefer maize since maize accounts for a large proportion of total farmed area, even in low rainfall regions. On the other hand, ENDA-Zimbabwe (1987) argues that households actually prefer small grains, but contend that households grow maize because processing small grains is labor-intensive. Furthermore, area allocated to small grains--which are better adapted to poorer agro-ecological regions--would increase if appropriate hulling technology were available.

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2.3.2 Rural household access to government services (since 1980)

Although rural households had limited access to social and agricultural services before Independence, the government is committed to redressing these inequities (ROZ, 1982); and has significantly expanded rural access to services since 1980.

Land

In 1930, the Land Apportionment Act legalized the racial segregation of land. A desire to redress the historical inequitable distribution of land was one of the major reasons for fighting for liberation.

At Independence, the government vowed to redress the inequitable land distribution by resettling 162,000 households on 10 million hectares of land by 1985 (Cusworth and Walker, 1988). By 1990, only 52,000 households have been resettled on 2.5 million hectares of land.

The slow progress of resettlement has been due to both insufficient government funds to purchase land and few willing sellers, most of whom farm only in the lower potential zones. Thus, access to land continues to be a critical political issue[19].

Extension services

Before Independence, government extension served primarily the European farmers. In 1981, government established AGRITEX (Agricultural, Technical and Extension Services) by merging the Department of Conservation and Extension with the Department of Agricultural Development. Between 1980 and 1985, government expenditures for extension services increased by 406 percent (CSO, 1987), thereby lowering the extension to farmer ratio from 1:1000 to 1:850; and has set as a target a ratio of 1:400 (Eicher and Rukuni, 1990).

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[19]For more information see Roth (1990), Blackie (1987), and Moyo (1987).

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<u>Agricultural research</u>

The Department of Research and Specialist Services (DR&SS) is responsible for agricultural research (crop, pastoral, livestock) and services such as regulation (plants and dairies), grading (meat and cattle), seed certification, and pesticide registration. Before Independence, these services almost exclusively served the needs of commercial farmers. Between 1980 and 1985, government expenditures increased by 35 percent (CSO, 1987), and research was reoriented to address the problems of communal farmers, including the establishment of on-farm research.

Until 1980, agricultural research primarily addressed production constraints associated with the agro-ecological conditions of commercial farmers. Technology research focused on mechanization, hybrid seed (primarily maize), and management of chemical inputs. Since 1981, DR&SS has reoriented the agricultural research agenda to address the needs of communal farmers by: 1.) conducting varietal trials under communal area conditions; 2.) initiating a breeding program for sorghums and millets; and 3.) establishing a farming systems research unit to study, develop a FSR model, and provide information to assist policy makers. To date, new technologies (eg., hybrid sorghum and improved tillage methods) are still in the development phase (Shumba, 1990 and Mudimu, 1987).

<u>Veterinary Services</u>

The Department of Veterinary Services is responsible for prevention and control of animal diseases, including the cattle dipping. Before Independence, these were mainly available to commercial farmers.

Since Independence, the importance of livestock in the poor agro-ecological areas has stimulated government to increase communal farmer access to veterinary services (Ndlovu, 1990). For example, between 1980 and 1985 government expenditures increased by 179 percent (CSO, 1987). Recently, AGRITEX began working with the Department of Veterinary services to int

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Services to introduce animal health and management centers in communal areas (Eicher and Rukuni, 1990) to improve access and quality of veterinary services.

Agricultural marketing

The Agricultural Marketing Authority (AMA) at the time of the survey coordinated the operations of the country's four marketing boards--Grain Marketing Board (GMB), the Dairy Marketing Board (DMB), Cotton Marketing Board (CMB), and the Cold Storage Commission (CSC). These boards oversee the marketing of their individual commodities. Controlled crops include: seed cotton, cattle and sheep, milk and butter fat, maize, sorghum, wheat, groundnuts, soybeans, coffee, sunflower (1980), bulrush millet (1980), finger millet (1980), and edible beans.

Before Independence, communal farmers had very limited access to marketing services; only three Grain Marketing Board depots served communal areas. Between 1980 and 1985, the government expanded market access in order to induce farmers to produce and market surpluses by constructing ten new depots and 55 collection points in communal areas (Muir, 1987). The government has attempted to increase rural incomes by offering incentive prices; for example in 1985/86, the government increased the sorghum (red and white) price by 120 percent (Z$80/mt to Z$180/mt).

Agricultural credit

Communal households had limited access to short term credit before 1980. In 1978, the Agricultural Finance Corporation (AFC) introduced a Small Farm Credit Scheme to promote agricultural by providing communal farmers credit for the purchase of farms and agricultural inputs. Between 1980 and 1985, short-term credit extended to farmers increased by 142 percent (CSO, 1987); primarily to communal farmers.

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Social services

Education

Because of the liberation war and underinvestment by previous governments, communal households have had limited access to primary and secondary education. The government, at Independence, declared that education is a fundamental right of every Zimbabwean (ROZ, 1982). To this end, between 1980 and 1985 government expenditures on education increased by 130 percent.

Between 1980 and 1985, primary education enrollment increased by 171%. There has been, though, an acute shortage of trained teachers. During this period, the number of teachers increased by 207 percent, but about 50 percent of the teachers in 1985 were temporary (untrained) teachers (CSO, 1987).

The government is also committed to providing every primary school graduate at least four years of secondary school. Between 1980 and 1985, the shortage of teachers and school facilities was even greater for secondary school than with primary education. During this period enrollment increased by 628 percent. The government has attempted to address this problem by training more teachers; and in the meantime, they have resorted to double-sessioning the class rooms and have hired expatriots.

Health

Government has sought to increase health care services in the communal areas. Between 1980 and 1985, government expenditures increased by 103 percent (CSO, 1987). Government efforts have focused on training village health workers 1981 and 1984, with 4,417 village health workers trained during this period; with a target number of 12,500 by 1993 (CSO, 1987).

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CHAPTER III

SURVEY METHODOLOGY

3.1 Introduction

The survey methods were designed to collect the data needed to estimate the analytical models required to address the research issues discussed in Chapter 1. This chapter describes the criteria used to select the research sites, the sampling frame, the mode of data collection, and the limitations of the data.

3.2 Survey area

The survey areas were selected taking into account both the research objectives and resource constraints.

3.2.1 Research area selection criteria

First, the general research objective was to assess the structure, level, and determinants of rural incomes in the more at-risk regions of the country. Secondary data indicates that yields are lowest and production most variable in the poorest agroclimatic regions, defined by rainfall and soil characteristics (CSO, 1987; Rohrbach, 1988).

Therefore, research sites (villages) were selected in Natural Regions IV and V, areas of the country with relatively less rainfall and less fertile soils. Rainfall averages 400-600 mm/year in Natural Region IV and less than 600 mm/year in Natural Region V. Both regions have a unimodal rainfall pattern, distributed over only three to four months.

The regional stratification provide a basis for assessing the differing income and expenditure pattern in the two contrasting agro-ecological regions.

Second, resource constraints required that the sites be located within a one-day drive of Harare, in order to enable supervision by University of Zimbabwe staff also engaged in teaching throughout the year. This constraint led to the identification of the Mutoko/Mudzi (NR IV) and Buhera (NR V) Districts.

Subsequently, a rapid appraisal was conducted in these two districts with the assistance of local agricultural extension (AGRITEX) officials. Because almost no secondary data were available, key informant advice was relied upon to assess the variability in farm management practices, technology adoption, land allocation, marketing possibilities and non-agricultural activities across the wards in each district. This information was used to choose the wards and village for the more detailed survey work, using the criteria noted below.

1. Production system

Crop production is a primary component of a household's ability to assure its own food security. Staple grains provide food for home consumption, with surpluses sold as cash crops to provide income to purchase food and meet other cash expenses. In addition, livestock sales are an important source of cash income, and store of wealth (Ndlovu, 1990).

To assess differences in crop production across wards, all wards were evaluated in terms of the importance of maize; small grains (red and white sorghum, bullrush millet, and finger millet); and oilseeds (groundnuts and sunflower).[1]

Consequently, villages were selected where households devote a high percent of their available land to small grains (millets and sorghums) and oilseeds.

[1] Also, across these sites, livestock are of varying importance, but relatively more important in Natural Region V.

2. Access to Markets. Previous research in communal areas of Zimbabwe (Stanning, 1985 and Rohrbach, 1988) has shown that distance to market is an important determinant of a household's food security strategy. In particular, market access influences a households' production and consumption opportunities.

Consequently, villages were chosen that range from 10 to 80 kilometers from the nearest Grain Marketing Board depot or collection point.

3. Sources of Off-Farm Income. Off-farm employment provides households with opportunities to improve their food security by supplementing agricultural income with wage earnings (Helmsing, 1987 and Chuta and Liedholm, 1979).

Although not specifically selected with respect to this criteria, the sites have a diversity of opportunities for households to generate income through off-farm activities-- thereby providing an opportunity to analyze the role and contribution of off-farm employment on household food security.

4. Potential of New Technology. New agricultural technology can reduce food insecurity by both increasing and stabilizing crop yields (Waddington and Kunjeku, 1988)--thereby enabling farmers to increase own production and their marketable surplus.

The Department of Research and Specialist Services (DR&SS), Ministry of Agriculture, Lands, and Rural Resettlement (MLARR) conducts on-farm experiments, and the extension service (AGRITEX) managed on-farm demonstrations in rural areas. Therefore, four villages in NR IV were selected near a set of Agritex trials/demonstrations with the expectation they would provide indicative technical coefficients to assess the potential impact of new crop technology on improving household food security.

5. Potential to Expand Small-Grain Utilization. Studies have reported that in recent years, households in low-rainfall areas have

increasingly substituted maize for small grains to meet food needs (ENDA-Zimbabwe, 1987). The primary reason cited was that the home-processing of small grains is more labor intensive, relative to maize.

A site was selected near a small-grain dehuller to assess its impact on the role and uses of small grains in food security strategies of communal farmers.

6. Access to Public Transfers. Public transfers, particularly food/cash provided through 'food-for-work' programs in drought years, are an important means for improving household food security (Reutlinger, 1985). While not an explicit selection criteria, food-for-work programs have provided access to food in varying degrees across then villages selected.

Table 3.1 shows the distribution of sites (villages) with respect to these six criteria.

3.2.2 Research Location

The research was conducted in two survey areas: Mutoko and Mudzi Districts (140 kilometers northeast of Harare) and Buhera District (300 kilometers southeast of Harare). Figure 3.1 shows the location of the two survey areas. Although Mutoko District is in both Natural Regions III and IV, all research sites are in Natural Region IV. Mudzi District is entirely in Natural Region IV. Buhera District spans Natural Regions III, IV and V, but all the research sites are in Natural Region V.

A total of 12 villages were selected, based on the criteria presented below. Six villages were chosen in each of the two survey areas.

3.3 Sampling procedures

A multi-stage sampling procedure was used to select the household sample. The first stage involved the purposive selection of two natural regions (IV and V). The second stage involved the purposive selection of villages to insure diversity across selection criteria (see 3.2.1).

Table 3.1. Distribution of Research Sites with Respect to Selection Criteria and District, 1987-88, Zimbabwe.

	MUTOKO/MUDZI						BUHERA					
CRITERIA	1	2	3	4	5	6	1	2	3	4	5	6
NATURAL REGION												
IV (400-600mm)	X	X	X	X	X	X						
V (<600 mm)							X	X	X	X	X	X
PRODUCTION SYSTEM												
MAIZE	X	X	X	X	X	X						
SMALL GRAINS							X	X	X	X	X	X
OILSEEDS	X	X	X	X	X	X	X	X	X	X	X	X
ACCESS TO MARKETS												
POOR	X			X		X					X	X
AVERAGE		X			X				X	X		
GOOD			X				X	X				
NON-AGRICULTURAL ACTIVITIES IMPORTANCE												
HIGH				X				X				X
MEDIUM	X				X	X	X			X	X	
LOW		X	X						X			
PROXIMITY TO TRIALS												
YES						X		X	X		X	
NO	X	X	X	X	X		X			X		X
PROXIMITY TO DEHULLER												
YES					X							
NO	X	X	X	X		X	X	X	X	X	X	X
ACCESS TO TRANSFERS	X	X	X	X	X	X	X	X	X	X	X	X

Source: UZ/MSU Food Security Project

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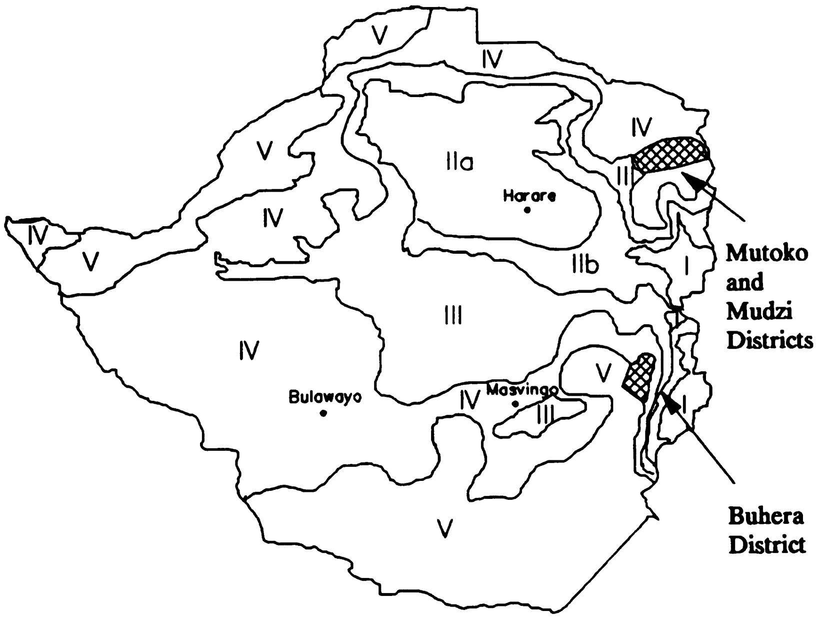
Figure 3.1 Location of the survey areas



3.3.1 Selection of households

At the third stage, a random sample of households was selected from population lists provided by local leaders (kraalheads) in each village.

3.3.2 Sample size

The initial sample included 345 households, 164 in the Mutoko/Mudzi Districts and 171 in the Buhera District, with 25-30 households in twelve villages (six villages in NR IV and V).

Some households were dropped from the survey sample for the following reasons:

1) Duplicate households in the sampling frame. Some households, given by village leaders, were included in the household population list, but were actually part of other households. Village leaders included these households because they thought the household lists were being developed to identify participants for a public transfer program (e.g., food-for-work or food aid).

2) Non-resident households. A few households with key members residing outside the village migrate to join their spouses when all agricultural activities are completed. Hence, no member was resident throughout the year. Also, some selected households were included in the population list even though they had permanently migrated out of the village.

3) Respondent fatigue. Some households felt burdened by the number of questions that they were asked. Feedback from enumerators, along with close scrutiny of the data, confirmed that these households had lost interest and stopped responding truthfully. Therefore, they were dropped from the sample.

4) Sensitive questions. A few households were unwilling to respond to key questions about their incomes and expenditures. Enumerators identified households which they believed were under-reporting income sources, either because of unwillingness or because

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A summary of the reasons why households were dropped from the final analysis are presented in Table 3.2.

The distribution of the remaining 285 households included in the study is presented in Table 3.3.

3.4 Data collection

This section describes the data collection process, including enumerator selection, questionnaire design, survey instruments, and data entry.

3.4.1 Enumeration

To minimize administration errors, careful attention was paid to enumerator (enumerator bias) selection, defining their responsibilities, and training.

3.4.1.1 Selection of enumerators

Local secondary school graduates were chosen as enumerators for two reasons: they serve as barometers for the accuracy of the responses by sample households, and they were known by the households (not considered outsiders). The choice of local school-leavers potentially could introduce bias because some households might hesitate to reveal confidential information about their personal activities to the enumerator. This is especially true for information about their incomes and expenditures.

Final selection was based on recommendations by Agritex extension workers, a written test, and an oral interview. One enumerator was assigned to each survey village.

Table 3.2. Summary of reasons why households were dropped from the final sample.

REASON DROPPED	NUMBER	PERCENT
Initial number of households selected	345	100
Households that are part of another household	7	2
Households that are not year-round resident	8	2
Households that migrated out of the village	12	3
Unreliable respondents (fatigued/unwilling)	5	1
Households with incomplete data	28	8
Final sample size	285	83

Source: UZ/MSU Food Security Project

Table 3.3. Distribution of the sample of households for the University of Zimbabwe Food Security Research Project, Zimbabwe, 1988-89.

CLUSTER			
STAGE I (NATURAL REGION)	STAGE II (VILLAGE)	STAGE III (HOUSEHOLDS)	TOTAL SAMPLE (HOUSEHOLDS)
NATURAL REGION IV			
MUTOKO/MUDZI DISTRICT	6	15-29	149
NATURAL REGION V			
BUHERA DISTRICT	6	20-25	136
TOTAL	12		285

Source: UZ/MSU Food Security Project

3.4.1.2 Responsibilities

The enumerators were responsible for administering all of the household survey modules to households in their village and bringing completed survey modules to field-based supervisors. They were instructed to conduct themselves in a professional manner, and maintain the confidentiality of responses given by households.

3.4.1.3 Training

The enumerators were trained by the members of the UZ/MSU Food Security team. The enumerators were first oriented to the project. Topics covered included the project's objectives, staffing, survey methods, and the questionnaire format. A handbook was prepared so the enumerators could review this information as needed.

Prior to executing each survey module, the enumerators were trained to ensure that they understood the questions and concepts. Training included: 1) explaining the research issues, 2) discussing each question, 3) practice interviewing through role playing between the trainers and other enumerators, and 4) practice interviews with non-sample farmers near the survey area.

3.4.2 Questionnaire design

Although specific team members were responsible for developing specific modules related to their research focus, all members participated in developing all questionnaires. To insure that the module met the research objectives and minimized non-sampling errors, the following nine steps were carried out to design each module.

(1) First, the team met to identify the important research issues, reference period, concepts, analytical model, and data needed to address the research issues.

(2) Based on these discussions, the principle investigator drafted the module.

(3) Next, the English version of the module was pre-tested with the enumerators, and then with farmers facing similar conditions to those in our survey areas.

(4) Based on the pre-test, the module was revised.

(5) The revised module was translated into Shona by research team members.

(6) The Shona module was reviewed with the enumerators to introduce them to the module, and determine if the questions and concepts were clear; and again pre-tested with farmers.

(7) After incorporating final revisions, the module was printed in its final form.

(8) Finally, the questionnaire was administered.

3.4.3 Data entry

The data were entered at the Department of Agricultural Economics and Extension using SPSSPC+ Data Entry, by a person hired by the UZ/MSU Food Security Project.

3.4.4 Survey instruments

The data were collected through both household interviews (single visit recall interviews and monthly monitoring) and key informant interviews. The 14 survey modules were designed to collect data concerning: household characteristics; parcel characteristics; equipment, animal, grain, and input inventories; monthly incomes and expenditures; farm management practices (1988 and 1989 seasons); technology adoption; crop marketing strategies; attitudes about crop diversification; household investment and grain consumption preferences; perceptions about how changes in the quality of rainfall affect their household; the representativeness of survey villages; processing constraints, utilization, and consumption of grain; and attitudes about purchased inputs, livestock, credit, school expenditures, transfers, and amount

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the amount of land that should be allocated to crops and pasture. See **Appendix** 1 for the schedule of research activities and **Appendix** 2 for a description of the individual survey modules.

3.5 Limitations of the data

Three factors limit the results obtained in this study. 1. Representativeness of the data. These data are not representative of all households in NR's IV and V, but of those households in the NR IV portion of the Mutoko/Mudzi Districts, and the NR V portion of the Buhera District. These households are not representative of all households in NR's IV and V because across these agro-ecological regions there exist considerable differences in the amount of rainfall, production systems, access to markets, and ethnic background. Compared to other districts in NR's IV and V, the districts selected have a.) above average rainfall, b.) a more diversified cropping pattern, and less reliance on livestock, c.) above average access to markets, and d.) all households are Shona speakers, while the ethnic mix of households in NRs IV and V are 20% Ndebele and 80% Shona.

2. Problems with transactions data. Income and expenditure data are subject to two main potential sources of non-sampling error: difficulty to recall information, and household's willingness to report all transactions. While it is possible to increase recall accuracy by shortening the recall period, this may increase non-sampling error associated with respondent fatigue. Also, more frequent interviewing increases data collection costs. Thus, project staff decided that a monthly income and expenditure module was the most appropriate compromise. Collection, handling, and verification of the income and expenditure modules took about two weeks per month. In addition, to minimize the recall problem, each household was given a notebook for a family member (or enumerator) to record daily household transactions. In retrospect, using a monthly recall period was the correct decision.

The research team members consisted of five members. Since all members had survey modules to be implemented, a more frequent interview schedule for the income and expenditure module would have compromised other team members' modules and over-burdened the sample households, as well as the enumerators and researchers.

3. Potential biases with the data. Sources of survey biases are classified into two categories: sampling biases and nonsampling biases. Potential sampling biases include that a small number of villages were chosen and may not represent Natural Regions IV and V (see previous discussion). Potential nonsampling biases include those related to observation (enumerator and researcher) and nonobservation (noncoverage and nonresponse)[2].

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[2] For additional information, see Alreck and Settle (1985) and Bulmer and Warwick (1983).

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CHAPTER IV

INCOMES AND EXPENDITURES: LEVEL, DISTRIBUTION, AND COMPOSITION

This chapter describes the level, distribution, and composition of household incomes and expenditures. First, the analytical framework (definitions and structure) for analyzing household incomes and expenditures is presented. Then, empirical results are presented at three levels of aggregation (the total sample, districts, and villages).

4.1 The definition, structure, and distribution of household incomes and expenditures

Although studies of incomes and expenditures use similar concepts, the specific definitions used vary depending on the objective of the analysis and available data (see Chapter 2). The income and expenditure concepts described below are used to (i) estimate household income; (ii) stratify the sample into income quartiles for subsequent analysis; and (iii) estimate the relative contribution of income sources and expenditure categories to total per capita income and total per capita expenditure, respectively.

4.1.1 Household income and expenditure concepts

4.1.1.1 Description of net household receipts categories

The four major sources of net household receipts are: production for home consumption, cash income-generating activities, transfers, and net credit receipts (Figure 4.1). All income estimates are presented in Zimbabwean dollars (nominal) and nominal prices (1988) are used to convert

physical quantities to monetary values, based on an intra-seasonal average prices.

1. Production for home consumption income

Production for home consumption (PHC) is the earned income equivalent value (residual) of production for current and future use. The value of "own use" grains and oilseeds, is estimated by adding the value of grains and oilseeds harvested to initial crop inventories; minus the value of all outflows (ie., grains and oilseeds sold, loans [new and repayments], gifts, labor payments, and outflows for any other reason [e.g., beer brewing]).

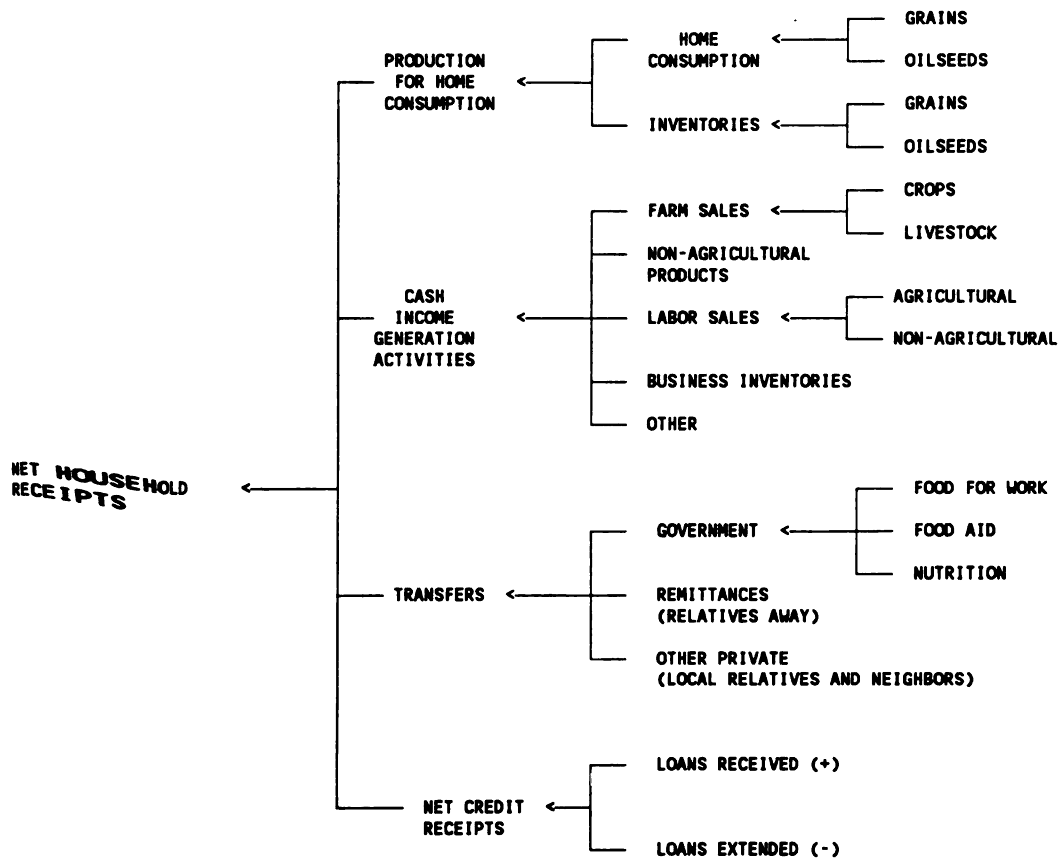
PHC is subdivided into *home consumption* (HC) and *ending inventories* (INVNT), since some households held large inventories at the end of the twelve month data collection period. First, secondary data were used to estimate the maximum amount of grain and oilseed a household could be expected to consume[1]. Then, for households holding grain and oilseed

[1]Maximum grain and oilseed consumption levels were estimated differently. Maximum grain consumption levels, based on FAO reported consumption levels and discussion with key informants, were estimated at 300 kilograms per adult equivalent. It was assumed that households consumed grains sequentially: maize first--given its limited storeability and preference--then other grain crops. The Zimbabwe dollar equivalent of maize was used as an estimate of grain consumption except:

1) If the amount of maize held by a household exceeded the maximum consumption level, then HC was calculated as the value of 300 kilograms of maize per adult equivalent, or
2) If the amount of maize held by a household was less than the maximum consumption level, then HC was calculated as the value of maize plus the Zimbabwe dollar value of other grains (millets, sorghums, and rice), not exceeding the maximum consumption level.

Maximum oilseed consumption levels (for groundnuts, bambara nuts, kidney beans, and cowpeas) were established based on information provided by key informants. The maximum levels (per adult equivalent) of these oilseeds are: groundnuts (Z$11.00), bambara nuts (Z$2.50), kidney beans (Z$1.50), cowpeas (Z$1.25). Any oilseeds available to households below these maximum levels were included as HC.

Figure 4.1. **Components of total annual net household receipts.**



stocks above this maximum, the surplus was transferred into the category, ending inventories. HC was estimated as the actual monetary value of the grain and oilseeds retained (net of outflows) for households that produced less than these maximum levels.

2. Market transactions

Receipts from *cash income-generating activities* (CIGA) is the income earned by household members (net of intermediate goods and services), regardless of whether the payment is made in cash or farm products[2]. The five cash income-generating subcategories are:

1.) *Farm sales* are cash receipts from sales of both crops and livestock sales.

2.) *Non-agricultural product sales* are cash receipts from the sale of home-produced non-agricultural goods.

3.) *Labor sales* are cash or cash-equivalent (farm products) receipts from agricultural and non-agricultural labor sales by resident household members.

4.) *Business inventories* are grain and oilseed stocks that were originally purchased for resale, but remained in inventory at the end of the year.

5.) *Other income* is cash and cash-equivalents (farm products) received by household members for other reasons (e.g., faith healing).

In estimating CIGA, three types of *intermediate goods and services* (IGS)--expenditures made to purchase goods and services used in the production process to generate cash income--were netted out of farm sales:

1.) *Agricultural inputs* are goods such as seed, fertilizer, pesticides, and insecticides.

2.) *Purchased labor* are labor services purchased by the household.

3.) *Transport costs* are payments made to transport agricultural products.

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[2] Farm products constitute only a small proportion of market transactions.

3. Transfers (received)

Total *transfers received* (TRI) are the total value of gifts and grants (cash and farm products) received without an explicit expectation of repayment. These transfers are subdivided into three groups:

1.) *Government transfers* are cash or in-kind grants (e.g., provided by food aid or food-for-work programs) given to a household member.

2.) *Remittances* are cash or farm products given to the household by non-resident family members.

3.) *Other private transfers* are gifts given to household members by neighbors or relatives living in the village.

4. Net credit receipts

Net *credit receipts* (NCR) are net income from loans extended or received by the household as cash or farm products. They are subdivided into loans received (+), repayments on loans made previously (+), loans made (-), and repayments on loans previously received (-).

5. Total annual income

Two related income totals are calculated to estimate household income: annual *net household income* (NHI) and *annual net household receipts* (NHR).

1.) Annual net household income is the total value of production for home consumption and income earned from cash income-generating activities; net of intermediate goods. This measures income earned from the allocation of household land, labor, and capital.

2.) Annual net household receipts is a more comprehensive income concept. It includes not only NHI, but also transfers received and net credit receipts. Thus, it provides a better indication of the amount of income available for consumption, investments, gifts, and saving.

Annual net household income and annual net household receipts are calculated as:

ANNUAL EARNED HH INCOME (NHI)	=	PRODUCTION FOR HOME CONSUMPTION (PHC)	+	CASH INCOME GENERATING ACTIVITIES (CIGA)

ANNUAL NET HH RECEIPTS (NHR)	=	PRODUCTION FOR HOME CONSUMPTION (PHC)	+	CASH INCOME GENERATING ACTIVITIES (CIGA)	+	TRANSFERS (TRI)	+	NET CREDIT RECEIPTS (NCR)

Where:

$$PHC = \sum_{i=1}^{n} (Q*P)_i + \sum_{j=1}^{n} (Q*P)_j$$

$$CIGA = \sum_{k=1}^{n} (Q*P)_k + \sum_{l=1}^{n} (Q*P)_l + \sum_{m=1}^{n} (TW)_m + \sum_{p=1}^{n} (Q*P)_p + \sum_{q=1}^{n} (Q*P)_q + \sum_{r=1}^{n} (Q*P)_r$$

$$NCR = \sum_{s=1}^{n} (Q*P)_s + M$$

NCR = LOANS IN (FARM+CASH) - LOANS OUT (FARM+CASH)

where:

i = 1,2,3,...,n (GRAINS AND OILSEEDS:CONSUMED)
j = 1,2,3,...,n (GRAINS AND OILSEEDS:INVENTORY)
k = 1,2,3,...,n (CROPS)
l = 1,2,3,...,n (ANIMALS)
m = 1,2,3,...,n (LABOR ACTIVITIES)
p = 1,2,3,...,n (NON-AGRICULTURAL PRODUCTS)
p = 1,2,3,...,n (BUSINESS INVENTORIES)
r = 1,2,3,...,n (INTERMEDIATE GOODS)
s = 1,2,3,...,n (GRAIN OR FLOUR)
Q = Quantity
P = Average seasonal price (nominal)
M = Total money received
TW = Total wages

In the analysis that follows, these two income measures are calculated per household, per capita, and per adult equivalent; although the analysis focuses on estimating per capita incomes.

1.) *Annual receipts per household* is the summation of income earned or received from all sources (net of intermediate goods and services) by all resident household members. This income estimate measures the total income available to the household production and consumption unit; but it is potentially misleading since household size varies considerably.

2.) *Annual per capita receipts* is the annual receipts per household, adjusted for the household size (number). This income estimate more accurately indicates available income than does per household receipts because it eliminates the influence of household size. Also, researchers most frequently present this measure, which facilitates comparing results with other income and expenditure studies.

3.) *Annual receipts per adult equivalent* is the annual receipts per household, adjusted for the age-sex composition of the household. Although this estimate provides the most precise measure of the adequacy of household income because it compensates for inter-household differences in age-sex composition, it is seldom reported. Consequently, it makes comparisons difficult with other income and expenditure studies.

4.1.1.2 Expenditures

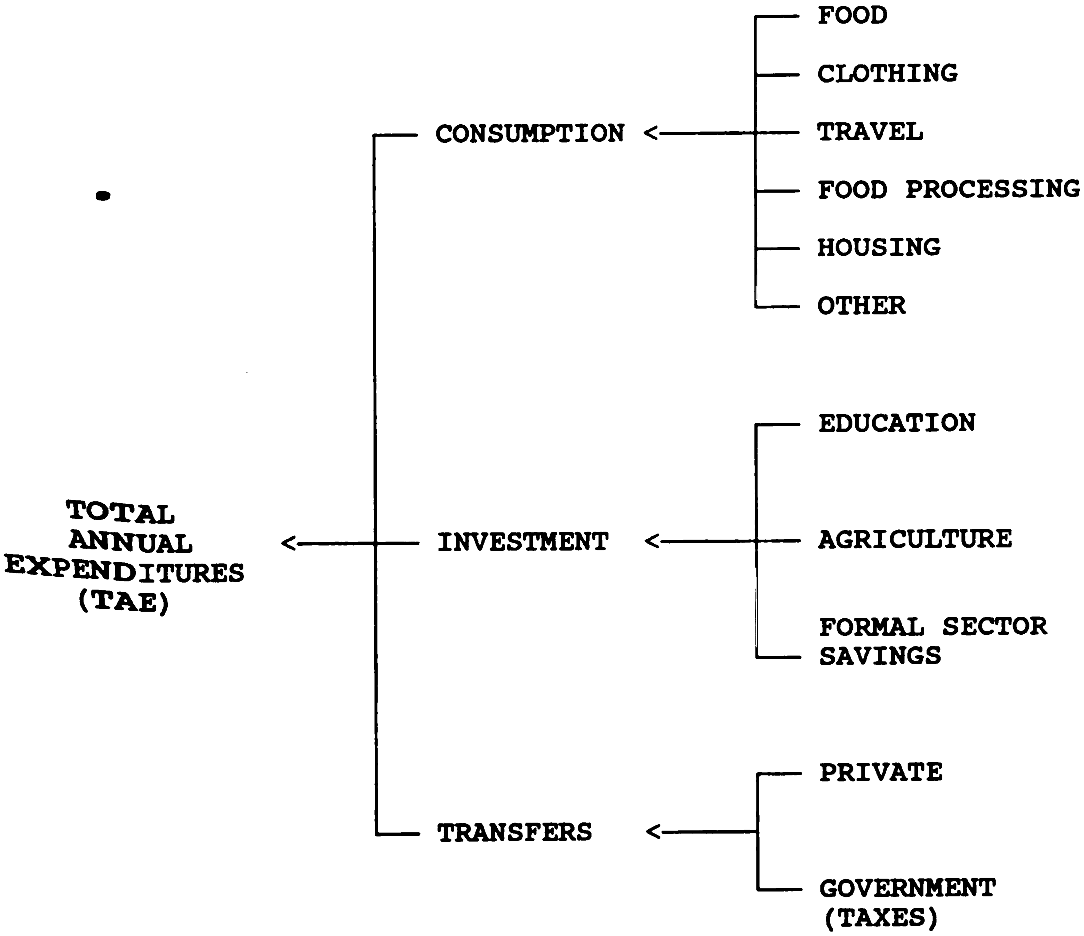
The three major categories are: consumption, investments, and transfers. All expenditures are presented in Zimbabwean dollars (nominal), using prices reported in the income and expenditure survey. The disaggregated components of the three expenditure categories are shown in Figure 4.2.

1. Consumption expenditures

Consumption expenditures (CX) are purchases or the use of home-produced goods and services to satisfy human needs and desires. CX are divided into five subcategories: food, clothing, travel, food processing, and other consumption expenditures.

1.) *Food consumption* is subdivided into home-produced and purchased food: a.) *home-produced food* is the value of commodities grown and used for home consumption (see above discussion of PHC); b.) *purchased food* is food paid for in cash; and is subdivided into grain, maize meal, and complements.

Figure 4.2. Components of total annual expenditures.



2.) *Clothing consumption* is the value of clothing purchased by household members.

3.) *Travel expenditures* are payments for travel by household members for personal reasons (excluding transport costs associated with input purchases and grain sales).

4.) *Food processing expenditures* are cash and in-kind payments for grain processing.

5.) *Housing repairs* are expenditures for repairing buildings at the household's homestead.

6.) *Other consumption expenditures* are cash and cash-equivalent (farm products) outpayments by household members for faith healing and similar items.

2. Investments expenditures

Investments (INV) are expenditures that are intended to increase household resources and, as a result, increase the household's long term productive capacity. Investments are subdivided into four subcategories:

1.) *Education investments* are educational expenditures (e.g., school fees, exam fees, and uniform purchases) that are intended to increase the long run potential earning power of household members.

2.) *Agricultural production investments* are expenditures for agricultural implements (purchase and repair) and livestock.

3.) *Publicly-held savings* are money held in the formal banking system (e.g., banks, post office savings accounts, and savings clubs) where interest is earned on the money deposited.

3. Transfers (granted)

Transfers granted (TRO) are the total value of transfers given by the household as gifts and grants (either cash or farm products) to relatives or neighbors, for which there is no explicit expectation of repayment.

4. Total annual expenditures

Total annual expenditures (TAE) are estimated by summing the reported value of consumption, investments, and transfers granted; as noted below.

$$\text{TOTAL ANNUAL EXPENDITURES (TAE)} = \text{CONSUMPTION EXPENDITURES (CX)} + \text{INVESTMENT EXPENDITURES (INV)} + \text{TRANSFERS (TRO)}$$

$$CX = \sum_{i=1}^{n} (Q*P)_i$$

$$INV = \sum_{j=1}^{n} (Q*P)_j$$

$$TRO = \sum_{k=1}^{n} M_k + \sum_{l=1}^{N} (Q*P)_l$$

<u>**where**</u>:

Q	=	Quantity
P	=	Price
M	=	Money
i	=	Consumption goods
j	=	Investment purchases
k	=	Cash transactions
l	=	Farm products

Expenditures are calculated per household, per capita, and per adult equivalent terms; although the analysis focuses on per capita expenditures.

1.) *Total annual expenditures per household* (TAE) are the total expenditures to all destinations by all resident household members. This measure estimates the gross level of household expenditures; but is potentially misleading because of differences in household size.

2.) *Annual per capita expenditures* (PCE) are the total annual expenditure per household, adjusted for household size (number). Per capita expenditures provides a more accurate measure of household expenditure behavior than does per household expenditures because it compensates for differences in household size.

3.) *Annual expenditures per adult equivalent* (AEE) are the total annual expenditure per household adjusted, for the age-sex composition of the household. This measure is the most precise estimate of household expenditure behavior--especially consumption decisions, but is seldom reported in the literature.

4.1.2 Structure of household incomes and expenditures

In semi-subsistence households, production, consumption and investment decisions are interrelated (Hayami, 1978 and Low, 1986). The initial descriptive analysis examines the structure of both household incomes (cash and in-kind) and expenditures in order to identify the major sources of income and uses of expenditures between households.[3] The relationship between incomes, expenditures, and household food consumption is summarized in Figure 4.3.

4.1.3 Distribution of incomes

Researchers use different statistics to describe the distribution of household incomes (see Chapter 2). This analysis uses skewness and kurtosis to assess symmetry; the median (village-level analysis) and the mean (district, sample, and per capita income quartile) to assess central tendency; and the coefficient of variation, the standard deviation of the natural logarithm of incomes, and the Gini coefficient to assess equality.

4.2 Analysis of net household receipts

This section presents the reported levels, distribution, sources, and monetization of annual net household receipts of households in Mutoko, Mudzi, and Buhera Districts.

4.2.1 Net household receipts levels

Estimates of net household receipts (NHR) (per household, per capita, and per adult equivalent; by village, district, and the total sample) indicate large differences in income (Table 4.1).

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[3] This information will serve as a basis for assessing the effect of current and alternative policy adjustments on households with different income and expenditure structures.

Figure 4-3- The relationship between incomes, expenditures, and household food consumption.

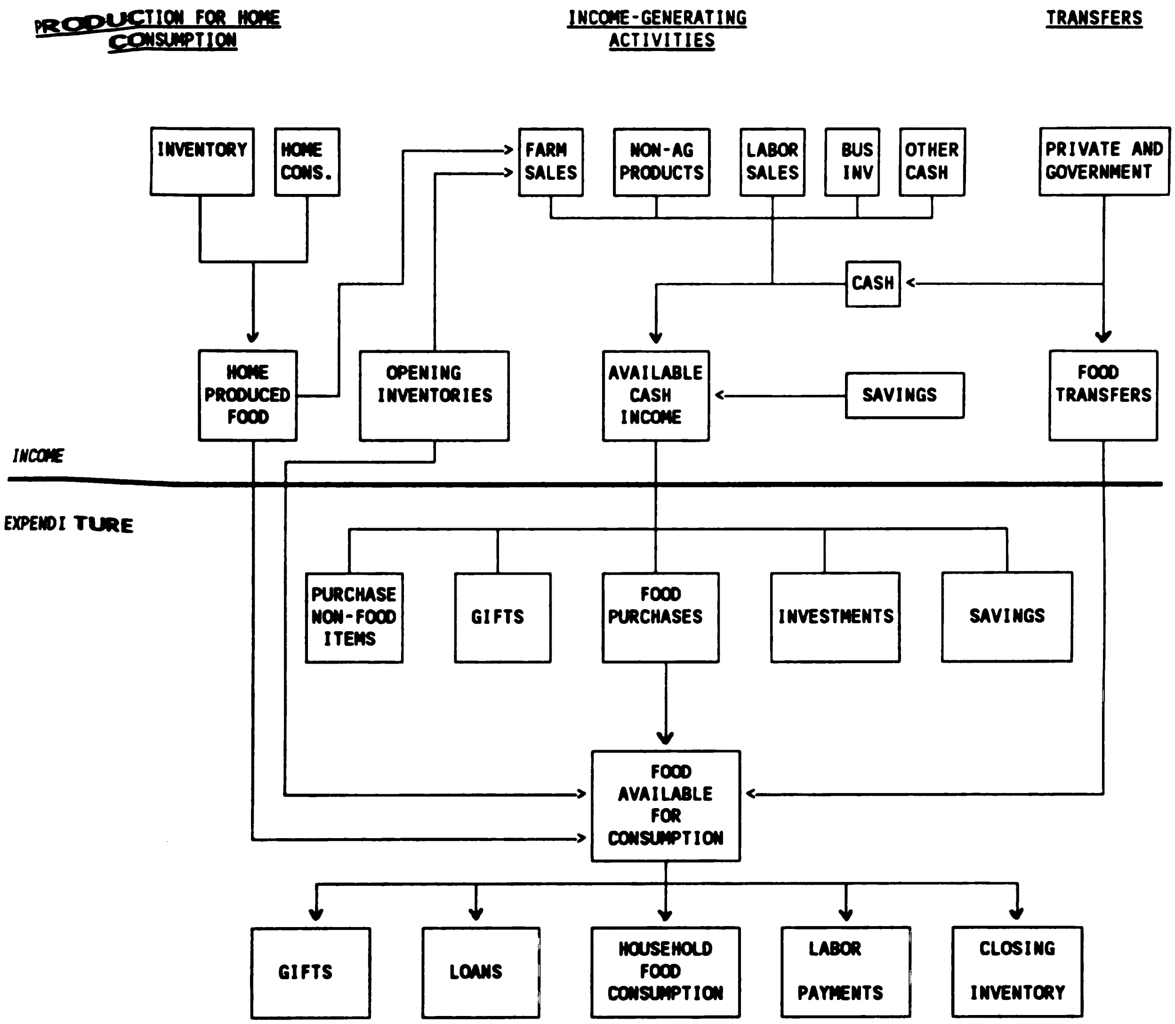

Table 4.1. Net household receipts by village, district, and total sample (Z$[a]), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[b]

District/ village	SAMPLE SIZE (n)	PER HOUSEHOLD MEAN	PER HOUSEHOLD SE	PER HOUSEHOLD MEDIAN	PER CAPITA MEAN	PER CAPITA SE	PER CAPITA MEDIAN	PER ADULT EQUIVALENT MEAN	PER ADULT EQUIVALENT SE	PER ADULT EQUIVALENT MEDIAN
Buhera										
1	25	2395	862	1588	390	81	265	558	122	329
2	23	1054	167	882	282	127	110	356	151	148
3	20	899	150	786	139	23	116	189	28	167
4	24	799	119	626	116	15	97	172	22	156
5	23	1222	207	964	222	47	123	336	81	181
6	21	1328	312	749	175	32	117	275	56	175
District total	136	1304	178	872	225	29	125	320	39	176
Mutoko/Mudzi										
1	26	992	161	744	227	52	146	307	70	204
2	29	1457	134	1179	296	26	263	379	34	335
3	15	489	62	504	161	36	141	227	55	190
4	27	720	178	496	115	20	93	153	26	114
5	29	704	65	797	124	12	100	181	19	145
6	23	1191	124	1014	229	29	169	339	44	243
District total	149	957	61	795	194	14	149	266	19	213
Sample total	285	1123	91	819	209	15	139	292	190	213

Source: Food Security surveys.

[a]Z$1.00 = US$0.60

[b]Differences in District means were tested for statistical significance at the 1 and 5 percent level. No differences in means were statistically significantly different.

Mean NHR[4] (per capita) averaged Z$209 for the total sample, Z$194 for Mutoko/Mudzi Districts (NR IV), and Z$225 for Buhera District (NR V), although the district differences are not statistically significant. By comparison, Stack (Stack and Chopak, 1990) reported mean incomes (per capita) of Z$260 and Z$100 for Shamva and Binga Districts, respectively. The CSO (1988) reported mean incomes (per household) of Z$2,992 and Z$1,237 for Mashonaland East and Manicaland Provinces, respectively; which, based on an average household size, represents Z$496 and Z$196 per capita, respectively.

The Mutoko/Mudzi and Buhera District estimates are similar to Stack's and the CSO's results since Stack's estimates are for a higher rainfall area (Bushu) and a poor rainfall year in a similar agro-ecological area (Binga); and the CSO estimates are provincial averages, which incorporate areas of higher rainfall than the survey area.

Although mean NHR (per capita and per adult equivalent) were slightly larger in Buhera District households than Mutoko/Mudzi District, these differences were not statistically significant (5 percent level). These results were unexpected since it was hypothesized that Mutoko and Mudzi Districts would have the larger mean NHR because of its more favorable resource base and stable rainfall pattern. On the other hand, median NHR (per capita and per adult equivalent) were larger for Mutoko/Mudzi District than Buhera. Since distributions of net household receipts are both highly skewed and peaked, the median is a more reliable measure of central tendency.

Within districts, there are large inter-village differences in median

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[4] The discussion of district and total sample incomes uses the mean as the measure of central tendency. There are small differences between the mean and median, which implies little skewness of the data; also, the mean facilitates comparisons with other studies.

ʀ[5]. Median per household NHR range from Z$626 to Z$1,588 in Buhera; and 496 to Z$1,179 in Mutoko/Mudzi. Median per capita NHR range from Z$97 Z$265 in Buhera; and Z$93 to Z$263 in Mutoko/Mudzi. Median per adult uivalent NHR range from Z$167 to Z$329 in Buhera; and Z$114 to Z$335 in toko/Mudzi. Except for small differences, the rank order of villages mains the same for all three income measures.

2.2 Distribution of net household receipts

The distribution of net household receipts (NHR) are assessed by alyzing the distribution across quartiles, their symmetry and equality.

ꝛ.2.1 Income quartile distribution

The distribution of households across NHR (per capita) quartiles is esented in Table 4.2[6]. The differences between villages and districts ı terms of the percent of households within income quartiles) is riking. First, villages range from having almost a majority of useholds in the lowest quartile (village 4 in Mutoko/Mudzi), to having st households in the upper quartile (village 1 in Buhera and village 2 Mutoko/Mudzi). Second, most villages in Buhera (excepts for village 1) ve a majority of households in the lower two quartiles; and most llages in Mutoko/Mudzi (except for villages 4 and 5) have most useholds in the upper two quartiles. These differences are discussed rther in Chapter 6.

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e discussion of village incomes uses the median as the of central tendency. The large difference between the mean median imply skewness in the data, and therefore the median appropriate measure of central tendency.

t household receipts was chosen to determine quartiles it gives the most comprehensive income definition.

Table 4.2. Distribution of households (percent) among net household receipts quartiles by village and district (Z$), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89.

District/ village	SAMPLE SIZE (n)	PER CAPITA NHR QUARTILES LOWER (< $85)	LOWER-MIDDLE ($85 - $139)	UPPER-MIDDLE ($139 - $243)	UPPER (> $243)
Buhera					
1	25	4	20	24	52
2	23	30	22	30	17
3	20	35	35	5	25
4	24	29	54	13	4
5	23	35	22	9	35
6	21	29	24	24	24
District total	136	26	29	18	26
Mutoko/Mudzi					
1	26	19	27	27	24
2	29	7	3	28	62
3	15	33	13	40	13
4	27	44	33	15	7
5	29	34	31	31	3
6	23	4	17	52	26
District total	149	23	21	31	24
Sample total	285	25	25	25	25

Source: Food Security surveys.

4.2.2.2 Symmetry of per capita net household receipts

The measures of central tendency and symmetry (skewness and kurtosis) indicate per capita net household receipts (NHR) are asymmetrically distributed across villages, districts, and the total sample (Table 4.3).

The distribution of NHR (per capita) is highly and positively skewed (tail to the right) in all villages, districts, and for the total sample, ranging from 0.6 to 4.4 across villages[7]. High positive skewness, characteristic of income data, indicates that for a majority of households, their NHR (per capita) are below the mean (a few households with large incomes are skewing up the mean). On average, positive skewness is higher in villages in Buhera District than in Mutoko/Mudzi Districts.

In all but two villages (one in each district) the distribution of NHR (per capita) are highly peaked (kurtosis), ranging from 0.331 to 20.461[8]. High positive peakedness indicates that households are concentrated in a narrow income band at the lower end. The two villages with a negative kurtosis value, also have less skewness--which implies a more symmetric distribution of NHR (per capita) in these villages.

4.2.2.3 Equality of net household receipts (per capita)

All three measures of equality--coefficient of variation, the standard deviation of the natural logarithm of income, and the Gini coefficient--indicate considerable differences in income distribution (Table 4.4).

Total sample results

All inequality measures indicate a large inequality in NHR (per capita). For the total sample, the Gini coefficient is 0.4689; the coefficient of variation is 1.2488; and the standard deviation of the

[7] Skewness is zero for a normal distribution.

[8] Kurtosis is zero for a normal distribution.

Table 4.3. Measures of central tendency and symmetry for net household receipts (per capita) by village, district, and sample, Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

District/ village	SAMPLE SIZE (n)	MEAN	MEDIAN	SD	SE	SKEWNESS	KURTOSIS
Buhera							
1	25	390	265	404	81	2.525	7.563
2	23	282	110	609	127	4.431	20.461
3	20	139	116	98	22	.859	(.392)
4	24	116	97	75	15	2.000	5.281
5	23	222	123	224	47	1.494	2.169
6	21	175	117	147	32	1.370	1.431
District total	136	225	125	335	29	5.486	39.063
Mutoko/Mudzi							
1	26	227	146	264	52	2.767	7.621
2	29	296	263	138	26	.978	1.580
3	15	161	141	140	36	2.553	7.978
4	27	115	93	104	20	2.455	6.488
5	29	124	100	64	12	.553	(.801)
6	23	229	169	138	29	1.191	.311
District total	149	194	149	166	14	2.621	10.162
Sample total	285	209	139	261	15	5.959	52.860

Source: Food Security surveys.
[a]Values in parentheses are negative numbers.

Table 4.4. Distribution of net household receipts (per capita) by village, district, and sample, Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89.

District/ village	SAMPLE SIZE (n)	GINI COEFFICIENT	COEFFICIENT OF VARIATION	STANDARD DEVIATION OF THE NATURAL LOG OF INCOME
Buhera				
1	25	.4632	1.0332	.3878
2	23	.6376	2.1596	.5672
3	20	.3775	.7050	.3507
4	24	.3080	.6466	.2514
5	23	.5079	1.0090	.5508
6	21	.4300	.8400	.4423
District total	136	.5257	1.4889	.4689
Mutoko/Mudzi				
1	26	.4772	1.1630	.3824
2	29	.2460	.4696	.2243
3	15	.3249	.8696	.3298
4	27	.4058	.9043	.3300
5	29	.2855	.5161	.2474
6	23	.3083	.6026	.2419
District total	149	.4040	.8557	.3461
Sample total	285	.4689	1.2488	.4073

Source: Food Security surveys.

natural log of income is 0.4073.

District level differences

All three measures of the distribution of NHR (per capita) are larger for Buhera District than for Mutoko/Mudzi Districts, indicating greater inequality in Buhera.

Inter-village variability

In terms of inter-village variability, there are three important results. First, NHR are unequally distributed. For example, the Gini coefficient demonstrates that two of the 12 villages have an high level of inequality, two are relatively high, one is moderate, and seven have a low level of inequality[9].

Second, the degree of inequality varies considerably across villages. For example, the Gini coefficients for Buhera District villages ranged from 0.3080 to 0.6376, and from 0.2460 to 0.4772 for Mutoko/Mudzi; the CVs for Buhera District villages ranged from 0.6466 to 2.1596, and from 0.4696 to 1.1630 for Mutoko/Mudzi; and the SDLs for Buhera District villages ranged from 0.2514 to 0.5672, and from 0.2243 to 0.3824 for Mutoko/Mudzi.

Finally, all three measures of NHR inequality provide generally the same ranking of villages within each district, except for two villages in Buhera District. In one of these villages (#1), their relative ranking among villages for their CV is higher than their Gini, but smaller for their SDL. This ranking switch implies a relatively greater inequality in the middle income range for that village than other villages. Conversely, in village 5 the SDL is relatively larger than both the Gini coefficient and CV, implying a relatively larger inequality in the lower income range in that village.

[9]FAO (1986) defines a low amount of income inequality as having a Gini coefficient less than or equal to 0.41; moderate inequality between 0.41 and 0.45; relatively high inequality between 0.46 and 0.50; and a high inequality if greater than 0.50.

4.2.3 Sources of net household receipts

This section discusses the magnitudes and contribution of different income sources to net household receipts (per capita). After presenting the sources of NHR across villages and districts, these sources are analyzed across NHR (per capita) quartiles.

4.2.3.1 Structure of NHR by village and district

The three major components of net household receipts (per capita) are: earned income (production for home consumption and cash income-generating activities (net of intermediate goods and services), transfers received, and net credit receipts (Table 4.5).

Disaggregated net household receipts

In terms of the relative importance of these major sources, three points stand out. First, for all villages in both districts, earned income accounted for the major share of NHR--ranging from 88 to 99 percent in Buhera; and 69 to 93 percent in Mutoko/Mudzi[10]. Second, transfer income (transfers received) was large for the total sample (15 % of NHR (per capita)), but more important in Mutoko/Mudzi District. For example, transfers accounted for over 25% of NHR in only one village in Buhera District, but for over 25% in 5 of 6 villages in Mutoko/Mudzi villages. Finally, although net credit receipts were less than 10 percent of NHR (except in one village in Buhera District), they were generally negative--indicating a credit burden.

Disaggregated earned income

The following sections explores the subcomponents of earned income (Table 4.6).

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[10]Note: The cumulative percent of earned income and transfers received can exceed 100 percent because many households had a negative outflow (therefore negative percent) of credit.

Table 4.5. Components of mean net household receipts (per capita) by source, village, and district, Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

District/ village	SAMPLE SIZE (n)	EARNED INCOME		TRANSFERS RECEIVED		NET CREDIT RECEIPTS		PER CAPITA NHR	
		AMOUNT (Z$)	PERCENT	AMOUNT (Z$)	PERCENT	AMOUNT (Z$)	PERCENT	AMOUNT (Z$)	PERCENT
Buhera									
1	25	387	99	34	9	(30)	(8)	390	100
2	23	269	95	11	4	2	1	282	100
3	20	122	88	35	25	(18)	(13)	139	100
4	24	115	99	10	9	(9)	(8)	116	100
5	23	214	96	11	5	(2)	(1)	222	100
6	21	169	97	14	8	(8)	(5)	175	100
District total	136	217 **	96	19 **	8	(11) **	(5)	225	100
Mutoko/Mudzi									
1	26	156	69	71	31	1	(<1)	227	100
2	29	239	81	56	19	2	1	296	100
3	15	138	86	38	24	(15)	(9)	161	100
4	27	107	93	9	8	(1)	(1)	115	100
5	29	96	77	26	21	1	1	124	100
6	23	176	77	66	29	(12)	(5)	229	100
District total	149 **	153	79	44 **	23	(3) **	(2)	194	100
Sample total	285	183	88	32	15	(7)	(3)	209	100

Source: Food Security surveys.

[a]Differences in District means were tested for statistical significance at the 1 (**) and 5 (*) percent level.

Table 4.6. Percent contribution to earned income (per capita) by village, district, and sample, Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

District/ village	SAMPLE SIZE (n)	PRODUCTION FOR HOME CONSUMPTION		CASH INCOME GENERATING ACTIVITIES				
		HOME CONSUME	INVENT-ORY[b]	FARM SALES	NON-AG SALES	LABOR SALES	BUSINESS INVENTORY	OTHER CASH
Buhera								
1	25	9	48	10	8	21	2	1
2	23	11	63	18	2	1	3	1
3	20	22	32	19	6	4	14	2
4	24	25	40	4	9	19	3	1
5	23	12	38	5	<1	42	1	<1
6	21	7	4	9	18	53	3	6
District total	136	12	42	11	6	21 **	3	2
Mutoko/Mudzi								
1	26	17	31	32	7	8	1	3
2	29	14	58	16	3	8	<1	<1
3	15	22	51	15	9	2	<1	0
4	27	28	24	25	9	14	1	0
5	29	30	47	<1	5	18	1	<1
6	23	17	36	16	14	16	<1	1
District total	149	20	43	18	7	11 **	1	1
Sample total	285	15	43	13	7	17	2	2

Source: Food Security surveys.

[a]Differences in District values were tested for statistical significance at the 1 (**) and 5 (*) percent level.

[b]For a discussion of the inventory category, see footnote 11.

Total sample

First, production for home consumption was the most important component of earned income, accounting for 58 percent of earned income; of which 43 percent was held as inventories[11] and 15 percent was assumed to be home consumed. Second, cash income-generating activities accounted for 42 percent of earned income; of which 17 percent was from labor sales, 13 percent from farm sales, 7 percent from non-agricultural product sales, and 4 percent from business inventories and other cash sources.

District level comparisons

In both Districts, three similarities stand out. First, production for home consumption accounted for over one-half of earned income; 54 percent in Buhera District and 63 percent in Mutoko/Mudzi. Second, farm and labor sales accounted for a two-thirds of earned income from cash income-generating activities (CIGA). Finally, non-agricultural product sales, business inventories, and other cash income sources contributed little to earned income; ranging from 2 to 6 percent in Buhera District and from 1 to 7 percent in Mutoko/Mudzi.

Two major inter-district differences between production for home consumption stand out. First, production for home consumption accounted for a larger share of earned income in Mutoko/Mudzi than Buhera (63 percent versus 54 percent), due to greater estimated consumption from home production (20 percent versus 12 percent). The percent contribution of

[11] The large mean inventory holdings--as a proportion of per capita earned income--is misleading. Means values were used to present the percent contribution of different subcomponents to per capita earned income. Analysis of the data indicates a large degree of skewness and peakedness in the level of total and grain inventories (per capita) held by households, suggesting that the median, not the mean, is the most appropriate measure of central tendency. An examination of median grain inventories reveals that in only two villages did households hold more than 1.5 bags of grain per capita. Furthermore, 73 percent of the total sample held 3 bags of grain or less. For a more thorough discussion see Appendix 5.

inventories was similar between the two districts (42 percent in Buhera and 43 percent in Mutoko/Mudzi).

Second, although farm sales and labor sales were the major source of earned income in both districts, farm sales were more important in Mutoko/Mudzi (18%) and labor sales were more important in Buhera (21%). In contrast, non-agricultural product sales accounted for a similar percentage (7 percent) of earned income in both districts, and both business inventories and other cash sources were minor sources of earned income.

Village level comparisons

Across villages, the production for home consumption share of earned income varied greatly; ranging from 11 to 77 percent. Among subcategories, home consumption ranged from 7 to 30 percent and inventories ranged from 4 to 63 percent (Table 4.6).

The three most important cash income-generating activities in all villages, were farm sales and labor sales; and in two villages non-agricultural product sales. Business inventories and income from other cash sources were small. Conversely, the contribution of CIGA was extremely variable across villages, ranging from 23 to 89 percent. Among subcategories, the contribution of labor sales ranged from 1 to 53 percent, farm sales ranged from <1 to 32 percent, non-agricultural product sales ranged from <1 to 18 percent, business inventories ranged from <1 to 14 percent, and other cash sources ranged from <1 to 6 percent.

4.2.3.2 Structure of net household receipts, by income quartiles

Across net household receipt (per capita) quartiles, four similarities stand out (Table 4.7). First, across all income quartiles, earned income contributed the largest share of NHR (87 to 92 percent); which is composed of production for home consumption (50 to 62 percent) and cash income-generating activities (32 to 37 percent).

Table 4.7. Structure of net household receipts (per capita) by income quartile (Z$), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

NET HOUSEHOLD RECEIPTS	LOWER (< Z$85)		LOWER MIDDLE (Z$85 - Z$139)		UPPER MIDDLE (Z$139 - Z$243)		UPPER (> Z$243)	
	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT
EARNED INCOME								
PHC	33 a	62	56 a	52	95 a	51	241 b	50
CIGA	17 a	32	40 ac	37	69 bc	37	180 bcd	37
TOTAL EARNED INCOME	49 a	92	96 ab	90	164 b	88	422 c	87
TRANSFERS	8 a	15	16 ac	15	32 bc	17	72 bcd	15
NET CREDITS	(4)	(8)	(5)	(5)	(8)	(5)	(10)	(2)
TOTAL NHR (pc)	53 a	100	107 ac	100	187 bc	100	486 bcd	100

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

Second, as expected, production for home consumption accounted for a larger share of NHR (per capita) for the lowest quartile (62%) than for the higher quartiles (50 percent for the highest quartile) households. Third, the share contribution of transfers was similar across income quartiles, ranging from 15 to 17 percent. Finally, net credit receipts were, on average, negative and small across quartiles (8 percent). This shows a higher repayment burden for the poorer households.

Earned income (by income quartile) is further disaggregated for additional analysis (Table 4.8).

4.2.3.3 Structure of earned income, by income quartiles

Across NHR quartiles, three important points stand out (Table 4.8). First, for all income quartiles production for home consumption (home consumption plus inventories) accounted for a similar share of earned income (57 to 67 percent). On the other hand, as NHR increase, households required a smaller share of income to meet recommended consumption levels. This is in part because an upper bound was placed on the maximum level of per capita consumption; but more importantly, as income rose the level of inventories significantly increased as a percent of earned income.

Second, for all income quartiles cash income-generating activities (CIGA) accounted for a similar share of earned income (43 to 35 percent); and the contribution of individual components of CIGA were similar across quartiles. In contrast, farm sales constituted a much larger share of earned income for the highest three quartiles. Surprisingly, labor sales constituted a larger share of CIGA in the highest income quartile (19 percent) than for the lowest quartile (14 percent).

Third, a review of potential farm sales (Table 4.9)[12] shows that for

[12] Potential farm sales equals total crop and livestock sales, plus inventories. Inventories are included as sales because they represent a reserve grain and oilseed stock that has not been consumed and is available for sale.

Table 4.8. Structure of earned income (per capita) by income quartile (Z$), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

EARNED INCOME	LOWER (< Z$85)		LOWER MIDDLE (Z$85 - Z$139)		UPPER MIDDLE (Z$139 - Z$243)		UPPER (> Z$243)	
	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT
PRODUCTION FOR HOME CONSUMPTION								
HOME CONSUMED	23	47	29	30	30	18	32	8
INVENTORY	9 a	18	28 ab	29	65 b	40	210 c	50
TOTAL PHC	33	67	56	58	95	58	241	57
CASH INCOME-GENERATING ACT.								
FARM SALES	3 a	6	13 ac	13	23 bc	14	63 bcd	15
NONAG PRODUCTS	4 a	8	7 ab	7	17 b	10	23 c	5
LABOR SALES	7 a	14	15 a	16	26 a	16	81 b	19
BUSINESS INV	2	4	3	2	1	1	8	2
OTHER CASH	2	4	2	2	2	1	5	1
TOTAL CIGA	17	35	40	42	69	42	180	43
TOTAL EARNED INCOME	49 a	100	96 ab	100	164 b	100	422 c	100

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

Table 4.9. Disaggregation of potential farm sales[a] (crop/livestock) by income quartile (including inventories), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[b].

POTENTIAL FARM SALES	LOWER (< Z$85)		LOWER MIDDLE (Z$85 - Z$139)		UPPER MIDDLE (Z$139 - Z$243)		UPPER (> Z$243)	
	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT
CROP								
TOTAL GRAINS	12 a	50	29 a	55	61 b	55	215 c	66
OILSEEDS	6 a	25	13 a	25	31 a	28	75 b	23
FRUITS & VEG	1 a	4	1 a	2	6 a	5	17 b	5
COTTON	1	4	<1	<1	1	1	1	<1
GROSS CROP SALES	20 a	83	43 a	81	99 b	89	308 c	94
LIVESTOCK SALES	4	17	10	19	12	11	19	6
POTENTIAL FARM SALES	24 a	100	53 a	100	111 a	100	327 c	100

Source: Food Security surveys.

[a] For a definition of potential farm sales see footnote 13.

[b] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

all income quartiles, grain sales accounted for the largest component of farm sales (50 to 66 percent), followed by oilseed sales (23 to 28 percent), and livestock sales (6 to 19 percent). While important for individual households, fruit and vegetable and cotton sales contribute relatively little to farm sales across all income quartiles.

4.2.4 Monetization of households

As household income increases, economists observe that households earn a greater share of income from cash sources, making it possible for households to invest in agricultural and non-agricultural capital which stimulates further household income growth (von Braun and Kennedy, 1986 and Matlon, 1977). To test this hypothesis, the contribution of 1.) cash (and non-cash income) to total per capita income and 2.) the composition of cash income (non-farm and farm)[13] were estimated.

First, as per capita incomes increase, the cash share of income increased substantially, and the non-cash share decreased (Table 4.10).

Second, for all income quartiles farm sales represented the largest share of cash income per capita (44 to 62 percent), although the contribution of different cash sources varied between income quartiles. For the lowest NHR quartile, farm sales were the largest component of cash income (44 percent), followed by transfers (26 percent), labor sales (19 percent), and net credit receipts (11 percent); and net credit receipts represented a large negative outflow of cash income. In contrast, for the highest NHR quartile, farm sales were also the largest component of cash income (62 percent); but labor sales (18 percent) were the second most important source, followed by transfers (14 percent). Net credit receipts, business inventories, and other cash income contributed little to per capita cash income.

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[13]Cash income is the summation of all receipts received by household members from all cash sources. Non-cash income is the summation of all income received by household members in-kind.

Table 4.10. Cash versus noncash income[a] by net household receipts (per capita) quartiles, Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89.

CASH VERSUS NONCASH INCOME	LOWER (< Z$85)		LOWER MIDDLE (Z$85 - Z$139)		UPPER MIDDLE (Z$139 - Z$243)		UPPER (> Z$243)	
	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT
TOTAL INCOME COMPONENTS								
NON-CASH	31	53	44	36	59	28	123	22
CASH	27	47	77	64	154	72	440	78
COMPONENTS OF CASH INCOME								
FARM SALES	12	44	41	53	89	58	273	62
NON-AGRI SALES	4	15	7	9	17	11	23	5
LABOR SALES	5	19	13	17	26	17	78	18
BUSINESS INVENT.	2	7	3	4	1	1	8	2
OTHER CASH	1	4	2	3	1	1	4	1
TRANSFERS	7	26	14	18	29	19	63	14
NET CREDITS (+/-)	(3)	(11)	(4)	(5)	(8)	(5)	(10)	(2)
TOTAL CASH INCOME	27	100	77	100	154	100	440	100

Source: Food Security surveys.

[a] For a definition of cash and noncash income, see footnote 13.

Finally, although transfers constituted a large share of cash income for the lowest quartile (26 percent), they were also quite large for the other three quartiles (18, 19, and 14 percent, respectively).

4.3 Analysis of household expenditures: empirical results

This section analyzes both annual household expenditure levels and patterns in Mutoko/Mudzi and Buhera Districts. The mean is used as the measure of central tendency for expenditures at the sample and district level; while the median is presented for the village level analysis.

4.3.1 Household expenditure levels

Mean and median expenditure levels were estimated per household, per capita, and per adult equivalent--by village, district, and the total sample (Table 4.11).

District level mean expenditures

For all three measures (per household, per capita, and per adult equivalent), mean expenditures were larger in Buhera than in Mutoko/Mudzi District. This result is consistent with earlier analysis which indicated that estimated incomes--for similar measure of income--were larger in Buhera than Mutoko/Mudzi District.

For the total sample, expenditures per household averaged Z$839; compared to Z$963 for Buhera District and Z$725 for Mutoko/Mudzi District. Expenditures per capita averaged Z$149; compared to Z$156 for Buhera District and Z$143 for Mutoko/Mudzi District. Expenditures per adult equivalent averaged Z$210; compared to Z$222 for Buhera District and Z$199 for Mutoko/Mudzi District.

Table 4.11. Expenditures by village, district, and sample (Z$), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

District/ village	SAMPLE SIZE (n)	PER HOUSEHOLD			PER RESIDENT			PER ADULT EQUIVALENT		
		MEAN	SE	MEDIAN	MEAN	SE	MEDIAN	MEAN	SE	MEDIAN
Buhera										
1	25	1221	168	855	226	27	173	329	47	250
2	23	995	87	1130	174	22	141	229	30	175
3	20	946	134	975	165	34	100	219	41	160
4	24	886	231	559	127	29	88	187	41	130
5	23	613	67	579	99	13	77	144	21	108
6	21	1111	198	764	141	19	117	218	35	184
District total	136	963**	66	760	156	11	114	222	16	160
Mutoko/Mudzi										
1	26	1224	156	872	262	56	195	355	75	254
2	29	434	45	371	86	10	65	111	14	84
3	15	564	69	492	174	30	129	237	41	197
4	27	378	40	334	61	5	60	81	7	77
5	29	560	53	593	99	7	87	145	13	121
6	23	1201	208	969	216	33	149	316	47	224
District total	149	725**	53	584	143	13	102	199	18	145
Sample total	285	839	43	658	149	8	107	210	12	151

Source: Food Security surveys.

[a]Differences in District means were tested for statistical significance at the 1 (**) and 5 (*) percent level.

Inter-village variability in expenditures

The expenditure data analysis, as with incomes discussed earlier, confirms the hypothesis that expenditure levels vary considerably between villages, although the rank order of villages was generally the same for all three measures.

Expenditures per household ranged from Z$613 to Z$1221 in Buhera District and Z$378 to Z$1224 in Mutoko/Mudzi; expenditures per capita ranged from Z$99 to Z$226 in Buhera District and Z$61 to Z$262 in Mutoko/Mudzi; expenditures per adult equivalent ranged from Z$144 to Z$329 in Buhera District and Z$81 to Z$355 in Mutoko/Mudzi.

4.3.2 Household expenditure pattern

This section examines the levels and composition of expenditures (per capita) to identify policy interventions to raise the level of available income--through increasing incomes, or reduce specific expenditures to increase available income.

4.3.2.1 Household expenditures by village and district

Expenditures (per capita) are grouped into three categories--consumption, investment, and transfers granted--with mean values estimated by village, district, and for the total sample (Table 4.12).

District composition of expenditures

For both districts, the composition of expenditures per capita were similar. For the total sample, consumption represented 71 percent of expenditures (70 percent in both Buhera and Mutoko/Mudzi Districts); investments represented 26 percent (26 percent in Buhera District and 24 percent in Mutoko/Mudzi); and transfers represented 4 percent (4 percent in Buhera District and 5 percent in Mutoko/Mudzi).

Table 4.12. Structure of expenditures (per capita) by village, district, and total sample (Z$), Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

District/ village	SAMPLE SIZE (n)	CONSUMPTION		INVESTMENT		TRANSFERS	
		AMOUNT	PERCENT	AMOUNT	PERCENT	AMOUNT	PERCENT
Buhera							
1	25	154	68	62	27	11	5
2	23	119	69	58	30	1	1
3	20	99	60	62	38	3	2
4	24	87	69	29	23	11	9
5	23	81	81	14	14	4	4
6	21	114	80	23	16	4	3
District total	136	110	70	41	26	6	4
Mutoko/Mudzi							
1	26	170	65	58	22	34	13
2	29	64	74	22	26	<1	<1
3	15	125	71	49	28	<1	<1
4	27	52	85	9	15	1	2
5	29	77	77	19	19	2	2
6	23	145	68	70	32	1	<1
District total	149	101	70	35	24	7	5
Sample total	285	105	71	38	26	6	4

Source: Food Security surveys.

[a]Differences in District means were tested for statistical significance at the 1 (**) and 5 (*) percent levels. No means were statistically significantly different.

As expected for low rainfall agricultural areas, consumption dominated household expenditures. Yet, households also invested a significant share of their income[14], and subsequent analysis will show that these investments were mostly made to pay school fees expenses. Although transfers given to others represented up to 13 percent of expenditures across villages, they were not an important expenditure in most villages.

Inter-village variability of expenditures

As was the case at the district level, the analysis confirmed that consumption expenditures dominated total expenditures in all villages; but the composition of these household expenditures varied greatly between villages.

Consumption expenditures (per capita) in Buhera District ranged from 60 to 81 percent and in Mutoko/Mudzi from 65 to 85 percent. Investment expenditures in Buhera District ranged from 14 to 38 percent and in Mutoko/Mudzi from 15 to 32 percent. Transfers in Buhera District ranged from 1 to 9 percent and in Mutoko/Mudzi from less than one to six percent.

4.3.2.1 Expenditures by net household receipts quartiles

The analysis of expenditures by net household receipts (per capita) quartiles provided three interesting insights into the relationship between income levels and the composition of household expenditures (Table 4.13). As incomes rose: 1.) consumption expenditures as a percentage of total per capita expenditures fell[15] (82 to 63 percent); 2.) investment

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[14]School expenses are often considered a consumption expenditures. This analysis classifies them as investments since households perceive them as a way to increase future income.

[15]Although home-consumed production has an assumed upper bound (see footnote 1, p. 55), its influence is small. For the lower quartile, home-consumed production represented 37% of consumption expenditures, which is an accurate estimate since these households had small inventory levels. For the upper quartile, home-consumed production represented only 20% of consumption expenditures.

expenditures rose (16 to 30 percent); and 3.) transfers given rose (1 to 7 percent).

Analysis of the disaggregated expenditure components points out three important patterns. First, for all income quartiles, food and clothing purchases dominated both total (54-69 percent) and consumption expenditures (84-87 percent). Second, as income rose, absolute expenditures on education rose; the absolute level is relevant because households had similar numbers of school-age children. Third, as incomes increased, agricultural production investments rose--both absolutely and relatively; which gave wealthier households a larger capacity to produce. Finally, as incomes increased, transfers given rose, but were a small share of expenditures for all quartiles.

4.4 Summary

This section presents an overview of the empirical analysis of the level, distribution, and composition of incomes and expenditures. This profile of household incomes and expenditures will be used to generate hypotheses that will guide the bivariate and multivariate analysis presented in Chapters V and IV, respectively.

Incomes

Estimated mean net household receipts (per capita)--Z$209 for the total sample, Z$194 for Mutoko/Mudzi Districts, and Z$225 for Buhera District--are consistent with results reported in studies conducted in Zimbabwe by MLARR (1990), the Central Statistics Office (1988), Stack (Stack and Chopak, 1990), Amin (1990), and Govaerts (1987) under similar agro-ecological conditions. Although mean NHR (per capita) were larger in Buhera District, median NHR (the more appropriate measure of central tendency) were larger in Mutoko/Mudzi District.

The distribution of households across net household receipt (per capita) quartiles varied greatly across villages. For example, in each

Table 4.13. Composition of expenditures (per capita) by income quartile, Mutoko, Mudzi, and Buhera Districts, Zimbabwe, 1988/89[a].

EXPENDITURE COMPOSITION	LOWER (< Z$85)		LOWER MIDDLE (Z$85 - Z$139)		UPPER MIDDLE (Z$139 - Z$243)		UPPER (> Z$243)	
	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT	MEAN	PERCENT
CONSUMPTION								
FOOD AND CLOTHING	52 a	69	70 a	64	100 b	63	136 c	54
TRAVEL	2 a	3	3 ac	3	6 bc	4	11 d	4
FOOD PROCESSING	3 a	4	5 a	5	5 a	3	8 b	3
HOUSING	2 a	3	2 a	2	16 b	10	6 a	2
OTHER	5	6	5	5	4	2	7	3
TOTAL CONSUMPTION	62 a	82	83 a	76	114 b	71	162 c	63
INVESTMENT								
EDUCATION	6 a	8	12 a	11	11 a	7	33 b	13
AGRI PRODUCTION	4 a	5	9 a	8	15 a	9	36 b	14
TOTAL INVESTMENTS	12 a	16	23 a	21	41 b	26	75 c	30
TRANSFERS	1 a	1	3 a	3	5 a	3	17 b	7
TOTAL EXPENDITURES (per capita)	75 a	100	109 a	100	160 b	100	254 c	100

Source: Food Security surveys.

[a]Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significance difference across quartiles.

district there was one village with greater than 50 percent of the households in the upper quartile; and one village with at least 75 percent of the households in the lower two quartiles. More households in Buhera District (55 percent) were in the lower two quartiles.

All measures of inequality indicated considerable income inequality across the total sample. District level analysis indicated that incomes were more unequally distributed in Buhera District, compared to Mutoko/Mudzi District.

Three major sources of NHR (per capita) were earned income, transfers received, and net credit receipts. Earned income was the largest source of NHR in all villages and both districts. Transfers were more important in Mutoko/Mudzi District, compared with Buhera District (although they were similar across NHR quartiles). Net credit receipts were small and negative across the total sample.

Subcomponents of earned income were production for home consumption (PHC) and cash income-generating activities (CIGA). There was little variability in PHC between districts, but there was considerable variability between villages. Conversely, as incomes increased, assumed home-consumed production fell and inventories increased. The overall level of CIGA varied little across districts. In Buhera District, labor sales were the largest source of CIGA; followed by farm sales; while in Mutoko/Mudzi District, farm sales were the largest source of CIGA, followed by labor sales.

Expenditures

For all three mean expenditure measures (per household, per capita, and per adult equivalent), expenditures were larger in Buhera District, compared to Mutoko/Mudzi District. The analysis confirmed that expenditure levels vary considerably across villages.

Expenditures were grouped into three categories--consumption, investment, and transfers granted--with mean levels estimated by village, district, and for the total sample. For the total sample, consumption was the largest expenditure category (70 percent); followed by investments (25 percent); and transfers granted (4 percent).

The composition of expenditures varied across income quartiles. First, as NHR (per capita) increased, the level of consumption expenditures fell. Second, as NHR increased, investments increased (mostly for education and agricultural production). Across all quartiles, transfers granted represented a small share of the budget.

CHAPTER V

RESOURCE ENDOWMENT AND EXTERNAL ENVIRONMENT

Both internal (endogenous) and external (exogenous) factors influence household income. Internal factors, partly under the household's control, include both the level of resources available to the household, and their ability to allocate them efficiently. External factors include the agroclimatic, institutional, technological, and cultural environment; all of which influence household decisions, but over which the household has little control.

This chapter describes the sample households' resource endowment, the external environment facing these households, and how they allocate resources to generate income. First, definitions and statistical measures to analyze resource distribution are presented. Second, household resource endowment levels are estimated. Third, the distribution of resource ownership is examined. Fourth, household access to key resources--labor, land, animals, and equipment--are evaluated across income quartiles. Finally, the external environment--physical, institutions, and technology--facing households is described.

5.1 Household resource definitions and measures of distribution

Key household resources, and the methods used to evaluate their distribution, are defined below.

5.1.1 Definitions

The first set of definitions relate to labor resources:

1.) Household. A household is composed of family members who are related to the household head, live together, and collectively make arrangements for feeding, budgeting, and other essentials of living.

2.) Resident. Resident household members are family members who live at the homestead the entire agricultural season (land preparation through harvesting).

3.) Household head. The household head is the resident household member who makes the major agricultural investment decisions.

4.) Classification of household head. This classification incorporates the gender and residency of both the household head and spouse. The three categories are: male-headed, female-headed with male non-resident, and female-headed with no male (divorce or death).

The second set of definitions relate to land resources:

1.) Tenure. In communal areas, there are four types of land tenure:

a.) *Household use rights*: This is the predominant type of tenure, and means that households have a secure right to cultivate or graze the land.
b.) *Rent*: This means that a household pays (or receives), in cash or kind, to temporarily use the land.
c.) *Share*: This means that a household pays (or receives) a percent of the harvest to use the land.
d.) *Borrow*: This means that a household temporarily gains (or gives) access to a piece of land, without an explicit payment (cash or kind).

2.) Soil quality. The household head's assessment (poor, average, or excellent) of the soil quality (fertility and drainage) of each parcel.

The third set of definitions relate to physical and human capital resources:

1.) Animal traction classes. The three classes of animal traction ownership are:

a.) *Non-equipped*: The household owns no oxen or traction equipment.
b.) *Semi-equipped*: The household owns either a plow or oxen, but not both.
c.) *Totally equipped*: The household owns both a plow and two oxen.

2.) Animal traction index. The animal traction index measures household ownership of animal traction equipment. A household is assigned a value of is zero if it has no animals or equipment (non-equipped), one-half if it has some animals or equipment (semi-equipped), and one if it has a full complement of animals and equipment (totally equipped).

3.) Master farmer. A master farmer is someone who has completed

AGRITEX's two year Master Farmer course[1], adheres to husbandry practices recommended by AGRITEX for that area, and attain crops yields as good as the upper 25% of area farmers over a five year period (AGRITEX, 1984).

5.1.2 Measures of resource distribution

The analysis uses skewness and kurtosis to assess symmetry; the median (village-level analysis) and the mean (district, sample, and per capita income quartile) to assess central tendency; and the Gini coefficient to assess equality of resource availability. See Chapter 2 for a more detailed explanation of these measures, and why they were chosen.

5.2 Overview of household resource availability

The three most important household resources are land, labor, and capital. Household access to these resources varied greatly across villages, districts, and the entire sample (Table 5.1).

<u>Labor</u>

In the study sites, household members were the primary source of labor (6.6 members per household). Generally, household labor was more abundant in Buhera District, where mean residents per household[2] averagd 7.4 compared to 5.9 in Mutoko/Mudzi Districts[3].

Furthermore, in Buhera District, households were less variable in size. For example, median residents per household ranged from 6 to 7 in Buhera villages, and 4 to 7 in Mutoko/Mudzi villages.

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[1]Participants must attend 24 one-day classes annually, plus a four day veterinary course, and a four day farm machinery course.

[2] See footnote 4 from Chapter 4.

[3]These means are similar to Stack (Stack and Chopak, 1990) estimates for Shamva and Binga Districts (6.3 and 12.9 residents per household, respectively); and Govaerts' (1987) estimate (7.8) for Mutoko District.

Table 5.1 Overview of household resource endowment[a] by village (median), district (mean), and total sample (mean), Zimbabwe, 1988/89[b].

LEVEL OF AGGREGATION	SAMPLE SIZE (#)	LABOR RESIDENT (#)	LABOR NON-RESID (#)	LAND AVAILABILITY TOTAL AREA (ha)	LAND AVAILABILITY LAND PC (ha)	LAND AVAILABILITY LAND PAE (ha)	ANIMAL TRACTION INDEX
BUHERA DISTRICT							
1	25	6	5	4.1	.7	.9	.78
2	23	7	5	6.2	.8	1.1	.83
3	20	7	5	5.1	.8	1.2	.91
4	24	7	5	5.4	.9	1.3	.89
5	23	7	5	3.7	.5	.7	.81
6	21	6	5	3.7	.6	.9	.75
DISTRICT TOTAL	136	7.4 **	5.3	5.6 **	1.0 *	1.4*	.83 **
MUTOKO/MUDZI							
1	26	7	4	2.4	.4	.6	.75
2	29	4	3	3.7	.6	.8	.76
3	15	4	3	3.1	.8	1.1	.70
4	27	7	5	4.0	.6	.9	.56
5	29	5	4	3.0	.5	.7	.69
6	23	6	4	1.8	.3	.5	.70
DISTRICT TOTAL	149	5.9 **	4.3	3.3 **	.7 *	.9*	.70 **
SAMPLE TOTAL	285	6.6	4.5	4.4	.9	1.2	.76

Source: Food Security surveys

[a]The median is used to assess central tendency for village level estimates; while the district and total sample level estimates are means.
[b]Differences in district means were tested for statistical significance at the 1 (**) and 5 (*) percent level.

Land

All measures of land availability (per household, per capita, and per adult equivalent; by village, district, and the total sample) indicated large differences in household access to land. Mean cultivated area averaged 4.4 hectares for the total sample, 5.6 hectares for Buhera District, and 3.3 hectares in Mutoko/Mudzi Districts. These means are somewhat smaller than Stack's (Stack and Chopak, 1990) estimate for Binga District (7.9 hectares per household); and slightly larger than Govaerts' (1987) estimate (2.6 hectares per household) for Mutoko District[4].

As expected, Buhera District households had greater access to land than Mutoko/Mudzi Districts households because the population density is lower in Natural Region V than in Natural Region IV.

Yet, district level averages tend to obscure the large inter-village differences in land availability. For example, land per household (median) ranged from 3.7 to 6.2 hectares in Buhera District; and 1.8 to 4.0 hectares in Mutoko/Mudzi Districts. Similarly, land per capita (median) ranged from 0.5 to 0.9 hectares in Buhera District; and 0.3 to 0.8 hectares in Mutoko/Mudzi Districts. These differences are even greater when converted to a per adult equivalent, ranging from 0.7 to 1.3 hectares in Buhera District; and from 0.5 to 1.1 hectares in Mutoko/Mudzi Districts.

Animal traction

Several studies[5] have identified access to traction animals and equipment as important factors that enable households to produce enough food. Overall, Buhera District households had greater access to traction.

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[4]Binga District is agro-ecologically similar to Buhera District. Our study's estimate for the three villages in Mutoko District was 2.7 hectares per household.

[5]For example, see Dione (1989).

The mean animal traction index was 0.76 for the total sample, 0.70 for Mutoko/Mudzi Districts, and 0.83 for Buhera District. As expected, Buhera District households had a higher animal traction index. Because Buhera District is less favorable for crop production, households place greater emphasis on livestock production, compared to Mutoko/Mudzi farmers.

As was the case for land, within both districts there are large inter-village differences in access to traction. Median animal traction index ranged from 0.75 to 0.91 in Buhera District and 0.56 to 0.76 in Mutoko/Mudzi Districts.

5.3 Distribution of household resources

The distribution of land, labor, and physical capital are assessed by analyzing their spread--symmetry and equality--across the total sample and districts. Land was measured as hectares per capita; labor as residents per household; and physical capital as the number of oxen owned per household.

5.3.1 Symmetry of resource ownership

The measures of symmetry (skewness and kurtosis) indicate an asymmetric distribution of resources across districts and the total sample (Table 5.2). Household residents, land per capita, and oxen owned had positively skewed distributions (tail to the right); and showed a high amount of kurtosis. This indicates that ownership was clustered at the low end and was spread over a very narrow range. Although all three resources were assymetrically distributed, the distribution of land was the most skewed; followed by oxen, and finally residents.

These same total sample trends hold for the districts, although for Buhera District the distribution of all three resources was more clustered at the lower end (skewness) over a narrower range (kurtosis)

Table 5.2 Distribution of household resources, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

HOUSEHOLD RESOURCE	SAMPLE SIZE (#)	SYMMETRY MEAN	MEDIAN	SD	SE	SKEWNESS	KURTOSIS	GINI COEFFICIENT
RESIDENTS								
BUHERA DISTRICT	136	7.4	7	4.6	.39	2.212	8.508	.3073
MUTOKO/MUDZI DISTRICTS	149	5.9	5	2.8	.29	0.347	(0.570)	.2657
SAMPLE TOTAL	285	6.6	6	3.8	.23	2.135	10.125	.2926
OXEN								
BUHERA DISTRICT	136	2.2	2.0	3.1	.26	4.695	26.511	.5764
MUTOKO/MUDZI DISTRICTS	149	1.6	1.0	1.9	.16	2.509	8.032	.6047
SAMPLE TOTAL	285	1.9	2.0	2.6	.15	4.959	34.078	.5947
LAND								
BUHERA DISTRICT	136	1.0	0.7	1.9	.17	9.648	104.745	.4442
MUTOKO/MUDZI DISTRICTS	149	0.7	0.5	0.6	.05	5.496	43.131	.3646
SAMPLE TOTAL	285	0.9	0.6	1.4	.08	11.625	166.319	.4175

Source: Food Security surveys.

[a]Values in parentheses are negative numbers.

than for Mutoko/Mudzi Districts.

5.3.2 Equality of resource ownership

The Gini coefficient is used to assess equality of resource ownership across the total sample, and for each district.

For the total sample, the Gini coefficient indicated a low level of inequality for residents (0.29), a moderate amount of inequality for land (0.40), and a high degree of inequality for oxen (0.66)[6].

For all three resources, Buhera District households had larger Gini coefficients than those in Mutoko/Mudzi, indicating that all three resources are less equally distributed in Buhera District than Mutoko/Mudzi.

5.4 Resource endowment by net household receipts quartiles

This section explores several hypotheses about the relationship between household resources and income by analyzing the distribution of land, labor, and capital across per capita net household receipts (income) quartiles.

5.4.1 Labor

Household labor resources varied in terms of their composition, and age and gender of the head (Table 5.3).

Household composition

Household composition varied greatly across per capita income quartile. The poorest (lowest quartile) households had the largest families (11.7) and the most resident household members (8.6). Although households had similar numbers of non-residents, for the upper income

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[6]FAO (1986) classifies degrees of equality, based on the following ranges in the Gini coefficient: less than 0.41 as low; 0.41 to 0.45 as moderate; 0.46 to 0.50 as relatively high; and greater than 0.50 as high.

Table
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Table 5.3 Household labor characteristics by income quartile (mean), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

HOUSEHOLD COMPOSITION	LOWEST (< Z$85)	LOWER MIDDLE (Z$85 - Z$139)	UPPER MIDDLE (Z$139 - Z$234)	UPPER (> Z$234)
HOUSEHOLD MEMBERS (#)				
RESIDENTS	8.6 a	7.0 b	5.8 c	5.0 c
NON-RESIDENTS	3.1	2.5	2.8	3.4
TOTAL MEMBERS	11.7 a	9.5 b	8.6 c	8.4 c
AGE DISTRIBUTION (%) (Residents)				
< 6	22	29	28	33
6 - 18	40	38	38	35
> 18	38	34	34	32
GENDER DISTRIBUTION (%) (Residents)				
MALE	49	47	47	46
FEMALE	51	53	53	54

Source: Food Security surveys.

a/ Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

group, 40 percent of the household members were non-resident, compared to only 26 percent for the lowest income quartile, a potential source of remittances.

Contrary to expectation, higher income households tended to have a larger percent of resident children (under six years) and fewer adults (older than 18 years) than lower income households. Finally, higher income households tended to have a slightly higher proportion (54 versus 50 percent) of female residents (including children) than the lowest quartile households, which is consistent with the results indicating that higher income households were more likely to have non-residents employed outside the community.

Household head

Household heads in all income quartiles were similar in age (48 to 50 years) and gender (82 to 87 percent male) (Table 5.4).

On the other hand, the cross classification of households by gender and residency status of the head provided unexpected results. First, as expected male-headed households were most common (82 to 87 percent) in all income quartiles; followed by female-headed households with the male away (8 to 15 percent) and female-headed households with no male (1 to 10 percent). Second, it was hypothesized that these female-headed households would earn the lowest incomes--unless they receive a significant amount of transfers--because they would have less access to labor resources. Although this relationship held for the lower three quartiles, it does not for the highest income quartile where there were more female-headed/no male households in the upper income quartile (10 percent) than any other quartile.

Table 5.4 Household head characteristics by income quartile (mean), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

HOUSEHOLD HEAD CHARACTERISTICS	LOWEST (< Z$85)	LOWER MIDDLE (Z$85 - Z$139)	UPPER MIDDLE (Z$139 - Z$234)	UPPER (> Z$234)
AGE (years)	50	50	48	48
GENDER DISTRIBUTION (%)				
MALE	85	82	87	82
FEMALE	16	18	12	18
CLASSIFICATION OF HOUSEHOLD HEAD(%)				
MALE HEADED	85	82	87	82
FEMALE HEADED/ MALE AWAY	10	15	11	8
FEMALE HEADED/ NO MALE	6 ab	3 a	1 a	10 b

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

5.4.2 Land

In an agricultural based economy, access to land is an important determinant of a family's income-earning potential.

Land availability, tenure, and quality

Although household access to land varied across income quartiles, there was no statistically significant relationship between income quartiles and tenure, soil quality, or distance to fields (Table 5.5).

Land availability (both per capita and per adult equivalent) increased from the lowest to highest income quartile. Strikingly, the highest income quartile households had twice as much land as the lowest income quartile households.

For all income quartiles, land was predominantly family owned[7] (93 to 96 percent).

Furthermore, there was little difference in soil quality (fertility and drainage) across income quartiles. Households reported that over half (52-59 percent) of their land was of average soil fertility; and over 74 percent assessed their soil fertility as average or excellent. Most households rated their soil drainage as excellent (49 to 62 percent) or average (25 to 40 percent).

Finally, the mean distance from the homestead to their fields was similar across income quartiles (10 to 13 minutes).

Land use

It was hypothesized that given the differences in rainfall between sites, land use patterns would vary across districts and across income quartiles.

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[7]Ownership means households had long term use rights, but couldn't sell the land.

Table 5.5 Land characteristics by income quartile (mean), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

LAND CHARACTERISTICS	LOWEST (< Z$85)	LOWER MIDDLE (Z$85 - Z$139)	UPPER MIDDLE (Z$139 - Z$234)	UPPER (> Z$234)
AREA AVAILABLE				
Per HH	4.8	4.6	3.7	4.5
Per capita	0.6 a	0.7 a	0.7 a	1.4 b
Per adult	0.8 a	1.0 a	1.0 a	1.8 b
TENURE (%)				
Own	95	93	96	96
Rent/share	0	0	1	1
Borrow in	4 a	7 b	3 a	3 a
Borrow out	< 1	< 1	< 1	< 1
Total	100	100	100	100
SOIL QUALITY				
Fertility (%)				
Poor	26	25	26	20
Average	58	52	55	59
Excellent	16	23	18	20
Total	100	100	100	100
Drainage (%)				
Poor	12	13	6	12
Average	40	25	34	36
Excellent	49	62	60	53
Total	100	100	100	100
DISTANCE TO FIELDS[b]	11	13	11	10

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

[b] The distance to field is a weighted average of the distance (minutes) of all fields from the homestead.

$$FIELD\ DISTANCE = \sum_{i=0}^{n} \frac{DISTANCE * AREA}{TOTAL\ AREA}$$

where: i = field number

Inter-district variability in land use

Two similarities across districts stand out (Table 5.6). First, households in both districts allocated similar proportions of land to crops (88 to 89 percent) and fallow (11 to 12 percent). Second, the relative amounts of land allocated to crop types was similar; grain occupied the majority of available land (78 to 82 percent), followed by oilseeds (14 to 15 percent), and other crops such as cotton, fruits and vegetables, and intercropping (3 to 6 percent).

In contrast, there were three major differences in cropping patterns across districts. First, although maize and small grains were the major crops in both districts, households in Buhera District allocated a significantly larger share of their land to small grains (61 percent) and less to maize (18 percent) than households in Mutoko/Mudzi Districts (36 and 37 percent, respectively). This result was expected since available maize technology is more appropriate for Mutoko/Mudzi Districts, which have relatively higher rainfall. Second, although oilseeds occupied similar portions of available land in both districts, households allocated a significantly larger share of their land to groundnuts in Buhera District (7 percent) than in Mutoko/Mudzi Districts (3 percent); but they allocated a significantly larger share of their land to sunflower in Mutoko/Mudzi Districts (10 percent) than in Buhera District (2 percent).

Differences in land use across income quartiles

Cropping patterns also varied greatly across per capita income quartiles[8] (Table 5.7). Crops were grouped as grains (maize, small grains[9], and rice), oilseeds (primarily groundnuts and sunflower), fruits and vegetables, cotton, and mixed (intercrops).

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[8]The importance of different crops varied for individual households, even within quartiles.

[9]Small grains include millet (bulrush and finger) and sorghum (white and red).

Table 5.6 Land use by District and total sample (mean), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

LAND USE	TOTAL SAMPLE	BUHERA DISTRICT	MUTOKO/MUDZI DISTRICTS
LAND USE (%)			
CULTIVATED	88	89	88
FALLOW	12	11	12
CROP ALLOCATION[b] (%)			
GRAIN			
MAIZE	27	18 **	37 **
SMALL GRAINS	48	61 **	36 **
MAIZE/SMALL GRAINS	2	2	3
RICE	2	1	2
TOTAL GRAIN	79	82	78
OILSEED			
GROUNDNUTS	5	7 **	3 **
SUNFLOWER	7	2 **	10 **
OTHER[c]	4	6	2
TOTAL	15	14	15
COTTON	1	0	2
FRUITS & VEGETABLES	1	1	1
INTER-CROPPED	3	2	3

Source: Food Security surveys.

[a]Differences in district means were tested for statistical significance at the 1 (**) and 5 (*) percent level.
[b]Percent of crops allocated to cultivated land.
[c]Other oilseeds include bambara nuts, cowpeas, and kidneys beans.

Table 5.7 Land use by income quartile (mean), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

LAND USE	LOWEST (< Z$85)	LOWER MIDDLE (Z$85 - Z$139)	UPPER MIDDLE (Z$139 - Z$234)	UPPER (> Z$234)
LAND USE (%)				
CULTIVATED	85 a	90 ab	87 ab	91 b
FALLOW	15 a	10 ab	13 ab	9 b
CROP ALLOCATION[b] (%)				
GRAIN				
MAIZE	22 a	25 a	33 b	28 a
SMALL GRAINS	59 a	43 b	41 b	40 b
MAIZE/SMALL GRAINS	1	4	1	4
RICE	1	1	3	1
TOTAL GRAIN	84 a	83 a	78 b	72 c
OILSEED				
GROUNDNUTS	4 a	4 a	4 a	8 b
SUNFLOWER	4 a	5 a	7 ab	10 b
OTHER OILSEEDS[c]	3	3	5	4
TOTAL	12 a	12 a	16 b	22 c
COTTON	1	1	1	1
FRUITS & VEGETABLES	0 a	1 ab	1 ab	2 b
INTER-CROPPED	3	3	3	3

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.
[b]Percent of crops allocated to cultivated land.
[c]Other oilseeds include bambara nuts, cowpeas, and kidneys beans.

Three similarities stand out across per capita income quartiles. First, in all income quartiles grain crops dominated area planted (72-84 percent). Second, the rank order of area (percent) by crops was similar across income quartiles. Grains were planted to the largest share of available land; followed by oilseeds (12-22 percent), inter-cropped plantings (3 percent), fruits and vegetables (1-2 percent), and cotton (1 percent).

In contrast, there were four important differences in land use that occur as per capita incomes increased. First, as incomes increased farmers tended to allocate a smaller share of their cropped land to grains (84, 83, 78, and 72 percent); and a larger share to oilseeds (12, 12, 16, and 22 percent). Second, as incomes increased the relative importance of individual grain crops changed. For example, as incomes increased, the maize share tended to increased (22, 25, 33, and 28 percent), and the small grains share decreased (59, 43, 41, and 40 percent). Third, as incomes increased, the proportion of land planted to individual oilseed crops increased. For example, higher income households planted a larger percent of their area to groundnuts (4, 4, 4, 8) and sunflower (4, 5, 7, and 10 percent). Similarly, higher income households planted a larger share of their land to fruits and vegetables (0, 1, 1, and 2 percent).

5.4.3 Capital ownership

The amount and quality of capital--physical, human, and financial--available to households is an indicator of both a household's wealth and its ability to cultivate available land in a timely manner.

Physical capital

In the low-rainfall areas of Zimbabwe, animals and equipment were the most important physical assets owned by households. Cattle, sheep, and goats were the most commonly held livestock, but some households also had pigs and donkeys. Plows were the most commonly owned agricultural equipment; but some households had cultivators, ridgers, harrows, sprayers, and ox carts.

Animal ownership

It was hypothesized that livestock ownership would vary across districts and per capita income quartiles.

Differences across districts

Two important inter-district differences in livestock ownership were identified (Table 5.8). First, households in Buhera District owned significantly more cattle (7.5 per household), oxen (2.2 per household) and small ruminants (10.6) than households in Mutoko/Mudzi District (4.7, 1.6, and 4.0, respectively). As expected, livestock were more important in Buhera District because: 1.) historically laws limiting herd size were enforced more rigorously in higher density areas (more like Mutoko/Mudzi than Buhera); and 2.) Buhera District has more grazing land, which permits households to manage larger herds.

The second inter-district difference was that Mutoko/Mudzi Districts households owned more pigs (0.7 per household) than Buhera District households (0.1)--possibly because pigs are fed maize in communal areas, which is more plentiful in Mutoko/Mudzi Districts.

Differences across income quartiles

The only statistically significant relationship between income and livestock ownership was for large and small ruminants (Table 5.9). Higher income households generally owned more total cattle (4.9, 4.8, 6.9, and 7.4) and oxen (1.5, 1.5, 2.0, and 2.5).

In contrast, the relationship between income and small ruminants and non-ruminants animals is less clear. For example, higher income households generally owned more sheep (0.6, 1.2, 0.6, and 2.3), except for the upper middle income households; but there was no consistent

Table 5.8 Capital ownership (mean) by district and total sample, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

CAPITAL OWNERSHIP	TOTAL SAMPLE	BUHERA DISTRICT	MUTOKO/MUDZI DISTRICTS
PHYSICAL CAPITAL			
Animal ownership (#)			
Cattle			
OXEN	1.9	2.2 *	1.6 *
BULLS	.3	.3	.2
STEERS	.3	.6 **	< .1 **
HEIFERS	.9	1.1	.7
DAIRY	1.7	2.1 *	1.3 *
CALVES	1.1	1.2	.9
TOTAL	6.2	7.5 **	4.7 **
Small ruminants			
SHEEP	1.2	2.4 **	.1 **
GOATS	5.9	8.2 **	3.9 **
Other			
DONKEYS	.2	.3	.1
PIGS	.4	.1 **	.7 **
Equipment (#)			
Plows	1.3	1.6 **	1.0 **
Cultivators/Ridger	.1	< .1 **	.2 **
Harrows	< .1	< .1	< .1
Ox carts	.3	.4 **	.1 **
HUMAN CAPITAL			
Education (%)			
None	24	17 **	31 **
> 1 years	76	83 **	69 **
Master farmer (%)			
No	83	88 *	77 *
Trainee	12	9 *	16 *
Master farmer	5	3	7
FINANCIAL CAPITAL			
AFC loan (%)			
No	96	95	98
Yes	4	5	2

Source: Food Security surveys.

[a]Differences in district means were tested for statistical significance at the 1 (**) and 5 (*) percent level.

Table 5.9 Capital ownership (mean) by per capita income quartile, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

CAPITAL OWNERSHIP	LOWER (< Z$85)	LOWER MIDDLE (Z$85 - Z$139)	UPPER MIDDLE (Z$139 - Z$234)	UPPER (> Z$234)
PHYSICAL CAPITAL				
Animal ownership				
Cattle				
OXEN	1.5 a	1.5 a	2.0 ab	2.5 b
BULLS	.3	.2	.3	.3
STEERS	.2 a	.3 ab	.3 ab	.5 b
HEIFERS	.7	.7	1.1	1.0
DAIRY	1.3	1.4	2.0	1.9
CALVES	.9	.9	1.2	1.2
TOTAL	4.9 a	4.8 a	6.9 ab	7.4 b
Small ruminants				
SHEEP	.6 a	1.2 a	.6 a	2.3 b
GOATS	5.0 ab	7.2 a	4.5 b	6.8 ab
Other				
DONKEYS	.2	< .1	.3	.2
PIGS	.4	.4	.3	.4
Equipment (#)				
Plows	1.2	1.3	1.2	1.4
Cultivators/ Ridgers	.1	.1	.1	.1
Harrows	< .1	0	.1	< .1
Ox carts	.2 a	.2 a	.3 ab	.4 b
HUMAN CAPITAL				
Education (%)				
None	27	26	22	21
> 1 years	73	74	78	79
Master farmer (%)				
No	85	80	85	81
Trainee	10	15	10	14
Master farmer	4	4	5	5
FINANCIAL CAPITAL				
AFC loan (%)				
Yes	4	1	1	7

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across quartiles have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across quartiles.

relationship between donkey, goat, or pig ownership.

Equipment ownership

This section presents the reported levels of household equipment ownership; for the total sample, district, and across per capita income quartile.

Differences across district

In both districts, plows were the only agricultural implement that were commonly owned, with 85 percent of the households reporting owning at least one plow (Table 5.8). Although few households owned ox carts, they were more common in Buhera District (0.4 per household) than Mutoko/Mudzi (0.1). On the other hand, cultivators were more available in Mutoko/Mudzi Districts (0.2 per household) than in Buhera (< 0.1). Finally, few farmers in either district owned ridgers, harrows, or sprayers.

Differences across income quartiles

Ownership of agricultural equipment (mean number owned) was surprisingly similar across per capita income quartiles (Table 5.9). Plow ownership was relatively constant across income quartiles (1.2 to 1.4 per household); and few households owned cultivators, ridgers, harrows, or sprayers, regardless of income quartile. On the other hand, although few households owned ox carts, ownership appeared associated with rising income levels.

Human capital

Formal and non-formal education contribute to strengthening human capital stock, which serves to increase an individual's ability to exploit income-earning opportunities. Two measures of human capital are education and participation in extension training (eg, master farmer program).

First, the proportion of household heads who had attended school differed across districts, but not across income quartiles. For example, significantly more household heads in Mutoko/Mudzi District had no formal education (31 percent), than in Buhera District (17 percent). In contrast, slightly more household heads in the upper two quartiles had attended school (78 and 79 percent, respectively), compared to the lower two quartiles (73 and 74 percent, respectively).

The proportion of household heads who had participated in the Master Farmer Program differed across districts, but not across per capita income quartiles. In Mutoko/Mudzi District, about twice as many household heads were master farmers (7 percent) or master farmer trainees (17 percent) than in Buhera District (3 and 9 percent, respectively). In contrast, the rate of household head participation in the Master Farmer Program was similar across income quartiles (4 to 5 percent).

Financial capital

Farmers made minimal use of formal--government and commercial--credit. For the total sample, only 4 percent of the households borrowed from the Agricultural Finance Corporation (AFC). These households were concentrated in three villages in Buhera and one in Mutoko/Mudzi District; and received only small loans (the median loan was Z$9.45). Rohrbach (1988) reported similar results. Households reported they didn't use AFC credit because they don't produce enough to repay the AFC (45 percent), don't want to sell crops (23 percent), were dissatisfied with AFC's lending policies (13 percent), and other reasons (20 percent).

There was no systematic relationship between credit use and income quartiles, although upper income quartile households used AFC credit most frequently (7 percent), followed by the lowest quartile (4 percent), and the two middle quartiles (1 percent each).

5.5 Income level and sources by resource endowment

To assess the relationship between median net household receipts--level and components--and resource endowment, households were classified by resource endowment (labor, land, and capital).

Labor

The level and sources of income varied by household size; and gender and age of the household head (Table 5.10).

Household size

Smaller households (fewer than 5 residents) earned more NHR (per capita) than larger households--small households reported incomes of Z$229; compared to Z$124 for households with five to seven members, and Z$97 for households with more than seven members.

While the sources of incomes were similar across household size, larger households earned slightly more income from labor sales.

Household head gender

Income level and sources were quite similar for male-headed and female-headed households, although male-headed households reported slightly larger incomes (Z$141) than female-headed households (Z$133). On the other hand, there were major gender differences with respect to transfers received, and credit obligations. Female-headed households received larger transfers (Z$18) and also incurred larger credit obligations (Z$5) than male-headed households (Z$8 and Z$1, respectively). Furthermore, male-headed households earned slightly larger receipts from farm sales (Z$15) and labor sales (Z$6) than female-headed households (Z$11 and Z$4, respectively).

5.10 Income level and sources by labor availability (median), Mutoko/Mudzi Districts, Zimbabwe, 1988/89[a].

LABOR OWNERSHIP	SAMPLE SIZE	NET RECEIPTS (pc)	NET INCOME (pc)	TPHC[b]	CIGA[c]	TFS[d]	TLS[e]	NAP[f]	TRI[g]	NCR[h]
Household size										
< 5	95	229	175	120	88	26	3	1	24	(1)
5-7	88	124	114	61	64	12	8	3	5	(3)
> 7	102	97	87	44	37	12	6	1	6	(1)
Household head gender										
Female	39	133	128	73	64	11	4	4	18	(5)
Male	243	141	118	61	61	15	6	2	8	(1)
Household head age										
< 35	68	149	136	57	67	10	6	<1	5	(2)
35-55	117	117	98	53	57	15	8	3	12	(2)
> 55	97	152	131	87	53	17	3	2	9	(1)

Source: Food Security surveys.

[a] Values in parentheses are negative numbers
[b] Total production for home consumption
[c] Cash income-generating activities
[d] Total farm sales
[e] Total labor sales
[f] Non-agricultural product sales
[g] Transfers received
[h] Net credit receipts

Household head age

Although younger household heads (less than 35 years old) earned similar incomes as the oldest household heads (greater than 55 years old), they earned less from production for home consumption, farm sales, nonagricultural product sales, and transfers. In contrast, younger households earned more from market transactions and labor sales.

Land ownership and use

Access to land, and how households allocate it to individual crops, are important determinants of income. This section first examines the relationship between land availability, and income levels and sources. Then, it examines the relationship between area allocated to crops and income levels and sources.

Land availability

Households with the least land (< 0.61 hectares per capita) earned less income (Z$109) than households with 0.61 to 0.96 hectare (Z$141) and much less than households with more than 1 hectare (Z$231) (Table 5.11). A similar relationship existed between land availability and production for home consumption, market transactions, and farm sales. In contrast, households with less than 0.61 hectares earned more income from labor sales (> Z$7) than those with more land (Z$4), implying that households without sufficient land available seek off-farm employment as a strategy to earn income to meet household needs. Finally, land poor households received more transfers (Z$9) than households in the middle two quartiles (Z$3-8), although households with the most land received the greatest amount of transfers (Z$18).

Land use

Analysis of the relationship between land use and income level and sources provided several insights.

5.11 Income level and sources by land ownership and use (median), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

LAND OWNERSHIP AND USE	SAMPLE SIZE	NET HOUSEHOLD RECEIPTS	PRODUCTION FOR HOME CONSUMPTION	CASH INCOME GENERATING ACTIVITIES	FARM SALES	LABOR SALES	NON-AG PRODUCTS	TRANS-FERS	NET CREDIT RECEIPTS
Land per capita (ha)									
< .41	63	109	46	56	11	8	2	9	(2)
.41 - .61	75	100	52	46	9	7	2	8	(1)
.61 - .96	75	141	67	50	15	4	1	3	(2)
> .96	72	231	105	90	40	4	2	18	(2)
Grain area (%)									
< 69	69	197	79	91	43	4	4	12	(1)
69 - 82	73	142	76	61	24	6	1	7	(2)
82 - 96	70	101	56	59	12	6	3	6	(1)
> 96	72	113	45	46	6	7	1	12	(1)
Maize area (%)									
< 12	71	100	45	46	9	6	1	5	(1)
12 - 24	72	150	61	61	13	8	2	11	(0)
24 - 40	70	144	87	67	22	5	1	6	(1)
> 40	72	159	73	66	18	5	6	20	(4)
Small grain area (%)									
0	23	265	114	98	41	9	3	46	(1)
1 - 43	89	168	69	81	41	3	5	18	(3)
43 - 64	86	119	68	46	11	6	2	5	(1)
> 64	86	100	38	45	8	7	1	6	(1)
Oilseed area (%)									
0	84	118	54	45	6	8	1	12	(1)
1 - 14	71	106	54	48	8	4	2	4	(1)
14 - 27	64	136	71	61	25	9	1	8	(3)
> 27	65	217	84	96	52	3	5	12	(3)
Cotton area (%)									
0	274	139	65	61	13	6	2	7	(7)
> 0	10	128	65	68	51	3	1	4	(3)
Fruit/Vegetabl area (%)									
0	269	139	64	60	14	6	2	8	(2)
> 0	15	121	65	70	29	4	0	14	0

Source: Food Security surveys.

[a] Values in parentheses are negative numbers.

Grain area

As the percent of the cropped area allocated to grain production increased, median incomes declined, households sold more labor, and generally received more transfers. For example, households that allocated more land to grain (> 96 percent) earned lower income (Z$113) than households that allocated less (< 69 percent) area (Z$197), and also earned less from production for home consumption, CIGA, farm sales, and nonagricultural product sales.

Maize area

On the other hand, maize area (%) was positively related to median incomes. For example, as the proportion of cropped area allocated to maize increased, incomes increased from Z$100 (< 12 percent maize) to Z$159 (> 40 percent maize). Also, households that devoted a larger share of their land to maize tended to earn more income from production for home consumption, CIGA, farm sales, nonagricultural product sales, and transfers; but less from labor sales.

Small grain area

In contrast, small grain area was inversely related to median income. For example, households that did not grow small grains earned almost twice the income (Z$265) as small grain producers (Z$168, Z$119, and Z$100). Furthermore, households with more land in small grains earned much less income from production for home consumption, market transactions, farm sales, and transfers.

Oilseed area

Area in oilseeds was positively related to income. For example, households with a larger share (>27 percent) of their land in oilseeds tended to have larger median incomes (Z$217) than households that did not plant oilseeds (Z$118). Also, households that allocated more land to oilseeds earned more from production for home consumption (Z$84), market transactions (Z$96), farm sales (Z$52), and had larger credit obligations (Z$3), than households with less oilseed land.

Cotton area

Only 4 percent of the sample households grew cotton. Compared to non-growers, those households earned slightly smaller incomes (Z$128 versus Z$139), and sold less labor (Z$6 versus Z$3); but earned more from market transactions (Z$68 versus Z$61), farm sales (Z$51 versus Z$13), and transfers (Z$7 versus Z$4) than non-growers.

Fruit and vegetable area

Only 6 percent of the households grew fruits and vegetables. These households earned slightly lower incomes (Z$121 versus Z$139) than non-growers. On the other hand, fruit and vegetable growers reported higher market transactions (Z$70 versus Z$60), farm sales (Z$29 versus Z$14), and transfers (Z$14 versus Z$8) than non-growers.

Capital ownership

This section analyzes the relationship between capital (physical, financial, and human), and income levels and sources (Table 5.12).

Physical capital

Analysis of the data found a positive relationship between income and the level of physical capital owned by households.

Oxen ownership

Households owning an oxen team (two or more oxen) earned more income (Z$184) than households with less than two oxen (< Z$122). Also, households with an oxen team reported greater production for home consumption (Z$68 versus Z$60), market transactions (Z$71 versus Z$46),

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5.12 Income level and sources by capital ownership (median), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

CAPITAL OWNERSHIP	SAMPLE SIZE	NET HOUSEHOLD RECEIPTS	PRODUCTION FOR HOME CONSUMPTION	CASH INCOME GENERATING ACTIVITIES	FARM SALES	LABOR SALES	NON-AG PRODUCTS	TRANS-FERS	NET CREDIT RECEIPTS
Physical capital									
Oxen ownership									
< 2	142	122	60	46	9	6	4	10	(1)
> 2	143	184	68	71	23	6	1	8	(2)
Plow ownership									
0	44	118	56	41	6	3	2	12	(<1)
> 1	241	141	65	65	17	6	2	8	(2)
Financial capital									
AFC loan									
No	275	138	62	62	15	6	2	8	(1)
Yes	10	252	138	69	14	21	0	19	(1)
Human capital									
Education of head									
0	68	122	69	37	8	3	2	10	(1)
> 1	214	143	61	65	18	7	2	8	(2)

Source: Food Security surveys.

[a] Values in parentheses are negative numbers.

farm sales (Z$23 versus Z$9), but less non-agricultural product sales (Z$1 versus Z$4), than households without an oxen team.

Plow ownership

As with oxen, there was a strong relationship between income and plows owned. Plow-owning households had larger incomes (Z$141) than non-owners (Z$118). Also, plow-owning households reported greater production for home consumption (Z$65 versus Z$56), market transactions (Z$65 versus Z$41), farm sales (Z$17 versus Z$6), labor sales (Z$6 versus Z$3), and credit obligations (Z$2 versus < Z$1) than non-owners.

<u>Financial capital</u>

Although only 4 percent of sample households borrowed from the Agricultural Finance Corporation (AFC), borrowers earned larger incomes (Z$252) than non-borrowers (Z$138). Credit-using households also reported much greater production for home consumption (Z$138 versus Z$62), labor sales (Z$21 versus Z$6), and transfers (Z$19 versus Z$8) than non-borrowers.

<u>Human capital</u>

Education was positively related to income. Households heads who had some schooling reported higher incomes (Z$143 versus Z$122) than heads without schooling. In addition, household heads who had attended school participated more in the market (Z$65 versus Z$37), earned more from farm sales (Z$18 versus Z$8) and labor sales (Z$7 versus Z$3).

5.6 Interrelationships between resource endowment and socio-economic characteristics

This section explores interrelationships between the major household resources. Crosstabulations are presented to identify socio-economic factors associated with differences in household land, labor, and

capital endowments.

Labor

Three measures of labor availability are household size, and the gender and age of the household head.

Although larger households cultivated less land (per capita) than smaller households, 0.47 versus 0.98 hectares, they owned more oxen (2 versus 1) (Table 5.13).

Surprisingly, male-headed and female-headed households were quite similar. Female-headed households had slightly fewer resident household members (5 versus 6), which partially accounted for their having slightly more land (0.75 versus 0.62 hectares per capita). In contrast, female-headed households owned more oxen (2 versus 1), possibly because their husbands had non-farm employment which enabled the household to invest in oxen.

As expected, households with older heads tended to have more residents than younger households (7 versus 5), cultivated more land (0.78 versus 0.56 hectares), and owned more oxen (2 versus 1).

Land use

Analysis of the data highlights important differences in land use patterns (crop priorities), associated with household resource endowment (Table 5.14).

Grain area

The relative importance a household placed on grain production was inversely related to farm size. Households that allocated the largest proportion (> 96 percent) of their land to grains cultivated less land per capita (0.51 versus 0.79 hectares), than households that allocated a smaller proportion of land to grains (< 69 percent).

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5.13 Resource endowment by household labor characteristics (median), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

LABOR CHARACTERISTIC	Sample Size	Number of Residents	Area Available	Oxen Ownership
Household size				
< 5	95	4	.98	1
5-7	88	6	.55	1
> 7	102	9	.47	2
Household head gender				
Female	39	5	.75	2
Male	243	6	.62	1
Household head age				
< 35	68	5	.56	1
35-55	117	7	.59	1
> 55	97	7	.78	2

Source: Food Security surveys.

Maize area

Similarly, except for households that grew almost no maize, the share of land planted to maize was inversely related to land availability. For example, households that planted a smaller shares (< 24 percent) to maize cultivated more land (0.62 versus 0.50 hectares), than households that allocated more land (> 40 percent) to maize.

Small grain area

In contrast, the relationship between small grain area and land availability is less clear. Farmers who planted the largest share of their land to small grains (>40 percent) tended to have more land per capita (> 0.60 versus 0.55 hectares) than farmers that did not grow small grains. Also, households that grew more small grains tended to have larger families and more oxen. This may be explained by the fact that poorer (larger) households tended to depend more on small grains, as did older households (taste preferences) who had accumulated more traction capital over their lifetime.

5.14 Resource endowment by land use (median), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Land Use	Sample Size (#)	Number of Residents (#)	Area Available (HA)	Oxen Ownership (#)
Grain area (%)				
< 69	69	5	.79	2
69 - 82	73	7	.66	2
82 - 96	70	6	.72	2
> 96	72	6	.51	1
Maize area (%)				
< 12	71	8	.62	2
12 - 24	72	6	.73	1
24 - 40	72	5	.65	2
> 40	70	6	.50	1
Small grain area (%)				
0	23	5	.55	1
1 - 43	89	6	.63	2
43 - 64	86	6	.66	2
> 64	86	7	.60	1
Oilseed area (%)				
0	84	6	.50	2
1 - 14	71	6	.72	1
14 - 27	64	7	.68	2
> 27	65	5	.77	2
Cotton area (%)				
0	274	6	.62	1
> 0	10	8	.66	2
Fruit/Vegetabl area (%)				
0	269	6	.64	1
> 0	15	7	.50	2

Source: Food Security surveys.

Cash crops

Oilseed, cotton, and fruits and vegetables were generally grown as cash crops. The analysis of grain crops suggested that households first attempt to meet food needs through grain production. As expected, once these needs were met, farmers tended to grow cash crops. This hypothesis is supported by the data that shows that households allocating the largest share (> 27 percent) of their land to oilseeds, had the largest cropped area (0.77 hectares).

Similarly, cotton producers cultivated slightly more land (0.66 versus 0.62 hectares) than non-growers. The fact that cotton producers had more household members (8 versus 6) and more oxen may be explained by the greater labor intensity of these crops and its high profitability, which facilitates investment in draft power.

In contrast, fruit and vegetable production is both land and labor intensive. The data suggests that land poor households (0.50 versus 0.64 hectares per capita) tended to grow fruits and vegetables which may enable them to more fully employ their larger (7 versus 6) household labor supply.

Capital ownership

Analysis of the data highlights the complementarity between resources available to households (Table 5.15).

Physical capital

Oxen were the most important capital asset in the communal areas. Households owning a full team (2 or more oxen) also had more family labor (5 versus 7) and access to more land (0.66 versus 0.55 hectares per capita).

Table 5.15 Resource endowment by capital ownership (median), Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Capital Ownership	Sample Size (#)	Number of Residents (#)	Area Available (HA)	Oxen Ownership (#)
Physical capital				
Oxen ownership				
< 2	142	5	.57	0
> 2	143	7	.70	2
Plow ownership				
0	44	5	.57	0
> 1	241	6	.64	2
Financial capital				
AFC loan				
No	275	6	.62	2
Yes	10	4	.85	0
Human capital				
Education of head				
0	68	5	.67	1
> 1	214	6	.60	2

Source: Food Security surveys.

Financial capital

Although few households (4 percent) reported borrowing from the AFC, borrowers had smaller families (4 versus 6) and less oxen (0 versus 2) than non-borrowers. On the other hand, borrowers from the AFC had more land (0.85 versus 0.62 hectares per capita).

Human capital

There were only small differences in resource endowment between household heads who had attended school and those that had no education. This may be partially explained by the fact that older farmers had less opportunity to attend school, but younger farmers had less land, which shows conflicting influences.

5.7 External environment

Farmers' income levels and structure is influenced by several factors exogenous to the household. This section presents the components of the external environment that define the household's opportunity set--physical environment (rainfall), services, and technology.

5.7.1 Physical environment

In semi-arid areas like Natural Regions IV and V, rainfall patterns play a dominant role in guiding household resource allocation decisions.

To evaluate rainfall patterns between the two sites, historical rainfall data were analyzed. Since long-term rainfall data were not available for the survey villages, the Mutoko and Middle Save rainfall stations were selected to represent the Mutoko/Mudzi and Buhera Districts, respectively. The Mutoko station was chosen because it was the closest rainfall station to the Mutoko/Mudzi survey area, although it was located in Natural Region III and our survey sites are in Natural

Region IV)[10]. Thus, the survey areas probably received both less rainfall and had greater year-to-year variability. The Middle Save station was selected to represent the rainfall pattern in Buhera since it is the station closest to the Buhera sites and is Natural Region V[11].

Comparison of the rainfall data for 1980/81 to 1983/84 shows that in Mutoko/Mudzi District, rainfall was substantially higher (706 versus 477 mm, four year average) than in Buhera District (Table 5.16). Both areas have similar long term intra-seasonal rainfall distribution, with November to March being the peak rainfall period. Furthermore, the coefficient of variation of rainfall is larger for Buhera (34%) than Mutoko/Mudzi Districts (26%) based on 32 and 36 year averages, respectively.

These data indicate that Mutoko/Mudzi District has a greater agricultural potential, and implies that household resource allocation patterns will differ across sites, in order to cope with the differential risk associated with rainfall.

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[10]Rainfall data from the Mutoko station is a valid proxy for Mutoko/Mudzi rainfall pattern, since Natural Regions are not distinct, but only general indicators of rainfall.

[11]The Buhera station is located in the Natural Region III portion of the district, so it was not selected.

Table 5.16 Rainfall pattern (millimeters) by District, Zimbabwe, 1980/84.

District	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Mutoko District													
1980/81	0	0	18	42	118	203	141	354	118	84	<1	0	1078
1981/82	0	<1	0	47	67	48	172	141	33	19	7	0	533
1982/83	<1	0	0	69	6	88	96	87	10	4	<1	14	373
1983/84	10	1	0	18	54	155	95	91	19	<1	5	0	448
LR average[a]	1	1	8	19	75	165	157	159	75	34	9	3	706
Buhera District													
1980/81													
1981/82	<1	2	35	26	71	139	136	91	32	36	37	0	604
1982/83	1	0	21	35	164	5	90	80	2	14	0	0	412
1983/84	3	0	2	21	104	30	6	74	26	5	0	0	269
	27	14	0	15	24	87	70	66	109	2	3	2	418
LR average[b]	2	3	8	24	67	98	89	100	51	18	10	6	477

Source: AGRITEX (1989).

[a] Average over 36 years (1952/53 to 1987/88).
[b] Average over 32 years (1952/53 to 1983/84).

5.7.2 Institutional environment

5.7.2.1 Access to services

Rural services are important catalysts to agricultural development. Since Independence (1980), household access to output and input markets, grain processing, and public transport, education, health, veterinary services, and extension has improved. Yet, access still varied considerably across villages (Table 5.17).

Output markets

Households primarily marketed their crops through Grain Marketing Board (GMB) depots and collection points, approved buyers[12], non-approved buyers, and marketing (output) cooperatives. Only the non-approved buyers and cooperatives were located in villages.

[12]The distance of households to approved buyers is similar to GMB depots in Mutoko/Mudzi Districts and collection points in Buhera District.

Table 5.17 Access to services by village, Mutoko/Mudzi Districts, Zimbabwe, 1988[a].

Service	Buhera District village 1	2	3	4	5	6	Mutoko/Mudzi Districts villages 1	2	3	4	5	6
Market access												
Outputs												
GMB depots (kms)	60	82	82	100	90	140	37	46	30	26	37	45
GMB collect points (kms)	50	52	12	30	20	20	na	na	na	na	na	na
Non-approved buyers (#)	0	3	5	2	4	0	0	0	0	0	0	2
Output cooperatives (#)	0	0	0	1	0	1	0	0	0	0	0	0
Inputs												
Shops: dry goods (#)	1	4	1	3	4	1	0	4	1	0	3	5
Shops: seed (#)	1	1	1	3	4	1	0	1	0	0	1	2
Shops: fertilizer(#)	0	1	0	0	0	0	0	1	0	0	1	0
Input cooperative (#)	0	0	0	0	0	0	0	1	0	0	0	1
Processing												
Maize mill (kms)	5	0	2	34	5	2	2	0	na	0	na	1
Sorghum dehuller (kms)	51	70	0	47	50	20	29	0	na	na	na	23
Transport												
Buses per week (#)	3	2	16	1	0	1	0	2	2	2	3	6
Months without bus service	0	0	0	0	0	0	0	0	0	4	0	2
Education												
Primary schools (#)	1	2	1	0	1	1	0	1	0	1	0	0
Secondary schools (#)	0	1	0	0	1	0	0	0	0	0	0	0
Health												
Clinics (#)	0	1	0	0	0	0	0	0	0	0	0	0
Veterinary services												
Cattle dips (#)	1	1	0	0	1	1	0	1	0	0	0	1
Extension												
Extension workers (#)	1	1	0	1	1	1	0	2	0	1	0	0

Source: Food Security surveys.

[a]na means these services were not available.

Given the existence of alternative marketing channels, it was difficult to clearly assess the degree of access to markets across districts and villages. Although none of the villages were close enough to a GMB depot for households to transport crops by foot or ox cart, households in Buhera District were much farther (60-140 kms) from GMB depots than households in Mutoko/Mudzi Districts (26-46 kms). On the other hand, only Buhera households had access to GMB collection points (located between 12-52 kilometers from their villages)[13]. Also, non-approved buyer were more prevalent in Buhera District (4 of 6 villages, compared to one village in Mutoko/Mudzi Districts).

Thus, although Mutoko/Mudzi households have greater access to GMB depots, the presence of collection points and non-approved buyers in Buhera District provided households the opportunity to market surpluses

Input markets

Households in both districts had limited local access to purchased inputs. Although all but two villages had dry good stores, only 74 percent of these stores sold seed and only 11 percent sold fertilizer. More specialized inputs, such as herbicides and insecticides, were even less available locally. In Mutoko/Mudzi Districts, poor access to privately sold inputs was partially mitigated by the existence of input-purchasing cooperatives in two villages, although no village in Buhera had an input cooperative.

Grain processing

Maize mills were generally more available to households than sorghum mills. Households in Mutoko/Mudzi District lived closer to maize mills (0-2 kms) than households in Buhera District (0-34 kms). Few households lived close to a sorghum dehuller (one in each survey area), with the

[13]GMB collection points had not been established in Mutoko/Mudzi Districts during the survey period.

median distance in Mutoko/Mudzi District being less (29 kms) than in Buhera District (49 kms).

Public transport

Bus service was infrequent (median of 2 buses per week) in all but one village in each district, which both had daily service. Transport was available year around, except in two villages in Mutoko/Mudzi District, where roads were inaccessible during the higher rainfall periods.

Education

Village-based primary education was more accessible than secondary education. A majority of villages (67%) had primary schools, with better coverage in Buhera District (83%) than in Mutoko/Mudzi Districts (50%). In contrast, only two villages had secondary schools, both located in the Buhera District.

Health

In both areas, households had poor access to modern health care facilities--only one village (Buhera District) had a health clinic.

Veterinary services

The distribution of veterinary services reflected the greater importance of livestock in Buhera than in Mutoko/Mudzi. For example, 67 percent of the Buhera villages had cattle dips, compared to only 33 percent in Mutoko/Mudzi Districts.

Extension

All villages were served by AGRITEX extension agents, but each agent was assigned to cover several villages. Buhera District households had better access to extension because more villages had resident extension workers (83%) than Mutoko/Mudzi District (33%).

5.7.2.2 Changes in access to services since 1980

Since 1980, the ROZ has invested heavily to strengthen rural services. Yet, in the survey villages, there has been little improvement in household access to services (Table 5.18). For example, since 1980 the number of non-approved buyers has increased in only two villages (one in each survey areas). Similarly, even though the number of dry good stores increased from 15 to 23, only three additional stores sell seed and one additional store sells fertilizer.

Furthermore, access to primary and secondary education has changed little since independence. For example, government has constructed only two additional primary schools (one in each area) and two secondary schools (both in Buhera District).

Similarly, local access to modern health care services has not improved significantly. For example, only one survey village (Buhera District) had a clinic, compared to none at independence.

Veterinary services have improved only marginally since 1980, with household access to cattle dips increasing for only two villages, one in each survey area.

Finally, access to extension services has changed little, as indicated by only one additional resident extension worker living in each survey area.

5.7.3 Technology

Household adoption of improved technologies depends mainly on its appropriateness (technical suitability) and availability. This section uses household awareness and adoption of technology as proxy indicators of household access to technology.

Table 5.18 Change in rural access to services since 1980, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1980 and 1988.

Change in rural services	Buhera District						Mutoko/Mudzi Districts					
	1	2	3	4	5	6	1	2	3	4	5	6
Market access												
Non-approved buyers (#)												
1980	0	1	2	2	4	0	0	0	0	0	0	0
1988	0	3	5	2	4	0	0	0	0	0	0	2
Shops selling dry goods (#)												
1980	1	1	1	3	4	0	0	2	1	0	2	3
1988	1	4	1	3	4	1	0	4	1	0	3	5
Shops selling seed (#)												
1980	1	1	1	3	4	0	0	0	0	0	0	1
1988	1	1	1	3	4	1	0	1	0	0	1	0
Shops selling fertilizer(#)												
1980	0	1	0	0	0	0	0	0	0	0	0	0
1988	0	1	0	0	0	0	0	1	0	0	1	0
Education												
Primary schools (#)												
1980	1	2	0	0	1	1	0	0	0	1	0	0
1988	1	2	1	0	1	1	0	1	0	1	0	0
Secondary schools (#)												
1980	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	1	0	0	1	0	0	0	0	0	0	0
Health												
Clinics (#)												
1980	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	1	0	0	0	0	0	0	0	0	0	0
Veterinary services												
Cattle dips (#)												
1980	1	1	0	0	1	0	0	1	0	0	0	0
1988	1	1	0	0	1	1	0	1	0	0	0	1
Extension												
Extension workers (#)												
1980	1	1	0	1	1	0	0	1	0	1	0	0
1988	1	1	0	1	1	1	0	2	0	1	0	0

Source: Food Security Surveys.

A majority of households reported they were aware of most technologies recommended by AGRITEX (Table 5.19). Across districts household awareness of recommended technologies was similar, except in Buhera District for technologies that were either not available (soil analysis) or more risky given the low level, and erratic distribution, of rainfall (soil liming and herbicide use).

Mutoko/Mudzi District households reported higher adoption rates for a majority of recommended technologies, than in Buhera District. In Mutoko/Mudzi District, households had high adoption rates for most field preparation and variable input technologies (ie., contour construction, field pegging,and fertilizer and insecticide application) primarily because these technologies were better suited to the agroecological conditions found in this area. In addition, the greater adoption of fertilizer and insecticide by Mutoko/Mudzi District households was consistent with household land use (more area allocated to crops such as maize, cotton, fruits, and vegetables). In contrast, Buhera District households had similar or higher adoption rates for recommended technologies that required the use of animals traction equipment and animals than Mutoko/Mudzi District households. This result supports the earlier finding that Buhera District households owned more oxen and plows than Mutoko/Mudzi District households.

5.8 Summary

Analysis of the survey data indicated that households differed considerably, in terms of access to owned resources--land, labor, and capital. Although these differences in resource endowment contributed to explaining inter-household variability, inter-village differences in the external environment were also important explanatory factors.

Table 5.19 Technology awareness and adoption, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Recommended Technology	Awareness (%)		Adoption (%)	
	Mutoko/Mudzi	Buhera	Mutoko/Mudzi	Buhera
Field Preparation				
Post harvest plowing	98	100	63	61
Secondary plowing	85	90	43	73
Field pegging	88	98	12	11
Tine ridging	100	96	54	66
Tied ridging	25	7	5	3
Contour construction	100	100	50	16
Soil analysis	55	9	16	0
Variable input				
Kraal manure	100	98	40	35
Hybrid seed	95	100	80	85
Basal fertilizer	100	95	58	3
Top dressing fert.	100	84	62	6
Soil liming	19	5	0	0
Insecticide	80	87	25	4
Herbicide	66	16	0	0
Equipment				
Hitch assembly	47	73	14	10
Yoke size	56	31	39	10
Cropping				
Dry planting	90	95	50	87
Sole cropping	81	84	52	64

Source: Govereh (1991).

Resource endowment

Households in Buhera District had more land (hectares per household), labor (residents), and capital (oxen) than households in Mutoko/Mudzi Districts. In contrast, the distribution of labor (residents) and land was relatively equal across districts and the total sample, while oxen ownership was highly unequal.

Labor

Households averaged 6.6 resident and 4.5 nonresident members. Buhera District households had both more resident (7.4) and nonresident (5.3) family members than households in Mutoko/Mudzi Districts (5.9 and 4.3, respectively). Households in both districts had similar age and gender structures.

Land

Households in Buhera District had greater access to land (1.0 hectares per capita) than Mutoko/Mudzi households (0.7 hectares per capita). Across districts, land use was similar in two ways. First, in both districts households cultivated a similar proportion of their total land (88-89 percent). Second, grains dominated household land use (78-82 percent of cultivated area), followed by oilseeds (14-15 percent), intercropped (2-3 percent), fruits and vegetables (1 percent), and cotton (0-1 percent).

Across districts, land use differed in three major ways. First, although households in both districts grew mostly maize and small grains, Mutoko/Mudzi District households allocated a larger share of their land to maize (37 percent) and less to small grains (36 percent) than did households in Buhera District (18 and 61 percent, respectively). Second, although households in both districts allocated the same proportion of their land to oilseeds, Buhera District households allocated a larger share to groundnuts (7 percent) and less to sunflower (2 percent) than households in Mutoko/Mudzi District (3 and 10 percent, respectively). Finally, only survey households in Mutoko/Mudzi District grew cotton. These differences in cropping patterns reflect the preference of households in Buhera District to rely more on drought tolerant crops, since the rainfall is lower and more variable than in Mutoko/Mudzi Districts.

Capital

Household capital assets included primarily livestock and draft-drawn euipment. Capital ownership had pronounced differences across districts. First, in Buhera District households owned more cattle (7.5 per household) and small ruminants (10.6) than households in Mutoko/Mudzi Districts (4.7 and 4.0, respectively). In addition, Buhera District households owned more plows (1.6 per household) and ox carts (0.4) than households in Mutoko/Mudzi District (1.0 and 0.1, respectively). These results reflect the fact that since Buhera District has a lower population density and is more arid, cattle play a more important role in the farming system than in Mutoko/Mudzi Districts.

Income level and sources by resource ownership

Labor availability contributed to explainning differences in income level and sources. For example, larger households earned less total income (NHR) and income from production for home consumption (PHC), but earned more from labor sales. Unexpectedly, there was no relationship between household head gender (except female heads received more transfers) and income.

With respect to land availability, households that owned more land employed more of their available labor on their own farm (ie. as total cultivated area increased, PHC and farm sales increased, but labor sales declined). Second, households primarily produced small grains for home consumption (ie. as small grain area increased, farm sales declined). Third, households grew oilseeds as a cash crop (ie. as oilseed area increased, farm sales increased). Finally, households pursued a food-first strategy (ie. as grain area decreased and oilseed area increased, net household receipts, production for home consumption, and farm sales increased).

With respect to capital ownership, households who owned a full complement of animal traction equipment and animals earned higher total income and had larger farm sales than non-owning households. In addition, households that borrowed from the AFC (4 percent of the total sample) had much larger NHR and PHC than non-borrowers.

External environment

Several factors exogenous to the household influenced the level and structure of net household receipts.

Physical environment

In Mutoko/Mudzi District, rainfall was substantially higher and less variable (lower cv) than in Buhera District (Table 5.16). In contrast, both areas had similar intra-seasonal rainfall pattern, with peak rainfall occurring from November to March.

Services

Although the ROZ has made major investments to strengthen rural services, the survey villages had not benefitted greatly. Since 1980, there had been little improvement of household access to output markets (GMB depots, approved buyers, and non-approved buyers), input markets, primary and secondary education, modern health care, and extension services (Table 5.18).

Technology

For most technologies recommended by AGRITEX, farmers in both districts reported similar levels of awareness. Yet, Mutoko/Mudzi District households have adopted more of the recommended technologies (especially variable inputs) than Buhera District households, except for technologies that required oxen or plows. This implies that these technologies were better suited to Mutoko/Mudzi districts more favorable agroecological conditions.

CHAPTER VI

DETERMINANTS OF INTER-HOUSEHOLD VARIATION OF INCOMES

Both endogenous and exogenous factors explain inter-household income variability. Endogenous factors are resources available to the household for allocating to competing economic opportunities; including land, labor, capital, and purchased inputs. Exogenous factors are elements external to the household that influence how households allocate their endogenous resources; including institutions, technology, and the physical environment. In poorer agroecological areas, exogenous factors are particularly important determinants of household income.

This chapter is divided into four sections. The first section presents variables hypothesized to explain the inter-household variation in incomes. The second section examines regression results that identify the determinants of income (NHR). The third section presents and examines regression results that identify determinants of several subcomponents of income (NHR)--the value of total agricultural production, labor sales, and transfers (received). The final section summarizes the results of the chapter.

6.1 Regression variables

This analysis attempts to explain inter-household variability in net household receipts and its major subcomponents--the value of agriculture production, labor sales, and transfers (received)--using independent variables identified in Chapter 5.

6.1.1 Dependent variables

First, net household receipts (NHR) was chosen as the dependent variable in the regression model of aggregate income. Because NHR is the most inclusive income measure, it best indicates a household's ability to meet its consumption requirements.

Second, the three major subcomponents of NHR, (ie., the value of agricultural production[1], labor sales, and transfers (received)) were chosen as the dependent variable in the regression models of income subcomponents because they accounted for at least ten percent of net household receipts (NHR)[2]. The specifications of individual regression models are presented in sections 6.2 and 6.3.

6.1.2 Independent variables

Both endogenous and exogenous independent variables were hypothesized to explain inter-household variation in total income, and its three major subcomponents. Due to the highly aggregated nature of net household receipts, it is not possible to infer a causal relationship between the NHR and the independent variables included in the model. On the other hand, it is possible to infer greater causality between the dependent variables in the components models (value of agricultural production, labor sales, and transfers received) and their associated independent variables, since there exists a clearer theoretical relationship between these independent and dependent variables. This section describes all of the independent variables used in all of the subsequent econometric models.

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[1]Production for home consumption and farm sales are included in the agricultural production (value) model.

[2]Subcomponents not included are nonagricultural sales (6 percent of NHR), business inventories (2 percent), and net credit receipts (3 percent).

6.1.2.1 Endogenous factors (to households)

Households allocate both owned resources and purchased inputs to income-generating activities.

1. **Owned resources.** These include labor, land, and capital (physical and human).

a. Labor: These variables measure the size and composition of the household labor assets.

1. *Household size*: Measures of household size are the number of resident members (RESIDENT), non-resident members (HHNONRES), and male non-resident members (M_NONRES).

2. *Household composition*: Measures of household composition are the number of adult equivalents[3] (ADULTEQV) and the dependency ratio[4] (D_RATIO1).

3. *Gender of the household head*: The household head's gender was incorporated in two ways: a dummy variable for male/female (HHSEX); and two dummy variables that distinguish between households that were male-headed, female-headed/male away (DHDSTAT1), and female-headed/no male (DHDSTAT2).

4. *Household head's age*: The household head's age was incorporated as both a continuous variable (HHAGE) and a dummy for age cohort group (D_HDAGE1 and D_HDAGE2).

b. Land: Land variables measure the amount, quality, access, or productivity of land available to the household.

1. *Available area*: Available area was measured by the amount of land (hectares per capita) available to the

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[3]Adult equivalents are a measure of household size, adjusted for the age-sex composition of the household.

[4]The dependency ratio is the number of resident household members per worker.

household (PCLAND).

2. *Land quality*: Land quality was represented by the proportion of land which had average or excellent soil fertility (SFRTADEQ).

3. *Land access*: Land access was estimated as the mean distance of all fields from the household (DISTAREA).

4. *Productivity*: Land productivity was represented by the ratio of gross harvest value to the total cultivated area (P_TIVITY).

c. Capital: Capital variables measure the availability of physical and human capital.

1. *Physical capital*: Three variables measure physical assets held by households.

a. Plows: The number of plows owned per capita (PLOWPC).

b. Oxen: The number of oxen owned per capita (OXENPC).

c. Animal traction: Two sets of dummy variables were constructed to measure animal traction availability. One of these variables differentiated households as to whether or not they had a full complement of equipment and oxen (D_AT)[5]. Another set of variables differentiated whether or not a household was non-equipped, semi-equipped (D_AT1), or totally equipped (D_AT2).

2. *Human capital*: Two sets of variables represent the quality of human capital.

a. Formal education: Formal education is

[5]A full complement is defined as having a minimum of 2 oxen and one plow.

represented by a continuous variable that measures the number of years of school attended by the household head (EDUC_Q), a dummy variable to whether or not the household head attended school (D_EDUC), and a dummy variable to indicate whether or not the household head was literate in English (D_LIT).

b. Nonformal education: Exposure to nonformal education is represented by the household head's attendance at extension meetings or participation in AGRITEX's master farmer program. One dummy variable (D_EW) represents whether or not the head attended extension meetings; and two dummy variables represented whether or not the head attended meetings (never, sometimes (D_EW1), or always (D_EW2)). Similarly, one set of dummy variable differentiates whether or not the household head was a master farmer trainee (D_MF1) or already was a master farmer (D_MF2).

2. **Variable inputs.** These include household use of purchased inputs and borrowed credit.

a. Input use: A continuous variable measured the amount (dollars per capita) of agricultural inputs used by the household (INPUT_PC).

b. Credit use: Use of government-provided credit is represented by both a continuous variable (AFC_PC) which indicates the dollars per capita borrowed, and a dummy variable which represents whether or not households borrowed (D_AFC) from the AFC.

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6.1.2.2 Exogenous factors (to households)

Exogenous factors include the agroclimatic conditions that characterize the farming environment; including household access to marketing outlets, input markets, extension, and technology.

1. **Agroclimatic conditions.** Agroclimatic conditions are represented by a set of dummy variables, which were constructed to reflect household perceptions about the previous year's rainfall level, indicating whether they thought it had been a poor, average (D_RAIN1), or good (D_RAIN2) season.

2. **Services.** These variables were constructed to measure household access to marketing outlets, input markets, and extension[6].

a. Marketing outlets: Access to marketing outlets is a composite variable which includes distance to the Grain Marketing Board's (GMB) depots and collection points, and the existence (in the village) of either non-approved buyers or marketing cooperatives. Households were evaluated as having either poor, average (D_MRT1), or good (D_MRT2) access to marketing outlets.

b. Input markets: Access to input markets is represented by two dummy variables; which represent whether either improved seed (primarily hybrid maize) was sold in their village (D_INPUT1), or both improved seed and fertilizer were sold in their village (D_INPUT2).

c. Extension: Household access to extension is represented by a dummy variable to indicate whether or not an AGRITEX extension worker lived in the village (D_EXT).

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[6]The Agricultural Finance Corporation (AFC) scheduled meeting days in all villages when households could apply for credit. Information was unavailable to distinguish inter-village access to credit services, so only household use of AFC credit was included in the analysis.

3. **Technology**. Technology was represented by variables that reflect household use of improved technology; including household access to input markets, use of variable inputs, and equipment ownership.

6.2 Determinants of net household receipts

The independent variables in the net household receipts model provide insights about factors associated with inter-household variation of net household receipts. This section first presents the specification of a multiple regression model. Then, the results of the regression model are presented.

6.2.1 Model specification

To explain inter-household variation in net household receipts, a multiple regression model--using both endogenous and exogenous factors--was fitted to the survey data using ordinary least-squares (OLS).

Assumptions

The assumptions of the regression model, including linearity, are those common to a classical multiple regression model[7], and when satisfied provide OLS estimators which are both unbiased and consistent. An evaluation of whether or not the assumptions are satisfied is discussed for each regression model.

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[7]The assumptions of a multiple regression model are (Pindyck and Rubinfeld (1981, pp. 75-76) :

1. The model is specified by the following equation:

$$Y = B_1 + B_2X_2 + B_3X_3 + \ldots + B_nX_n + e$$

2. The independent variables are nonstochastic; and there is no exact linear relationship between one or more of the independent variables.
3. The error term has a zero expected value and constant variance for all observations. Errors corresponding to different observations are uncorrelated. The error variable is normally distributed.

<u>Multiple regression model</u>

Five sets of independent variables are included in the econometric model; including variables that measure exogenous factors (services, agroclimatic factors, and technology), labor characteristics, land availability, capital ownership, and the use of purchased inputs. The final model specification is represented as:

$$NHR = C + B_1D_1 + B_2D_2 + \ldots + B_6D_6 + B_7X_1 + B_8D_7 + B_9X_2 + B_{10}X_3 + B_{11}X_4 + B_{12}D_8 + B_{13}D_9 + B_{14}D_{10} + B_{15}D_{11} + B_{16}X_5 + B_{17}X_6 + e$$

Where:

NHR	=	Net household receipts
C	=	Constant term
D_1	=	Output market access: medium (dummy)
D_2	=	Output market access: high (dummy)
D_3	=	Input market access: seed availability (dummy)
D_4	=	Input market access: seed and fertilizer available (dummy)
D_5	=	Rainfall rating: average (dummy)
D_6	=	Rainfall rating: good (dummy)
X_1	=	Household head age (years)
D_7	=	Household head gender: male (dummy)
X_2	=	Land per capita (hectares)
X_3	=	Number of oxen (per capita)
X_4	=	Education of household head (years)
D_8	=	Household head is a master farmer trainee (dummy)
D_9	=	Household head is a master farmer (dummy)
D_{10}	=	Household head <u>sometimes</u> attends extension meetings (dummy)
D_{11}	=	Household head <u>always</u> attends extension meetings (dummy)
X_5	=	Input use per capita (Z$)
X_6	=	Amount borrowed from AFC per capita (Z$)
e	=	Error term

6.2.2 Results of the model

This section presents the degree to which the assumptions of multiple regression were met, and the results when the data were fitted to the model.

6.2.2.1 Satisfaction of the assumptions

The model was examined for specification error (functional form), the relationship between independent variables, and the characteristics of the error term.

Functional form

A linear regression model was specified for two reasons. First, a linear relationship between the dependent and independent variables was chosen because no *a priori* information existed that suggested otherwise. Second, a review of scatterplots between each independent variable and net household receipts also suggested a linear relationship.

Relationship between independent variables

The presence of multicollinearity was tested both by examining the correlation matrix of the independent variables, and observing if the T statistics are low and the goodness of fit (R^2) is high. An examination of the correlation matrix identified that the highest correlation existed between the amount of land available and oxen ownership (a zero-order correlation coefficient of 0.60). To assess the impact of this correlation, the variable representing oxen ownership was then dropped, but the model was weakened, specifically it had less predictive power (F statistic) and a poorer goodness of fit (R^2). Therefore, both variables were included in the regression model.

Characteristics of the error term

The regression residuals were examined for heteroskedasticity, serial correlation, and the normality of their distribution to test if the regression model's results are BLUE (best linear unbiased estimators).

Heteroskedasticity, or unequal variance of the error terms, was tested by reviewing the standardized scatterplot of the residuals of the actual and predicted values of net household receipts. This procedure demonstrated that except for a few outliers, the error term displayed a relatively equal variance.

The presence of serial correlation was evaluated in two ways. First, a visual examination of the residual plot indicated that serial correlation did not exist. Second, the Durbin-Watson statistic was calculated (DW = 1.91) for first-order serial correlation. These result imply that the null hypothesis--that no serial correlation exists--should be accepted.

Finally, the error term was evaluated for the normality of its distribution. An examination of a histogram of the standardized residuals showed that the distribution was generally normal, but slightly peaked.

6.2.2.2 Results of the net household receipts regression model

The results of the regression model indicated that there was a strong statistical relationship between net household receipts and the included independent variables (Table 6.1). The results of the regression model is divided into its performance and interpretation.

Performance of the regression model

The performance of the regression model is evaluated using the F statistic, R^2, and adjusted R^2. The F statistic (24.79), which tests for linearity between the dependent and independent variables, was statistically significant at the one percent level.

The included independent variables explained nearly 62 percent (R^2 = 0.615), and 59 percent when adjusted for the degrees of freedom (adjusted R^2 = 0.590), of the variation of net household receipts for the sample households.

Interpretation of the regression coefficients

The estimated regression coefficients provides several insights. First, household reliance on agriculture to earn income is highlighted by the large magnitude and statistical significance of production related variables--land availability (1 percent level), oxen ownership (5 percent

Table 6.1 Regression coefficients and test statistics for the econometric model examining inter-household variation of net household receipts, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Independent Variables	Regression Coefficient		Standard Error	Mean	Standard Deviation
Exogenous factors (HH)					
1. Services					
a. Output markets					
Medium	69.34	*	51.48	0.07	0.26
High	73.27	**	40.26	0.32	0.47
b. Input markets					
Seed	81.44	***	33.19	0.58	0.50
Fertilizer	27.71		38.61	0.18	0.39
2. Agroclimatic					
Average	194.24	****	42.38	0.28	0.45
Good	- 2.97		45.69	0.54	0.50
Endogenous factors (HH)					
1. Labor					
a. Head's age (years)	0.08		0.80	48.84	15.73
b. Head's gender	6.41		32.62	0.86	0.35
2. Land					
a. Per capita availability (ha)	121.98	****	9.21	0.86	1.43
3. Capital					
a. Physical					
Oxen (#)	49.64	***	21.72	0.37	0.62
b. Human (Head)					
Education (years)	8.37	**	4.50	3.68	2.90
Master farmer program					
Trainee	110.54	****	39.19	0.10	0.30
Master farmer	4.54		55.49	0.05	0.21
Extension meeting attendance					
Sometimes	-26.33		27.06	0.49	0.50
Always	-41.09		45.02	0.12	0.33
4. Variable input use					
a. Input use per capita (Z$)	7.47	***	3.21	1.10	3.32
b. Amount borrowed from AFC (Z$)	9.10		12.68	0.13	0.81
Constant term	-89.88		74.75		

Summary statistics

Sample size	285
Multiple R	0.784
R square	0.615
Adjusted R square	0.590
F statistic	24.790
Sign. of F statistic	.00005 level

Significance level:

*	20 percent	***	5 percent
**	10 percent	****	1 percent

level), and input usage (5 percent level)[8]. This result complements earlier results which showed that households earn a majority of their net household receipts (62 percent) directly from agricultural production.

The regression coefficients of land availability implies that, *ceteris paribus*, a one hectare increase in land (per capita) was associated with a Z$121.17 increase in per capita net household receipts. Of the resources available to households, land appeared to have the largest impact. Similarly, oxen ownership has a large regression coefficient, implying that an additional ox (per capita), *ceteris paribus*, was associated with an additional increase of Z$49.64 to net household receipts. Finally, an additional dollar of inputs used, *ceteris paribus*, would result in an additional Z$7.47 in net household receipts.

Second, the importance of factors exogenous to household was demonstrated by the statistically significant relationship between net household receipts and household access to output markets, input markets, and rainfall. Household access to agricultural marketing outlets was statistically significant for both medium (20 percent level) and high access (10 percent level). Both variables imply a positive, but weak relationship between output market access and the level of net household receipts; though caution should be used when interpreting this result since other factors[9] strongly influence whether households produced enough to participate in these markets.

Household access to input markets also provided interesting results. First, the variable used to assess the impact of household access to stores that sold improved seed (within village) was statistically significant (5 percent level) and large (Z$81.44), thus implying a strong

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[8]Plow ownership was also highly correlated with net household receipts (0.59), but due to multicollinearity with oxen ownership and land availability, it was not included in the regression model.

[9]Including household resources (land, labor, and capital) and other exogenous factors (access to input markets and rainfall).

influence on income. In contrast, household access to stores that sold both seed and fertilizer (within village) was not statistically significant (at the 20 percent level), possibly due to the generally low level of fertilizer use.

The village rainfall dummy variables provided mixed results. The average rainfall (previous season) variable was statistically significant (1 percent level) and large (Z$194.24), illustrating the impact of rainfall on income. But good rainfall in the previous year was not statistically significant even, at the 20 percent level.

Third, the proxies for human capital gave mixed results. Although education of the household head was statistically significant (10 percent level), an additional year of education, *ceteris paribus*, was associated with only in an additional Z$8.37 to net household receipts. The influence of whether the household head was involved in the master farmer trainee program was statistically significant (1 percent level), implying that household heads which participated in the program, *ceteris paribus*, earned an additional Z$110.54 per capita. Yet, caution is needed in interpreting these results because it is impossible to discern the direction of causality[10]. On the other hand, the influence of the household head being a master farmer graduate and attendance at extension meetings was not statistically significant, even at the 20 percent level.

Finally, household head characteristics were not significantly (20 percent level) related to the level of net household receipts. The nonsignificance of both the age and gender of the household head suggests that resources available to the household were more important than the household head's individual characteristics.

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[10]It is not possible to determine whether households with larger net household receipts wanted to be master farmers, or if the participation in the program had resulted in higher levels of net household receipts.

6.3 Determinants of household receipt components

Net household receipts is composed of several components. For each major component, a regression model was estimated to explain inter-household variability. All regression models were fitted using ordinary least squares (OLS), and use the classical multiple regression model assumptions. This section presents the model specification and regression results for four specific household receipts components--the value of agricultural production, labor sales, and transfers (received).

6.3.1 Determinants of agricultural production

Agricultural production was the largest income source, comprising 62 percent of net household receipts. The value of agricultural production (Z$) was chosen as unit to aggregate all agricultural goods produced by the household.

6.3.1.1 Model specification

Twenty independent variables--representing factors both exogenous and endogenous to the household--were used to explain inter-household variability of agricultural production (value).

The final model specification for the value of agricultural production is represented as:

$$AGPROPC = C + B_1D_1 + B_2D_2 + \ldots + B_7D_7 + B_8X_1 + B_9D_8 + B_{10}X_2 +$$
$$B_{11}X_3 + B_{12}X_4 + B_{13}X_5 + B_{14}X_6 + B_{15}D_9 + B_{16}D_{10} +$$
$$B_{17}D_{11} + B_{18}D_{12} + B_{19}X_7 + B_{20}X_8 + e$$

Where:

AGPRODPC	=	Agricultural production (per capita)
C	=	Constant term
D_1	=	Output market access: medium (dummy)
D_2	=	Output market access: high (dummy)
D_3	=	Input market access: seed availability (dummy)
D_4	=	Input market access: seed and fertilizer available (dummy)
D_5	=	Rainfall rating: average (dummy)
D_6	=	Rainfall rating: good (dummy)
D_7	=	Extension worker lives in village (dummy)
X_1	=	Household head age (years)
D_8	=	Household head gender: male (dummy)
X_2	=	Dependency ratio
X_3	=	Land per capita (hectares)
X_4	=	Mean distance to fields
X_5	=	Number of oxen (per capita)
X_6	=	Education of household head (years)
D_9	=	Household head is a master farmer trainee (dummy)
D_{10}	=	Household head is a master farmer (dummy)
D_{11}	=	Household head <u>sometimes</u> attends extension meetings (dummy)
D_{12}	=	Household head <u>always</u> attends extension meetings (dummy)
X_7	=	Input use per capita (Z$)
X_8	=	Amount borrowed from AFC per capita (Z$)
e	=	Error term

6.3.1.2 Results of the regression model

This section presents evidence that the classical multiple regression model assumptions were satisfied, and the results when the data were fitted to the model.

Satisfaction of the assumptions

Following the procedures outlined in section 6.2.2.1 (p. 189), the model was examined for specification error, the relationship between independent variables, and the characteristics of the error term. The estimated model satisfied all of the assumptions of a classical multiple regression model.

Results of the model

The independent variables explained nearly 38 percent, and 34 percent when adjusted for the degrees of freedom, of the inter-household variability of agricultural production (Table 6.2). The F statistic (8.10) was statistically significant at the one percent level.

The estimated regression coefficients provide several insights. First, among endogenous variables, capital (physical and human) and land resources contribute towards explaining the level of agricultural production; highlighted by the large magnitude and statistical significance of the independent variables--oxen ownership (1 percent level), land availability (5 percent level), mean distance to fields (10 percent level), and whether the household head was a master farmer (5 percent level) or trainee (1 percent level). These relationships supported the results from the earlier regression model of net household receipts, which suggested a strong household reliance on agriculture. Oxen ownership had a large positive regression coefficient, implying that an additional ox (per capita) was associated with, *ceteris paribus*, an additional Z$88.54 in the value of agricultural production, demonstrating the importance of timely land preparation. The impact of oxen ownership

Table 6.2 Regression coefficients and test statistics for the econometric model examining inter-household variation of the value of agricultural production, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Independent Variables	Regression Coefficient		Standard Error	Mean	Standard Deviation
Exogenous factors (HH)					
1. Services					
a. Output markets					
Medium	-43.53		44.16	0.07	0.26
High	0.21		31.56	0.32	0.47
b. Input markets					
Seed	76.32	****	25.72	0.58	0.50
Fertilizer	54.44	**	31.77	0.18	0.39
2. Agroclimatic					
Average	128.29	****	34.50	0.28	0.45
Good	46.47		36.83	0.54	0.50
3. Extension	27.39		21.88	0.60	0.49
Endogenous factors (HH)					
1. Labor					
a. Head's age (years)	- 0.27		0.66	48.85	15.76
b. Head's gender	4.47		25.04	0.86	0.35
c. Dependency ratio	-28.59	*	18.18	1.75	0.54
2. Land					
a. Per capita availability(ha)	14.21	***	7.17	0.86	1.43
b. Mean dist to fields (min)	-1.19	**	0.69	11.28	12.39
3. Capital					
a. Physical					
Oxen (#)	88.54	****	16.80	0.37	0.62
b. Human (Head)					
Education (years)	2.92		3.53	3.67	2.89
Master farmer program					
Trainee	92.41	****	30.27	0.10	0.31
Master farmer	82.39	**	42.83	0.05	0.21
Extension meetings					
Sometimes	-15.24		20.86	0.48	0.50
Always	-33.03		34.59	0.12	0.33
4. Variable input use					
a. Input use per capita (Z$)	6.13	***	2.55	1.11	3.32
b. Borrowed from AFC (Z$)	13.53	*	9.81	0.13	0.81
Constant term	15.48		72.95		

Summary statistics

Sample size	285
Multiple R	0.619
R square	0.384
Adjusted R square	0.336
F statistic	8.096
Sign. of F statistic	.00005 level

Significance level:

*	20 percent	***	5 percent
**	10 percent	****	1 percent

was larger, as expected, on agricultural production than on net household receipts. Although highly significant, the coefficient for land availability was smaller (Z$14.21) in agricultural production income model, compared to the net household receipts model. The mean distance of all fields to the homestead was negatively related to agricultural production, possibly suggesting that fields farther away from the homestead received less crop management inputs. Households whose head was either a master farmer or trainee had large positive regression coefficients (Z$82.39 and Z$92.41, respectively), implying that participating households benefitted from the advice provided. In contrast, household head's education (years) and attendance at extension meetings were not statistically significant, even at the 20 percent level.

Second, the importance of factors exogenous to the household was illustrated by the statistically significant relationship between the value of agricultural production and household access to input markets and rainfall. Household access to inputs markets was significant for both villages with stores that sold only seed (1 percent level) and stores that sold fertilizer (10 percent level). Both variables imply a positive relationship between agricultural production and access to input markets, but the relative size of the coefficients imply that access to seed stores was more important.

The village rainfall dummy variables gave mixed results. Average rainfall in the previous season was significant (1 percent level) and large (Z$128.29), suggesting a strong influence of rainfall on agricultural production. In contrast, the dummy variable representing good rainfall in the previous season was not statistically significant, even at the 20 percent level. (explain)

Third, the influence of household labor characteristics on agricultural production was weak. Only the variable "household's dependency ratio" (eg., the ratio of household size to the number of workers) was weakly significant (20 percent level). Both the household head's age and gender were not statistically significant, even at the 20 percent level--further reinforcing the argument that physical resources (land and capital) were more important in explaining agricultural production than household head characteristics.

Finally, household use of purchased inputs and credit were both significant (5 and 20 percent levels, respectively) and large (Z$6.13 and Z$13.53, respectively), implying that their use has a positive impact on agricultural production. However, caution should be used in evaluating the impact of purchased inputs and credit because the mean value used by households was low (Z$1.11 and Z$0.13, respectively).

6.3.2 Determinants of labor sales

Labor sales comprised an average of 15 percent of net household receipts for the entire sample, ranging from 1 to 51 percent across villages. Payment for these services was primarily received as cash (95 percent). Although labor was predominantly sold by the household head and spouse (85 percent) for agricultural services (greater than 80 percent), this dependent variable also incorporates labor sold for other purposes.

6.3.2.1 Model specification

Fourteen independent variables--representing factors both exogenous and endogenous to the household--were used to explain the inter-household variability of labor sales.

The final model specification for labor sales is represented as:

$$LS(PC) = C + B_1D_1 + B_2D_2 + B_3D_3 + B_4D_4 + B_5X_1 + B_6D_5 + B_7D_6 + B_8X_2 + B_9X_3 + B_{10}X_4 + B_{11}X_5 + B_{12}D_7 + B_{13}D_8 + B_{14}X_6 + e$$

Where:

LS(PC)	=	Labor sales (per capita)
C	=	Constant term
D_1	=	Output market access: medium (dummy)
D_2	=	Output market access: high (dummy)
D_3	=	Input market access: seed availability (dummy)
D_4	=	Input market access: seed and fertilizer available (dummy)
X_1	=	Household head age (years)
D_5	=	Household head gender: female head/ male away (dummy)
D_6	=	Household head gender: female head/ no male (dummy)
X_2	=	Dependency ratio
X_3	=	Land per capita (hectares)
X_4	=	Land productivity
X_5	=	Education of household head (years)
D_7	=	Household head is a master farmer trainee (dummy)
D_8	=	Household head is a master farmer (dummy)
X_6	=	Input use per capita (Z$)
e	=	Error term

6.3.2.2 Results of the regression model

This section presents whether the classical multiple regression model assumptions were satisfied, and the results when the data were fitted to the model.

Satisfaction of the assumptions

Following the procedures outlined in section 6.2.2.1 (p. 189), the model was examined for specification error, the relationship between independent variables, and the characteristics of the error term. The estimated model satisfied all of the assumptions of a classical multiple regression model.

<u>Results of the model</u>

The independent variables explained nearly 27 percent (23 percent when adjusted for the degrees of freedom) of the inter-household variability of labor sales (Table 6.3). The F statistic (6.86) was statistically significant at the one percent level.

The estimated regression coefficients provide several insights. First, female-headed households--whether there was no male or he was away--had a strong negative relationship with labor sales by resident household members. In both cases, the coefficient was large and negative (-78.76 and -77.46 for female-head with male away and no male, respectively), and highly statistically significant (1 percent level), suggesting that both spouses are needed for households to take advantage of available employment opportunities.

Second, variables associated with labor composition were also important in explaining the variation in labor sales. The household's "dependency ratio" was significant (5 percent level), implying that households with more children (ie., a smaller number of workers per household) sought wage employment, possibly due to their greater need for additional income to supplement their agricultural income.

Third, the relationship between agricultural related variables and labor sales was mixed. Although land productivity and the level of purchased inputs were statistically significant (1 and 20 percent levels, respectively), land productivity had a small positive influence (0.13) and input usage had small negative influence (-2.22) on labor sales. The amount of available land was significant (1 percent level), but small (Z$1.54), implying that additional land would have had little impact on household labor sales.

Fourth, among variables measuring human capital resources, only household participation in the master farmer program, whether a master farmer or trainee, were significant (1 and 5 percent level). Households heads that participated in the master farmers had a negative statistical

Table 6.3 Regression coefficients and test statistics for the econometric model examining inter-household variation of labor sales, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Independent Variables	Regression Coefficient		Standard Error	Mean	Standard Deviation
<u>Exogenous factors (HH)</u>					
1. Services					
a. Output markets					
Medium	75.82	****	16.81	0.08	0.26
High	-0.33		9.89	0.32	0.47
b. Input markets					
Seed	12.28		11.33	0.58	0.50
Fertilizer	-6.56		13.83	0.18	0.39
<u>Endogenous factors (HH)</u>					
1. Labor					
a. Head's age (years)	0.03		0.34	48.86	15.76
b. Head's gender					
Female headed/male away	-61.21	****	19.17	0.85	0.36
Female headed/no male	-57.63	****	22.54	0.10	0.31
c. Dependency ratio	23.64	***	9.25	1.75	0.54
2. Land					
a. Per capita availability (ha)	1.54	****	9.21	0.86	1.43
b. Productivity	0.13	****	0.02	189.77	179.25
3. Human capital					
Education (years)	1.68		4.50	3.67	2.89
Master farmer program					
Trainee	26.75	***	13.64	0.10	0.31
Master farmer	-47.43	****	19.57	0.05	0.21
4. Variable input use					
a. Input use per capita (Z$)	-2.21	**	1.26	1.11	3.32
<u>Constant term</u>	3.24		33.68		

Summary statistics	
Sample size	285
Multiple R	0.515
R square	0.265
Adjusted R square	0.227
F statistic	6.86
Sign. of F statistic	.00005 level

Significance level:

*	20 percent	***	5 percent
**	10 percent	****	1 percent

relationship with labor sales (they sell Z$44.39 less labor), implying that households with master farmer heads focused more on their agricultural activities. Conversely, household heads that were training to become master farmers had a positive statistical relationship with labor sales. Both the level of formal education and attendance at extension meetings were not statistically significant (20 percent level) in explaining labor sales. This is not surprising, given that most local employment opportunities were for agricultural labor. Variables representing physical capital--oxen and plow ownership--were initially included in the model, but were dropped both because they were not statistically significant and were correlated with other independent variables.

Finally, the importance of factors exogenous to the household provided mixed results. Only medium household access to output markets was significant (1 percent level), suggesting that access to marketing outlets (primarily non-approved buyers) encouraged households in these villages to intensify agricultural production. Household access to input markets and high access to output markets were not statistically significant, even at the 20 percent level.

6.3.3 Determinants of transfers (received)

Transfers, on average, comprised 15 percent of household receipts for the entire sample, ranging from 4 to 31 percent across villages. Although households received transfers from both government and private sources, almost all (99 percent) were from private sources (primarily remittances).

6.3.3.1 Model specification

Fifteen independent variables--representing factors both exogenous and endogenous to the household--were used to explain the inter-household variability of transfers received.

The final model specification for transfers received is represented as:

$$TRI = C + B_1D_1 + B_2D_2 + \ldots + B_9D_9 + B_{10}X_1 + B_{11}X_2 + B_{12}X_3 + B_{13}X_4 + B_{14}X_5 + B_{15}X_6 + e$$

Where:

TRI	=	Transfers (received)
C	=	Constant term
D_1	=	Output market access: medium (dummy)
D_2	=	Output market access: high (dummy)
D_3	=	Input market access: seed availability (dummy)
D_4	=	Input market access: seed and fertilizer available (dummy)
D_5	=	Rainfall rating: average (dummy)
D_6	=	Rainfall rating: good (dummy)
D_7	=	Household head age cohort group: 35 to 55 years old (dummy)
D_8	=	Household head age cohort group: more than 55 years old (dummy)
D_9	=	Household head gender: male (dummy)
X_1	=	Dependency ratio
X_2	=	Number of male nonresident household members
X_3	=	Land per capita (hectares)
X_4	=	Land productivity
X_5	=	Education of household head (years)
X_6	=	Input use per capita (Z$)
e	=	Error term

6.3.1.2 Results of the regression model

The model was examined for specification error (functional form), the relationship between independent variables, and the characteristics of the error term.

<u>Satisfaction of the assumptions</u>

Following the procedures outlined in section 6.2.2.1 (p. 189), the model was examined for specification error, the relationship between independent variables, and the characteristics of the error term. The estimated model satisfied all of the assumptions of a classical multiple regression model.

<u>Results of the model</u>

The independent variables explained nearly 25 percent (20 percent when adjusted for the degrees of freedom) of the inter-household variability of transfers (Table 6.4). The F statistic (5.74) was statistically significant at the one percent level.

The estimated regression coefficients provide several insights. First, the age of the household head was positively related to the level of transfers received. Both middle-aged and older household heads were statistically significant (10 and 1 percent, respectively), with older household heads receiving larger amounts of transfers (Z$30.36) than middle-aged households (Z$25.18). This result suggests that older household heads had offspring that were old enough to help supplement their family's income.

Second, the number of male nonresident household members was also statistically significant (1 percent level), suggesting that male nonresident members had greater income earning opportunities than females. This result is consistent with cultural practices that associate obligations for males with their household, and females with their husband's household.

Third, there was a relationship between agriculture and transfers received. Both agricultural productivity and purchased input use were statistically significant (10 and 1 percent level, respectively). Agricultural productivity and transfers received had an inverse relationship, implying that nonresident family members played an important role in assuring their household had an adequate income level. The positive relationship between transfers received and use of purchased inputs demonstrates the importance of transfers as a source of cash to invest in agriculture.

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Table 6.4 Regression coefficients and test statistics for the econometric model examining inter-household variation of transfers received by household, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Independent variables	Regression Coefficient		Standard Error	Mean	Standard Deviation
Exogenous factors (HH)					
1. Services					
a. Output markets					
Medium	1.16		18.20	0.08	0.26
High	-6.64		12.95	0.32	0.47
b. Input markets					
Seed	20.14	**	12.34	0.58	0.50
Fertilizer	10.27		14.10	0.18	0.39
2. Agroclimatic					
Average	49.98	****	16.02	0.28	0.45
Good	16.13		16.83	0.54	0.50
Endogenous factors (HH)					
1. Labor					
a. Head's age cohort group					
Middle aged	24.08	**	12.94	0.24	0.43
Older	29.62	****	10.25	0.41	0.49
b. Head's gender	-7.84		11.41	0.86	0.35
c. Dependency ratio	8.50		8.52	1.75	0.54
d. Number of male nonresidents (#)	13.46	****	3.67	0.87	1.13
2. Land					
a. Per capita availability (ha)	3.06		2.69	0.86	1.43
b. Productivity	-0.04	**	0.02	189.77	179.25
3. Human capital					
Education (years)	-0.38		1.65	3.67	2.89
4. Variable input use					
a. Input use per capita (Z$)	7.95	****	1.21	1.11	3.32
Constant term	12.51		25.57		

Summary statistics

Sample size	285
Multiple R	0.495
R square	0.245
Adjusted R square	0.203
F statistic	5.74
Sign. of F statistic	.00005 level

Significance level:

*	20 percent	***	5 percent
**	10 percent	****	1 percent

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Finally, although the importance of factors exogenous to the household were significant, their interpretation is problematic. Although the variables, household access to stores that sold seed and villages with average rainfall, were statistically significant (10 and 1 percent levels, respectively), one would expect households in poor rainfall environments--and less access to inputs--to depend more on transfers. Household access to output markets, access to stores that sold fertilizer, and good rainfall were not statistically significant, even at the 20 percent level.

6.4 Summary

Inter-household variability of per capita net household receipts (total income), and three subcomponents (ie., value of agricultural production, labor sales, and transfers received) is influenced by endogenous (controlled by the household) and exogenous (beyound the household's control) factors. This analysis identifies constraints households face to increase their income.

First, factors exogenous to the household were important in explaining inter-household variation in total income (output and input markets and agroclimatic conditions) and value of agricultural production (input markets and agroclimatic conditions) models, but explained little in the labor sales and transfers (received) models.

Second, endogenous factors--primarily access to land and oxen--were important in explaining inter-household variation in total income and the value of agricultural production, but explained little in the labor sales and transfers (received) models. This result demonstrates household dependence on agriculture, and suggests that poorer households could have increased their total income and agricultural productivity by acquiring more land and oxen.

Third, household labor characteristics were important in explaining inter-household variation in labor sales (household head's gender and the dependency ratio) and transfers (household head's cohort group and the

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number of male nonresidents), but explained little in the total income and value of agricultural production models. This result further supports the hypothesis that physical resources are more important in explaining agricultural production. Furthermore, it suggests that individual household characteristics determine whether households are able to take advantage of local employment opportunities or supplement their income with transfers.

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CHAPTER VII

RURAL DEVELOPMENT STRATEGIES

Policies that maximize the impact of government on rural development must take into account two factors. First, they must anticipate the effect of macroeconomic policies--exchange rate, foreign exchange, interest rates, and inflation policies--on the performance of agriculture and national development objectives. For example, the agricultural sector can promote national development by 1.) generating or saving foreign exchange, 2.) reducing inflationary pressure, and 3.) creating an effective demand for commodities produced by other sectors. Second, policies must be designed with an understanding of the socio-economic characteristics of the poor (and the subsequent short-run impact of policy changes on the poor) since their impact will depend on household access to resources and their enterprise mix (de Janvry and Sadoulet, 1989).

If policy makers had sufficient information to evaluate, *ex ante*, the probable consequences--intended and unintended--of alternative policies on households with different income structures and productive assets, they would be able to identify policies having the most desirable effects on food insecure households (Strauss, 1986; Bigman, 1985; and Behrman and Murty, 1982).

This chapter draws on the insights from previous analysis to examine the effect of current policies on rural households, and suggests a rural development strategy to raise incomes of the rural poor. First, a typology of households is presented, based on access to resources. Second, the effect of current policies and services on different household

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household types is evaluated. Finally, rural development strategies are proposed under two scenarios--first, for the short run (existing technology), and then for the long run, assuming proposed technological change.

7.1 Household typology

Analysis in Chapter 6 found that a households' income-earning strategy depends on its access to land, labor, and capital. Based on access to resources, three types of rural households are found in rural Zimbabwe (Table 7.1).

1. Resource-poor households. These households were in the bottom two per capita income quartiles. Although they had relatively more labor, they owned relatively little land and capital assets (oxen), and used minimal purchased inputs.

2. Marginal-farm households. These households were in the upper-middle per capita income quartile. Although they were also relatively land poor, these households had less labor but owned more capital assets (oxen), and used more purchased inputs compared to resource-poor households.

3. Small-farm households. These households were in the upper per capita income quartile. In contrast, although these households had the least amount oflabor, they owned twice as much land, more capital assets (oxen), and used considerably more purchased inputs than resource-poor and marginal-farm households.

Across the villages studied, mean incomes (per capita) ranged from Z$115 to Z$390. Observed differences in access to resources also serves to explain these inter-village income differences. Villages with a higher mean incomes, had a larger proportion of their households in the upper income quartile (Table 4.2), and these households had greater access to assets. For example, in village #1 (Buhera District), the 52 percent of the households in the upper quartile owned more than twice the land (per capita), and almost twice as many oxen, as households in the other three quartiles. Alternatively, in village #4 (Mutoko/Mudzi District), the 44 percent of the households in the lower income quartile, owned only 65 percent as much land (per capita), and 55 percent as many oxen, as households in the other three quartiles.

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Table 7.1 Summary of household assets and performance measures across household types, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89[a].

	RESOURCE-POOR HOUSEHOLDS	MARGINAL-FARM HOUSEHOLDS	SMALL-FARM HOUSEHOLDS
Household assets			
Land (per capita)	0.7 a	0.7 a	1.4 b
Residents (#)	7.8 a	5.8 b	5.0 b
Capital assets			
Oxen (#)	1.5 a	2.0 ab	2.5 b
Plows (#)	1.3	1.2	1.4
Variable capital			
Input (Z$/c)[b]	4.3	5.7	7.7
Ag investment	6.6 a	15.0 a	35.7 b
Performance measures			
Labor productivity[c]	102 a	231 b	585 c
Land productivity[d]	116 a	225 b	302 c
Prod. adequacy[e]	80 a	>100 b	>100 c

Source: Food Security surveys.

[a] Duncan's Multiple Range test was used to assess the statistical significance of the difference of means, when there are three or more groups (means). Numbers that are statistically different (5 percent level) across household types have different letter(s) assigned to them. No letter after a number signifies that there was no statistically significant difference across household types.
[b] Includes only those households that purchased inputs.
[c] Ratio of net household income to the number of adult equivalents.
[d] Ratio of the gross harvest value to total cultivated area (hectares).
[e] Percent of food and clothing met through production for home consumption (including inventories).

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Given this socio-economic differentiation of households, "diverse policies, technological packages, and institutional innovations are needed" to address the varying needs of different household types (Eicher, 1990).

7.2 Effect of current policies and services on rural income

Since 1980, the Government of Zimbabwe has sought to increase rural incomes through policies designed to influence output prices, market access (inputs and outputs), credit, extension, agricultural research, education, and small scale enterprises.

Although these policies are credited for Zimbabwe's agricultural revolution, they have largely benefitted marginal- and small-farm households, and had minimal (or negative) impact on the resource-poor households (Table 7.2). The following analysis reviews the respective policies, and identifies factors responsible for their differential impacts, in order to identify opportunities to stimulate more broad-based rural development.

Pricing policies

In Zimbabwe, government has relied heavily on incentive prices to increase small grain, maize, and oilseed production since these are the dominant crops in low rainfall areas (Chapter 2).

Although government anticipated that these policies would increase the incomes of all communal farmers, they have primarily benefitted marginal- and small-farm households because these households had access to under-utilized resources, or were able to reallocate resources from other enterprises. Although resource-poor households had more labor (resident) than either the marginal- or small-farm households, they owned less land, less oxen, and invested less in agriculture. Thus, were less able to take advantage of price incentives to alter their enterprise mix and thereby generate an agricultural surplus--even in the

Table 7.

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Table 7.2 Summary effects[a] of current government policies across household types, Mutoko/Mudzi and Buhera Districts, Zimbabwe, 1988/89.

Existing Policies and services	RESOURCE-POOR (< Z$139)			MARGINAL-FARM (Z$139 - Z$243)			SMALL-FARM (> Z$243)		
	NHR[b]	C[c]	M[d]	NHR[b]	C[c]	M[d]	NHR[b]	C[c]	M[d]
Price									
Small grain	0	-	0	0	0	0	+	+	+
Maize	0	-	0	+	+	+	+	+	+
Oilseeds	0	0	0	+	+	+	+	+	+
Market access									
Inputs	0	0	0	+	0	+	+	0	+
Outputs	0	0	0	+	0	+	+	0	+
Credit	0	0	0	0	0	0	+	+	+
Extension	0	0	0	0	0	0	+	0	+
Agricultural Research	0	0	0	+	+	+	+	+	+
Education	0	0	0	0	0	0	0	0	0
Small-scale enterprises	0	0	0	0	0	0	0	0	0

Source: Food Security surveys.

[a] 0 = no effect; + = positive effect; and - = negative effect.
[b] Net household receipts
[c] Consumption
[d] Marketing

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relatively good rainfall season such as 1987/88. In addition, since resource-poor households purchased more maize (and mealie meal), increasing the producer price actually has had a negative effect on consumption (increases cost of food budget).

Market access

Household participation in input and output markets[1] depends on a household's ability to bear environment-related production risk (input markets) and generate an agricultural surplus (output markets).

Resource-poor households purchased few agricultural inputs (fertilizer, insecticide) other than hybrid maize seed, due to the risky production environment (Table 7.1). The high rainfall variability makes a profitable return uncertain; and if the crop fails, resource-poor households had insufficient capital to bear the risk.

To participate in output markets, households must generate an agricultural surplus. But in the study areas, only marginal- and small-farm households owned sufficient land and/or oxen to generate maize and oilseed surpluses; and only the small-farm households produced a marketed surplus of small grains (sorghum and millet).

Credit

Household access to credit appears unbiased, since the Agricultural Finance Corporation (AFC) held meetings in all villages and accepted loan applications from all applicants. Although few households borrowed from the AFC, small-farm households borrowed most frequently and took larger loans. A likely explanation is that small-farm households were more likely to borrow because they were better able to bear the consequences of crop failure by being able to repay a loan from savings.

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[1]Household access to input and output markets was a village phenomenon, not varying across household types.

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Extension

Although AGRITEX extension workers are mandated to work with all farmers, time and resource constraints make this impossible. First, the low extension agent to farmer ratio (1:817, 1:946, and 1:900 for Mutoko, Mudzi, and Buhera Districts, respectively), limited potential farmer contact. Second, some extension agents had no transport, thus limiting their geographical coverage. Finally, in many cases (primarily in Mutoko/Mudzi Districts) extension agents didn't live in the villages they served, further limiting their contact with farmers.

Analysis of the survey data showed that small-farm households attended AGRITEX extension meetings more frequently, which suggests that these farmers either perceived extension advice to be of greater value, or that extension was biased towards recruiting wealthier farmers.

Agricultural research

Until 1980, agricultural research primarily addressed production constraints associated with the agro-ecological (mainly soil quality and rainfall) conditions of commercial farmers (and to a lesser extent communal farmers in Natural Regions I, II, and III). Research focused on mechanization, hybrid seed (primarily maize), and management of chemical inputs (fertilizer, insecticide, and herbicide).

Since 1981, DR&SS has reoriented the agricultural research agenda to address the needs of communal farmers in three ways: 1.) they conducted varietal trials under communal area conditions; 2.) they initiated a breeding program for sorghums and millets; and 3.) they established a farming systems research unit to study communal farmers' problems, develop a FSR model, and provide information to assist policy makers. To date, new technologies for low rainfall communal areas (eg., hybrid sorghum and improved tillage methods) are still in the development phase (Shumba, 1990; Mushonga, 1986; and Nyati and Nyamudzera, 1984).

Currently, hybrid maize and fertilizer are the most "appropriate" of the av

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the available technologies for increasing agricultural production in low rainfall areas since both are land-extending technologies. Hybrid maize adoption is high because it is the only readily available maize seed. Because fertilizer is land-extending, one would normally expect resource-poor and marginal-farm to apply more, since they face a land constraint. Yet, fertilizer use was highest for small-farm households. Throughout the study area, very few farmers used fertilizer because it is a risky technology, given the high variability of rainfall (a coefficient of variance of 26 and 34 for Mutoko/Mudzi and Buhera Districts, respectively). Furthermore, adoption was lowest for resource-poor households because they were least able to bear the risk, given their lack of financial capital.

Education

Although the government has extended rural access to education to more communal households since Independence, many children have not benefitted[2]--especially children of resource-poor households.

Although primary education was "free", parents were required to pay building fees (maintenance, repair) and purchase uniforms and school supplies; which resource-poor households were less able to afford (ie., 92 percent of resource-poor households' children attended primary school, compared to 98 percent for small-farm households, respectively).

To attend secondary school, parents must pay school fees to enroll their children. Because these fees were high, relative to the household income, many children weren't able to attend school. For example, only 38 percent of the children of resource-poor households attended secondary school, compared to 68 and 90 percent of the marginal- and

[2]Primary and secondary school enrollment was similar across districts, with Mutoko/Mudzi District having slightly higher enrollment than Buhera District.

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small-farm households, respectively. Thus, a smaller percent of resource-poor households' children earned secondary education diplomas which enable them to migrate and find urban jobs to help their family financially (remittances).

Small-scale enterprises

Government interventions to stimulate small-scale enterprises have focused on creating the Small Enterprise Development Corporation (SEDCO) and encouraging cooperatives in rural areas. These programs have had no effect in our survey area since none of our sample reported participating in SEDCO-sponsored activities. While few marginal-farm and small-farm households sold nonagricultural products, almost no resource-poor households reported sales. Furthermore, most sales involved traditional, natural resource-based (eg., clay and reeds) products that were generally of low quality. Therefore, production and marketing of these products were limited geographically.

7.3 Strategies to accelerate rural development

The previous analysis suggests that to date, agricultural-based rural development policies have had minimal impact on increasing the incomes of the majority of rural households. The resource-poor--and to a lesser extent the marginal-farm--households did not own sufficient land or physical capital to benefit from these policies. Therefore, a broader rural development strategy is required that addresses the needs of resource-poor households.

A successful rural development strategy must take into account four key practical realities. First, policies must take into account household resource endowments and local economic opportunities, but not compromise national food security and macroeconomic goals. For example, policies intended to help resource-poor households should increase the demand for the factors of production (quality and quantity)

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to which poor households have access, but not interfere with government's broader objectives (eg., efficient resource allocation).

Second, unless policies are targeted to relieve the resource constraints facing the resource-poor, households with access to key productive resources (ie., land and oxen) will be able to adjust more quickly and more vigorously to general policy interventions than resource-poor households, and thus capture the policies'intended benefits. For example, in the mid 1980s when relative prices are adjusted to encourage the production of small grains, only wealthier households were able to reallocate available resources to generate a small grain marketable surplus, thereby undermining the objective to help the rural poor.

Third, policies must avoid introducing long-run production or consumption distortions by taking into account both consumer tastes and preferences and production possibilities of all households (wealthy and poor, rural and urban). For example, Zimbabwe's introduction of an incentive producer price for small grains, designed to help communal farmers, induced large grain stocks for which there was limited domestic or export demand.

Finally, policy makers should decide whether they want to help a specific group (targeted policy) or all rural households (nontargeted policy). Targeted interventions reduce the cost of helping individuals most in need of assistance (resource-poor households), but often provide benefits to nontargeted individuals (leakages). Therefore, to minimize leakages, targeted interventions must be designed with a clear understanding of the socio-economic characteristics of the poor.

This section first examines a short-run rural development strategy to increase incomes of the rural poor, given current technology. Then, long run rural development strategies, which incorporate technological changes, are explored.

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7.3.1 Short and medium term strategies to help resource-poor households

In the short and medium term, it will be difficult to raise the agricultural productivity of resource-poor households. Traditional short-run agricultural policies will have a limited effect on raising the agricultural productivity and incomes of resource-poor households because these policies (ie., agricultural product prices, credit, and extension) do not address the two major constraints facing resource-poor households--farming in a risky environment and limited access to land. First, for all households, the agricultural potential of our survey areas was limited by environment-related production risk, specifically low, erratic rainfall[3]. Therefore, the research system will require several years to develop more "appropriate" technologies which adapt crops (varietal improvement) or cropping practices (eg., tied-ridges) to better use the available rainfall; or modify the environment (eg., irrigation) to achieve higher and more stable yields from current crop varieties.

Second, traditional policies designed to intensify crop production are likely to have little impact on the resource-poor. Not only did resource-poor households have limited access to land and oxen, they also had limited financial capital, which restricted their ability to purchase inputs (ie., fertilizer), and bear the risk of repaying input loans in case of crop failure. Recall that marginal-farm and resource-poor not only owned half the land (per capita) compared to small-farm households, but had less than half the financial capital. While resource-poor households had relatively more labor, because they lacked access to land, it is likely that their labor was not fully employed.

However, in the short-run government can help resource poor-households though transfer programs designed to immediately insure food

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[3]In both survey areas, rainfall was low (long-run averages of 477mm and 706mm for Buhera and Mutoko/Mudzi Districts, respectively) and the coefficients of variance were high (34% and 26% for Buhera and Mutoko/Mudzi Districts, respectively).

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security, while longer-run interventions are developed. Three such programs that are consistent with the government's stated objectives of improving rural services and raising incomes are: food-based policies, public employment schemes, and human capital development (van der Walle, 1990).

Targeted food policies

The government should examine the effect of food pricing and distribution policies on poor households in order to identify opportunities for expansion. Since food was the single largest expenditure item--and poor households spent a larger proportion of their income on food than other household types--expanding these programs offers great potential for supplementing incomes of the poor. For example, a current government program links regular clinic visits of children under five years, with a supplemental feeding program (Tagwireyi, 1989). This program is important because it links access to food and health services and targets these benefits to an especially vulnerable group (young children).

A non-targeted intervention to reduce the food cost of not only the poor, but for all households is proposed by Chigume and Jayne (1991). Chigume and Jayne observe that since there are already maize grinders in rural areas, permitting local sales of mealie meal would lower the cost of meal. Currently, the GMB assembles grain in the rural areas, transports it to Harare for milling, and then sends it back to rural areas for sale as meal. This redundant movement of grain increases the price of purchased grain, which places a disproportionate burden on poor households who spend a larger share of their income on food purchases.

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Public employment schemes

Government should continue, and possibly expand, the cash-for-work program in low rainfall areas--especially after poor rainfall years[4]. First, it provides an important welfare function by creating a market for the surplus labor of resource-poor households (since they are relatively labor abundant), especially after a poor rainfall season when own-production is lowest. Second, although this program currently focuses on constructing rural roads and buildings, it could be expanded to include environment projects, as is done in Botswana (Asefa et al, 1989). For example, cash-for-work could be targeted to construct soil conservation gullies and terrace fields, in addition to repairing roads and building schools--all of which would contribute to agricultural and rural development in the long run.

Human capital development

Subsidizing secondary education is a potential short-run intervention that could help raise (long run) rural incomes, and provide equal opportunity to education for resource-poor households. As discussed earlier, although primary and secondary enrollment has increased substantially since independence, not all household types have benefitted. Only 38 percent of the secondary school age children of resource-poor households' attended secondary school, compared to 68 percent and 90 percent for marginal-farm and small-farm households, respectively. Government could improve resource-poor households' access to secondary education through a subsidy targeted to this group. The subsidy would transfer the risk inherent in the traditionally low pass rate of rural students to the government. Survey results suggest that an additional 16 percent of resource-poor households would enroll their

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[4]The data collection period coincided with a good season for most households, so these programs were not wide-spread in our survey areas.

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children if school fees were halved, and 34 percent if school fees were eliminated.

7.3.2 Long term rural development strategies

A rural development strategy to assist resource-poor households must take into account the resource availability, relative factor abundance, productivity potentials, and local alternative economic opportunities of the poor. This strategy should seek to both assist resource poor households to increase their agricultural income, but also expand opportunities for marginal producers to diversify into non-agricultural activities, or migrate[5].

7.3.2.1 Agricultural diversification

This section presents suggestions for technological generation and diffussion needed to address the environment-related production risk facing households in low rainfall areas.

7.3.2.1.1 Technology generation

It is clear that a major constraint to raising agricultural incomes--especially those of rural poor households--is environment-related production risk. A shortage of water is the main constraint limiting agricultural productivity, so technologies that improve water-use efficiency are needed (Waddington and Kunjeku, 1987). To reduce the risk associated with the high inter-seasonal variation and low levels of

[5]The discussion focuses on assisting resource-poor households, because it is assumed that marginal- and small-farm households are better able to adjust to policy changes than resource-poor households, and they will also be able to benefit from benefit from policies designed to assist resource-poor households. Marginal- and small-farm households have more financial capital and larger agricultural inventories which allow them to bear more risk. Conversely, it is less likely that policies designed to assist small-farm households will help the resource poor.

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rainfall, government should expand efforts in soil and water conservation, varietal improvement, and irrigation development.

1. Soil and water conservation: In both their "Growth with Equity" (1982) and "First Five-Year National Development Plan" (1986) policy papers, the Government of Zimbabwe recognizes that natural resources in many parts of the country have been poorly managed. Although the government currently promotes several environmental programs--including rural reforestation, land resettlement, transferring more administrative decision-making power to local authorities, more emphasis on agricultural and conservation in schools, and increased expenditures on infrastructure and extension--Whitlow (1988) argues these programs have fallen short in the face of the enormity of the task[6].

In communal areas, approximately 3.8 million acres[7] are severely degraded (Whitlow, 1988). Whitlow cites land tenure and high population growth as the main causes, resulting in deforestation, over-grazing, and over-population. Conservation efforts in communal areas date back to 1936 when contour ridges and stormwater drainage techniques were introduced to conserve soil and water. Subsequent interventions included retiring degredated land, reduction of livestock herds, compulsory conservation methods, and replacing traditional land tenure with one based on individual rights. Yet, these conservation interventions had little impact because they: 1.) failed to take into account the socio-cultural (status) and economic (store of wealth) role of livestock; 2.) lacked the necessary manpower and finances to implement them; 3.) were compulsory, and therefore resisted; and 4.)

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[6] It was estimated in the late 1930s that, given the available resources, it would take 250 years to complete the needed anti-erosion work in communal areas (Whitlow, 1988).

[7] This is a conservative estimate since it is based on aerial photographs, which only detect advanced levels of soil erosion.

were promoted during periods of political, economic, and security problems (pre-independence). Therefore, available evidence suggests that techniques to control soil erosion and conserve soil moisture are a high priority, and should be more vigorously examined, tested, and promoted to ensure the long-run sustainability of communal agriculture.

Two conservation techniques, improved tillage methods and mulching, can relax some of the soil and climatic constraints. First, potential conservation tillage methods include winter plowing, deep tillage and soil inversion, and tied-ridging (Sanders, 1989). Winter plowing allows farmers to plow at the end of the year so fields are ready for sowing when the first rains come (Shumba, 1990). Deep tillage and soil inversion methods increase water penetration to the plant's roots. In West Africa, farmer adoption of these methods has increased yields of millets, sorghums, maize, upland rice, and cotton (Charreau and Nicou, 1971). Tied-ridges, a practice that holds surplus water to allow more infiltration into the soil, also has the potential to increase yields, reducing risk, and slowing soil erosion in communal areas. Research conducted by DR&SS at the Chiredzi Research Station (Natural Region V) since 1982 suggests that tied-ridges increased yields for sorghum (25 percent), maize (15 percent), and cotton (34 percent)[8] (DR&SS and AGRITEX, 1987).

Second, mulching with crop residues, leaves, and stems can improve the soil's physical properties, add nutrients and organic matter, and reduce soil temperatures (Lal, 1987). Mulching also conserves soil moisture by decreasing the amount of runoff and evaporation. Yet, mulching has less potential impact in communal areas (especially Natural Region V) than conservation tillage because crop residues are an important source of livestock feed (Ndlovu, 1989).

[8]Four year averages for 1983/84 to 1986/87.

<u>2. Crop improvement</u>: Since agriculturalists believed that Natural Regions IV and V are not suitable for intensive rainfed cropping, prior to independence DR&SS conducted little research to assess which crops and cropping techniques were most appropriate under these rainfall and soil conditions (Mudimu, 1986; Nyati and Nyamudeza, 1984). This research orientation ignored the fact that 74 percent of the communal land area is located in these natural regions, and that these households depend on rainfed agriculture.

Analysis of the survey data suggests two reasons why DR&SS should give high priority to increase drought tolerance in staple grain crops. First, resource-poor households met only 80 percent of their food and clothing needs through own production, compared to marginal- and small-farm households who met more than 100 percent of their needs. Second, all households tended to allocate grains to a smaller proportion of their land area, once their food needs were secure. Thus, increasing staple crop yields enabled resource-poor households to meet their food and fiber needs and enabled them to expand the proportion of land allocated to cash crops--thereby increasing their cash earnings potential.

Because breeding for drought tolerance is a lengthy and costly undertaking, the government must consider: 1.) consumer preferences, 2.) yield potential, and 3.) available researcher expertise.

First, DR&SS should give high priority to continuing its efforts to develop maize varieties that are better suited to low rainfall areas because households throughout communal areas have a strong preference for maize. For example, about 97 percent and 83 percent of the households in Mutoko/Mudzi (NR 4) and Buhera (NR 5) Districts, respectively, grew maize. Even in low rainfall villages where maize fails in more years than it succeeds, farmers continue to plant it annually. Furthermore, recent research results suggest that maize has considerable potential in low rainfall areas. For example, in DR&SS

cereal comparison trials (1983-1988) at Makoholi Experimentation Station (NR IV), hybrid maize outyielded sorghum (Shumba, 1990). Since these trials were conducted at an experimentation station, additional research is needed to fully exploit the yield potential of maize under local farmer conditions. Finally, emphasizing maize improvement is also consistent with Zimbabwe's long and successful history of maize breeding. Over the past 50 years, Zimbabwe has developed many breeding lines and has developed a cadre of experienced breeders (Rattray, 1989).

Second, sorghum research is more developed than millet research in Zimbabwe, with DR&SS currently developing and testing higher-yielding sorghum hybrids (Mushonga, 1986). To support these efforts, the ICRISAT/SADCC initiated a regional sorghum improvement program in 1983/84 at the Matopos Research Station (near Bulawayo). This program's objectives are to both collect traditional varieties to conserve genetic diversity, and to assist national programs strengthen their varietal improvement efforts (House, 1987).

Although sorghum's yield potential is high and this crop has lower water requirements than maize, at present there is little urban consumer demand for sorghum. Recent research suggests that the demand for sorghum could be increased through changes in food technology. First, Gomez et al. (1987) reports that with available composite flour technology (ie., the blending of sorghum and wheat to make bread). It is possible to partially replace wheat with sorghum, which would significantly reduce wheat imports, and thereby save foreign exchange. Second, making sorghum processing technology available in rural areas has the potential to increase rural consumption by reducing the processing constraint (ENDA-Zimbabwe, 1987).

Therefore government should continue to support research to increase sorghum yields and select for drought tolerance to help poorer households assure their food supply (especially in low rainfall years), but also explore new commercial uses for sorghum and assist in improving rural household access to village-level processing technology.

<u>3. Irrigation</u>: The potential of small-scale, village-based irrigation to reduce environment-related production risk is recognized at the regional, national, provincial, and district level (Rukuni, 1989). Not only does SADCC's Food Security Programme support a project (#12) to develop irrigation and improve management techniques throughout the region, but government is also committed to promote irrigated cultivation in communal areas (ROZ, 1986). Furthermore, in our survey areas, the Provincial and District development plans cited small-scale irrigation schemes as an important development strategy (Development Plans for Mashonaland East and Manicaland Provinces, and the Mutoko, Mudzi, and Buhera Districts, 1988).

In many parts of Sub-Saharan Africa, small-scale irrigation projects were generally more profitable than larger-scale projects, although there is a need for more research on the technical, economic, social, and environmental impacts of these smaller schemes (World Bank, 1987). Rukuni (1989) suggests that small-scale irrigation has considerable potential to reduce food insecurity where it is introduced as a supplemental enterprise in a rainfed-based cropping system.

Despite this potential, small-scale irrigation development faces several constraints. First, schemes--such as the ones in Buhera District, administered by local farmer committees--have suffered from mismanagement, conflicts between extension workers and farmers, and poor administration (Buhera Development Plan, 1988). Yet, in spite of these difficulties, the average income of participants was higher than the district average for communal households. Second, irrigation development has proven to be very expensive. Consequently, government has been unable to invest heavily in expanding these schemes (Rukuni, 1989).

Thus, given the high development costs and the need to improve the food security of a large number of small farmers, future research and development efforts should focus on development schemes that integrate rainfed and irrigated agriculture, as recommended by Rukuni. Food crops--such as maize, small grains, and some oilseeds--could be grown as rainfed crops; and high value cash crops--such as cotton, tobacco, oilseeds, and vegetables--could be grown as irrigated crops. Such a strategy would maximize the private and social profitability of the development costs of irrigation.

7.3.2.1.2 Technology diffusion

Successful farmer adoption of these risk-reducing technologies require government to both improve household access to limiting resources and put in place complementary agricultural policies. For example, without improved access to traction animals, resource-poor households can not adopt improved tillage methods. Similarly, households will not adopt new crops and associated management practices unless research is undertaken to relax prevailing technical constraints, and provide incentive price, marketing, credit, and extension policies, as discussed below.

Agricultural research

Continued applied agricultural research is needed to field test risk-reducing technologies to see which are technically feasible and economically viable with resources owned by resource-poor households, under the varying agroclimatic (specifically, soil texture and water availability) and socio-economic conditions that characterize Natural Regions IV and V. For example, small-scale irrigation is only feasible in areas with sufficient water reserves, and clay soils that can hold water. Second, DR&SS should evaluate the level of resources (including human capital) that households require to adopt these technologies. For example, farmers will require training to successfully manage an irrigation scheme; and fall plowing requires traction animals. Third, DR&SS in conjunction with AGRITEX should develop farmer recommendations that will facilitate household adoption of these technologies, including where these technologies are agroclimatically feasible, what management techniques are required, and what cropping system are suggested. Fourth, DR&SS should coordinate with AGRITEX to develop a supporting extension program to help farmers adopt these technologies, including written materials (for farmers and extension workers), field days, and demonstrations.

Pricing policy

In the absence of other policy changes, higher prices alone will likely raise only the incomes of marginal- and small-farm households. If the government wants to stimulate agricultural production with pricing policies, they must set prices at levels that correspond with those prevailing in the market place to not burden the budget. Furthermore, only crops for which there is market (either domestic or foreign) should be promoted.

Market access

As new technologies are developed farmers will require additional complementary input and expanded output marketing services. For example, a more stable production environment will increase the demand for both inputs that are currently used at low levels of intensity such as fertilizer, and new inputs required to grow the promoted crops.

Currently, inputs are distributed in communal areas through private sector retailers who purchase inputs in anticipation of future sales. Due to capital constraints, initially these small retailers may be unwilling or unable to carry larger and more varied inventories required to support the nacent increased demand. To address this initial constraint, the AFC could assess the feasibility of providing input inventory loans to retailers to induce them to stock these inputs locally.

The major output marketing problem currently facing communal farmers is an inadequate number of trucks and the unreliability of transporters (Chigume and Shaffer, 1989). Farmers reported difficulties in securing transport, even after contracting transporters to collect their crops. During informal interviews, transporters reported they were unwilling to service more remote villages for two reasons. First, transport was insufficient to meet demand because they lacked spare parts to repair disabled vehicles, due to a foreign exchange constraints. Second, traveling to villages served by poor quality (dirt) feeder roads caused excessive wear and tear on trucks, which shorten their useful life.

Government should consider two strategies for alleviating the transport constraint. First, to expand the supply of private transport, government should increase the foreign exchange allocation for spare parts for heavy duty trucks. This would permit existing transporters to increase their utilization capacity, thereby allowing them to better serve communal areas. In addition, in good rainfall years when marketed surplus is large, government could make available District Development Fund (DDF) trucks to collect crops, and charge farmers by deducting a transport charge from the farmer's GMB payment check. Making available DDF trucks to supplement private sector transport services would enable households to market their crops immediately after harvest and receive early payment.

Furthermore, in locations targeted for the promotion of perishable vegetable crops, it will be necessary to develop special marketing arrangements (ie., contracts) to insure timely delivery to market.

Credit

Survey results showed that households, especially resource-poor households, had limited working capital. Unless additional working capital is made available, only the small-farm households will be able to adopt the new technologies, and expand input use.

To meet the expanding demand for working capital, AFC will need to expand credit services for all farmers. In addition, to meet the special needs of the resource-poor households, the AFC should examine the feasibility of establishing a targeted lending scheme to the households to acquire a maximum of two oxen per household (to take advantage of the new technologies), with credit terms designed to minimize leakage to marginal- and small- farm households.

Extension

Close collaboration between the farming systems research activities of DR&SS and AGRITEX's extension program is needed to insure that new technologies effectively address farmer's constraints. As new technologies become available, agricultural extension should be redirected to support their diffusion. First, extension staff should be trained how to adapt these new technologies to farmers' environment and resources. Second, demonstrations should be held to make farmers aware of the newly developed technology. Third, extension workers should work with farmers to teach them how to modify the new technology to fit their circumstances. Finally, extension workers should be encouraged to work more with resource-poor households, and incorporate them into the Master Farmer program.

7.3.2.2 Rural development programs

Although the strategies outlined above are intended to increase the agricultural productivity of resource-poor households, a more comprehensive rural development strategy is required to substantially raise their incomes. To assist these resource-poor households, government will have to initiate a rural development program which incorporates land reform/resettlement, greater access to social

services, and expanded rural employment opportunuities.

Land reform/resettlement

Although this study did not explicitly study land reform or resettlement, two findings suggest that access to land is highly associated with income levels. First, small-farm households owned twice as much land (1.4 hectares) as resource-poor households (0.6 hectares) (Table 7.1). Second, the multivariate analysis (Chapter 6) of both net household receipts and agricultural production showed that the land availability coefficient was both large and statistically significant.

These results suggest that government could substantially alleviate the plight of the resource-poor households by expanding opportunities for them to resettle in new project areas. In addition, rural outmigration and land redistribution (and associated land degredation) would alleviate land pressure for the remaining households.

Access to social services

As part of its long run strategy for reducing poverty, the World Bank places high priority on targeting investment in human capital towards the poor (van de Walle, 1990). Earlier analysis demonstrated that resource-poor households (in particular) continue to have limited access to education and health. For example, many resource-poor households could not afford to send their children to secondary school. Furthermore, only 58 percent of the survey villages had primary schools, 17 percent had secondary schools, and 8 percent had a clinic.

Consequently, government should continue to expand social services for rural households, and explore the feasibility of expanding access to education for resource-poor households through targeted subsidies.

Employment creation

As population pressure grows, it is unrealistic to expect on-farm agricultural activities to absorb the increase in the labor force, and have agriculture continue to provide the primary source of income for rural households. Although in our sample labor sales averaged only 17 percent of per capita net household receipts (Table 4.6), they represented a particularly critical source of income for poor households. Not only did labor sales finance food purchases, but they also provided an opportunity for resource-poor households to monetarize their relatively abundant factor of production, family labor. Currently, households reported that a majority of their labor sales were as agricultural labor on other households' fields.

Although the introduction of more labor intensive crops will increase the demand for labor--which will particularly benefit poor households, government should expand its efforts to expand nonagricultural employment in rural areas. Kilby and Liedholm (1988) argue that small scale enterprises have the potential to absorb surplus labor if investment are made to develope infrastructure.

7.4 Summary

Zimbabwe's agricultural policies and services were designed to raise the incomes of rural households. An implicit assumption underlying these policies was that all households have sufficient land and capital to respond to these policies; and thereby increase agricultural production and generate an agricultural surplus.

Empirical evidence shows that many households actually had limited access to land and oxen--thereby limiting the resource-poor households from taking advantage of these new opportunities.

Thus, government needs to formulate a more comprehensive rural development strategy. Potential short and long run rural development strategies were examined to assess their likely effect on the agricultural production and incomes of the poor. In the short run (current technologies), it is apparent that government has limited ability to increase the agricultural productivity of the resource poor households. On the other hand, government can implement policies that will improve the food security of the poor in the short run, and invest in longer run by expanding food-based policies to increase poorer households' access to food, using public employment schemes to promote conservation interventions and infrastructural development; and investing in human capital by increasing access to secondary schools for children of resource poor households through a targeted subsidy.

In the long run, technology development should focus on reducing environment-related risk since this is a major constraint to increasing agricultural productivity in low rainfall areas. Three strategies that would address this constraint include interventions to promote soil and water conservation, crop improvement, and small-scale irrigation. Soil and water conservation techniques--primarily improved tillage, terracing, and crop management methods--have successfully relaxed soil and climatic constraints in several semi-arid areas of Sub-Saharan Africa. Crop improvement, targeted at increasing drought-tolerance, also has potential to reduce the risk of crop failure due to water stress. Government efforts to stabilize yields through incorporating greater tolerance to environmental stress (primarily drought) should concentrate on maize and sorghum. Finally, although small-scale irrigation schemes represent a potential strategy, further research is needed to evaluate its role in the communal areas because historically, small-scale irrigation schemes have experienced administrative problems and historically high development costs. Small-scale irrigation should focus on the promising opportunity to integrate rainfed (food crops) and irrigated (high value cash crops) enterprises into a crop-livestock based farming system.

Furthermore, a rural development program designed to assist resource-poor households must incorporate a broader set of interventions than traditionally included in an agricultural development strategy. Resource-poor households typically have insufficient land to take advantage of strategies to increase income through incentive prices and improved marketing infrastructure. Since agriculture alone can not absorb the increase in the labor force, the government should explore assiting resource-poor households by expanding the current land resettlement program, increasing rural access to social services, and stimulating rural employment creation.

CHAPTER VIII

SUMMARY AND LIMITATIONS OF THE RESEARCH

At Independence, Zimbabwe's stated development objectives included: (1) transformation and expansion of the economy, (2) land reform and increasing the efficiency of land usage, (3) higher living standards for the entire population, especially the rural population; (4) employment creation and manpower development; (5) development of science and technology and (6) incorporation of environmental concerns into development programs. Of these six broad objectives, four impact directly on the well-being of the rural population: land reform, expanding employment opportunities and manpower development, raising rural living standards, and incorporating environmental concerns into development programs.

But, government has experienced difficulty in achieving its objectives for two reasons. First, macroeconomic constraints have limited government's ability to implement interventions to improve rural living standards. Since Independence, Zimbabwe's development has been constrained by shortages of foreign exchange (which have reduced the country's ability to import capital goods, and resulted in budgetary shortfalls) foreign and domestic trade restrictions, and a large external debt (Zvinavashe, 1990). These problems are the consequence of both internal policies (interest rate, exchange rate, and trade policies) and external shocks (global recession, strong U.S. dollar, and foreign trade policies).

Second, many researchers have highlighted the need for a comprehensive understanding of the structure, level, and distribution of

rural incomes as a precondition for effective policy design (Eicher and Baker, 1982 and World Bank, 1983). To date, few studies have addressed this need. Thus, Zimbabwe's lack of reliable data about the target rural population's characteristics and household objectives has made it difficult for government to design and target policies to increase access to economic opportunities to lower income, rural households.

Therefore, the general objective of this study is to provide a better understanding of the structure, level, and determinants of rural incomes in low-rainfall areas of Zimbabwe in order to 1.) assess the impact of current strategies on increasing the rural poors' incomes and access to services, and 2.) propose new policy options to better serve the needs of the rural poor. This study will address these general objectives through four specific objectives.

1. Describe the level, distribution, and composition of household incomes and expenditures, including the contribution of the major sources of incomes (home-used production, cash income-generating activities, and transfers) and expenditures (consumption, investment, and transfers).
2. Describe the resource endowment of households in low rainfall areas and how they allocate these resources between alternative uses.
3. Identify the factors associated with the inter-household variability of incomes, especially for poor households.
4. Assess the impact of recent policies on rural incomes, and propose alternative rural development strategies (short, medium, and long term) to increase incomes and expand income opportunities for the rural poor.

This chapter summarizes the research findings, and then presents policy prescriptions and needed research.

8.1 Summary of findings

The most important findings relate to the distribution of incomes, the level and sources of income, household resource endowment, the distribution of resource ownership, determinants of incomes and specific subcomponents, and the effect of current policies and services.

8.1.1 Level and sources of rural incomes

All measures of incomes (net household receipts)--per household, per capita, and per adult equivalent--indicated large income differences across villages and districts (Table 4.1). For example, median per capita incomes ranged from Z$97 to Z$265 in Buhera; and from Z$93 to Z$263 in Mutoko/Mudzi. These results are similar to other studies conducted under similar agroclimatic conditions.

Major income sources across villages and districts

The analysis specified three major income sources: earned income (production for home consumption and cash income generating activities, net of intermediate goods and services), transfers received, and net credit receipts (Table 4.5).

Across the twelve villages, the relative importance of these major sources varied greatly. First, earned income accounted for the major share of the total income (per capita)---ranging from 88 to 99 percent in Buhera; and 69 to 93 percent in Mutoko/Mudzi. Second, transfer income (transfers received) was large for the total sample (15 % of total per capita income), but was more important in Mutoko/Mudzi District. Transfers received exceeded 25 percent of total income (per capita) in only one village in Buhera District, but accounted for greater than 25 percent in five of six villages in Mutoko/Mudzi District. Finally, although net credit receipts equalled less than ten percent of total per capita income (except in one village in Buhera District), they were generally negative.

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Across districts, there were three major similarities with respect to earned income components. First, production for home consumption accounted for over one-half of earned income; ranging from 54 percent in Buhera District and 63 percent in Mutoko/Mudzi. Second, farm and labor sales accounted for three-fourths of income from cash income-generating activities (CIGA) in both districts. Finally, non-agricultural product sales, business inventories, and other cash income were minor contributors to earned income.

Furthewr analysis of income from cash income-generating activities indicated that farm sales and labor sales are the major source of CIGA in both districts, although farm sales were more important in Mutoko/Mudzi (18%) and labor sales were more important in Buhera (21%). Furthermore, non-agricultural product sales accounted for a similar percentage (7 percent) of income in both districts, and both business inventories and other cash sources were minor sources of income.

Differences in income sources and levels across income quartiles

To further evaluate income sources and levels, the sample of households was divided into four income quartiles. Mean income (net household receipts per capita) was less than Z$85 for the lowest quartile; ranged from Z$85 to Z$139 for the lower-middle quartile; ranged from Z$139 to Z$243 for the upper-middle quartile; and was greater than Z$243 for the upper quartile.

This analysis illustrates several points. First, earned income accounted for the largest share of income for all quartiles (87 to 92 percent); while production for home consumption ranged from 50 to 62 percent and cash income-generating activities ranged from 32 to 37 percent (Table 4.7). Second, as expected, production for home consumption accounted for a larger share of household income for the lowest quartile (62 percent) than for higher quartiles (50 percent for the highest quartile). Third, across quartiles there was little

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difference in the share contribution of transfers, ranging from 15 to 17 percent. Finally, although net credit receipts were, on average, negative and small for all quartiles, the lowest quartile reported the largest net outflows (8 percent).

8.1.2 Distribution of rural incomes

The three measures of equality--coefficient of variation, the standard deviation of the natural logarithm of income, and the Gini coefficient--showed considerable differences in income equality (Table 4.4). All three measures of per capita NHR distribution indicated greater income inequality in Buhera District than in Mutoko/Mudzi Districts.

8.1.3 Household resource endowment

The three most important household resources were land, labor, and capital. Household access to these resources varied greatly across villages, districts, and the entire sample (Table 5.1).

In the study sites, household members were the primary source of labor. Generally, household labor was more abundant in Buhera District. Buhera District households had both more resident and nonresident family members, and were less variable in size, than households in Mutoko/Mudzi Districts. For example, median residents per household ranged from 6 to 7 in Buhera villages and 4 to 7 in Mutoko/Mudzi villages.

All measures of land availability (per household, per capita, and per adult equivalent; by village, district, and the total sample) indicated large differences in household access to land. As expected, Buhera District households had greater access to land than did Mutoko/Mudzi Districts households because population density is lower in Natural Region V than in Natural Region IV. Yet, district level averages tend to obscure the large inter-village differences in median land availability, which ranged from 0.3 to 0.9 hectares per capita.

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As expected, Buhera District households had a higher animal traction index. Since Buhera is less favorable for crop production and has a lower population density, more pasture land was available than in Mutoko/Mudzi Districts. As was the case for land, within both districts there were large inter-village differences in access to traction, which ranged from 0.70 in Mutoko/Mudzi Districts to 0.83 in Buhera District.

8.1.4 Distribution of resource ownership

For the total sample, the Gini coefficient indicated a low level of inequality for labor (0.29), a moderate amount of inequality for land (0.40), and a high degree of inequality for oxen (0.66).

Across Districts, the Gini coefficients were larger for Buhera District than for Mutoko/Mudzi, indicating that all three resources were less equally distributed in Buhera District.

8.1.5 Determinants of incomes

This section presents the dependent and independent variables used to explain the inter-household variation in per capita net household receipts (income) and its most important subcomponents--specifically, the value of agricultural production, labor sales, and transfers (received).

Net household receipts

The included independent variables explained 59 percent (adjusted R^2) of the variation in income for the sample households.

The estimated regression coefficients in the income model provide several insights. First, agriculture's important contribution to earn income is highlighted by the large (and statistical significant) coefficients for production-related endogenous variables--land availability (Z$121.98), oxen ownership (Z$49.64), and input usage (Z$7.47). These results complement earlier analysis which showed that hous

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households earned a majority of their income (62 percent) directly from agricultural production. Second, among the household-owned resources, land appears to have had the largest impact on income. Third, several factors exogenous to the household were statistically significant, including household access to output markets, input markets, and rainfall conditions. Household access to agricultural marketing outlets was marginally significant for both medium (Z$69.34, 20 percent level) and high access (Z$73.27, 10 percent level). Both variables imply a positive, but weak relationship between output market access and income[1]. Household access to input markets also provided interesting results. First, the variable used to assess the impact of household access to stores that sold improved seed (within village) was statistically significant and large (Z$81.44). In contrast, household access to stores that sold both seed and fertilizer (within village) was not statistically significant, possibly due to the generally low level of fertilizer use.

Finally, household head characteristics (age and gender of the household head) were not statistically significant, suggesting that resources available to the household were more important than the household head's individual characteristics.

Value of agricultural production

The included independent variables explained 34 percent (adjusted R^2) of the inter-household variability of agricultural production income (Table 6.2).

The estimated regression coefficients provide several insights. First, several endogenous independent variables were statistically

[1]Caution should be used when interpreting this result since other factors--including household resources (land, labor, and capital) and other exogenous factors (access to input markets and rainfall level)--strongly influence whether households produce enough to participate in these markets.

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significant and made a major contribution to explaining agricultural production income--oxen ownership (Z$88.54), land availability (Z$14.21), mean distance to fields (- Z$1.19), and whether the household head was a master farmer (Z$82.39, 10 percent level) or trainee (Z$92.41). These relationships support the results from the earlier regression model of net household receipts, which indicated a strong household reliance on agriculture. As expected, oxen ownership had a larger impact on agricultural production income than on total income (NHR).

Second, the importance of factors exogenous to the household is illustrated by the statistically significant coefficients for two input access proxy variables--villages with stores that sold only seed (Z$76.32) and stores that sold fertilizer (Z$54.44, 10 percent level). Both variables imply a positive relationship between agricultural production income and access to input markets, but the relative size of the coefficients imply that access to seed stores was more important.

Third, unexpectedly, variables selected to measure the impact of household labor characteristics, and the household head's age and gender were not statistically significant (even at the 20 percent level)--further reinforcing the argument that physical resources (land and capital) were more important in explaining agricultural production than household head characteristics.

Finally, the purchased inputs variable (Z$6.13) was significant, but the credit variable (Z$13.53) was only significant at the 20 percent level. While these results imply that purchased inputs had a positive impact on agricultural production, the mean sample values for these variables were low (Z$1.11 for purchased inputs and Z$0.13 for credit).

<u>Labor sales</u>

The included independent variables explained nearly 23 percent (adjusted R^2) of the inter-household variability in labor sales (Table

6.3).

The estimated regression coefficients provide several insights. First, labor sales were significantly lower for households with no male (- Z$57.63) or where he was away (- Z$61.21). This suggests that both spouses are needed for households to take advantage of available local employment opportunities.

Second, the labor composition variable was also important in explaining the variation in labor sales. The significant household's "dependency ratio" variable implied that households with more children (ie., a smaller number of workers per household) sought wage employment due to their greater need for additional income to supplement their agricultural income.

Third, among agricultural-related variables, both the land productivity variable (Z$0.13) and land (Z$1.54) were statistically significant. Since these coefficients are relatively small, they imply that both agricultural productivity and land had only a minimal effect on labor sales.

Fourth, among variables measuring human capital resources, only household participation in the master farmer program was statistically significant. Households heads that completed the master farmer program sold less labor (- Z$47.43), implying that households with master farmer heads focused more on their agricultural activities.

Transfers (received)

The included independent variables explained nearly 20 percent (adjusted R^2) of the inter-household variability in transfers (Table 6.4).

The estimated regression coefficients provide several insights. First, both middle-aged (Z$24.08) and older (Z$29.62) household heads received significantly more transfer income than younger household heads, suggesting that older household heads had children that were old enough to work away from home and help supplement their family's income.

Second, households with more male nonresident members (Z$13.46) earned significantly more transfer income, suggesting that male nonresident members had greater income-earning opportunities than females. This result is consistent with cultural practices that obligates males to assist their parents, and females to help their husband's household.

Finally, two agriculture-related variables were statistically significant. Households with greater agricultural productivity (- Z$0.04, 10 percent) received more transfers income, implying that households with lower agricultural productivity relied more on nonresident family members to supplement their income. The positive relationship between transfers received and purchased inputs (Z$7.95) suggests the potential importance of transfers as a source of cash to invest in agriculture.

8.1.6 Effect of current policies and services

Overall, agricultural policies have had minimal (or negative) impact on resource poor households, but have benefitted marginal-farm and small-farm households. Resource-poor households do not have access to sufficient physical (especially land) or financial resources to generate an agricultural surplus, or bear the risk of intensifying their production (crop failure). Although these resource-poor households had relatively more labor than other households, they were unable to exploit this advantage due to insufficient land or capital.

Consequently, short-run agricultural-focused policies (ie., agricultural product prices, credit, and extension) will have a limited impact on raising the incomes of resource-poor households because they fail to address the two major constraints to increasing their agricultural productivity: access to land and the quality of their environment (soil and rainfall).

Yet, in the short run, government can help resource-poor households through transfer programs directed at raising their incomes. For example, targeted food programs would directly increase poorer households' access to food; public employment (cash for work) would directly increase their labor income; and education subsidies would both reduce the cost of educating their secondary school age children, and contribute to human capital development.

8.2. Policy adjustments and needed research

To improve the incomes of households in low-rainfall areas of Zimbabwe, government must initiate a broad-based rural development strategy. Although improved technologies are needed, the strategy must include a broader set of initiatives if it is to benefit resource-poor households.

Because the major constraint to increasing agricultural productivity in low rainfall areas is environment-related production risk, technology development should focus on reducing this risk. To reduce the risk associated with the high inter-seasonal and low levels of rainfall, government could promote three technologies: soil and water conservation, crop improvement, and small-scale irrigation. In various semi-arid regions of Africa, research has demonstrated that soil and water conservation techniques--primarily improved tillage and crop management methods--can effectively reduce soil degradation and climatic constraints. Similarly, additional crop improvement research (especially breeding designed to stabilize yields by incorporating greater resistance to environmental stress factors--(primarily drought tolerance)--into maize and sorghum is needed to develop improved varieties and management practices appropriate for low rainfall areas. Finally, research evidence from Zimbabwe suggests there is considerable potential for small-scale irrigation--particularly systems that integrate rainfed (food crops) and irrigated (high-value cash crops) agriculture. Yet, further research is needed to exploit this potential because throughout Africa, irrigation schemes have been plagued by administrative problems and high development costs.

In addition to increasing agricultural productivity, the suggested rural development program should incorporate a broader set of initiatives to specifically assist resource-poor households, since they do not have sufficient resources to benefit from agricultural development programs alone, and agriculture alone can not absorb the projected increase in the rural population. In order to address this need, government should allocate greater resources to expanding income-generating opportunities for resource-poor households by, for example, accelerating the on-going land resettlement program, providing greater access to social services, and investing in rural employment creation.

8.3 Limitation of the results

The results of this study are limited by the survey methods employed. First, the sample included only households in the NR IV portion of Mutoko/Mudzi Districts and the NR V portion of Buhera District. These households are not representative of all households in NR's IV and V because there exist considerable differences across these agro-ecological regions in terms of rainfall, production systems, access to markets, and ethnic background.

Second, income and expenditure data are subject to main potential sources of non-sampling error: households' difficulty to recall information, which may have led to their under-reporting of sales, inventory levels, and illegal activities. While it is possible to increase recall accuracy by shortening the recall period, this may increase non-sampling error associated with respondent fatigue.

Finally, this study is based on observations from a single year. Thus, it was not possible to observe how households actually adjust their i

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their income and expenditure strategies in response to varying rainfall patterns and changes in personal circumstances.

APPENDIX 1:
SCHEDULE OF RESEARCH ACTIVITIES

Crop Calendar — 1987 <------------> 1988 <------------>

Production Activities — Land Prep <------> Plant <----> Weed <------> <-----Harvesting-----> ... Land Prep <------>

Marketing Activities — Buy Inputs <-----> ... Crop Marketing <------------> Buy Inputs <----->

Activity	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV
Pre-data Collection	X	X													
Secondary Data Review			X	X	X										
Rapid Appraisal	X			X											
Village/HH Selection		X	X	X											
Hire/Train Enumerators				X											
Major Modules															
Household Characteristics					X										
Parcel Characteristics					X										
Resource Inventory							X								X
Income-Expenditure				X	X	X	X	X	X	X	X	X	X	X	X
Season Representativeness													X		
Off-farm Activities												X			
Marketing Decision-making												X			
Policy Options Decision-making													X		
Coping Strategies								X							
Minor Modules															
Area Representativeness												X			
Farm Practices									X						
GMB/Approved Buyers/ Non-approved Buyers													X		
Transporters														X	
Credit Institutions															X

APPENDIX 2:

SURVEY MODULES

The survey modules implemented by the University of Zimbabwe/Michigan State University Food Security Project covered a broad spectrum of topics since they were intended for the use of all team researchers.

1. Household Characteristics Module

Single visit; January 1988; all 300 households (12 villages x 25 households per village) in the two survey areas.
Collect information on household characteristics for all household members: age, sex, education, literacy, civil status, availability for agricultural work, non-agricultural on-farm activities and off-farm activities.

2. Field Characteristics Module

Single visit; January 1988; all 300 households in the two survey areas.
Collect information on the land allocated to all crops in amount (hectarage), soil quality (type, drainage, texture, and color) both historically (1985-86 and 1986-87) and the current agricultural season.

3. Inventory Module

Two visits; February 1988 and October 1989; all 300 households in the two survey areas.
Collect information on the opening and closing ownership of major equipment (plows, cultivators, harrows, sprayers, carts, ...) and animals (oxen, heifers, and donkeys) in terms of numbers and condition; seasonal inputs (fertilizer, insecticide, herbicide and seed); and the food stocks.

4. Income and Expenditure Module

Twelve visits (1 visit per month); December 1988 - July 1989; all 300 households in the two survey areas.
Collect information on the inflow and outflow of money and farm products to and from the households; and on the income generated and money spent from these transactions on a monthly and annual basis.

5. Season Representativeness Module

Single visit; September 1988; Group meeting with farmers.
Collect information on how this year compares with past years in terms of rainfall (amount and timing), harvest, availability of inputs, accessibility to markets and extension coverage.

6. Off-farm Activities

Single visit; September 1988; all 300 households in the two survey areas.
Collect information on the off-farm activities of the households. Data such as occupation, distance from the household, length of time in job, amount of time available for agricultural activities, and the time during the year when does off-farm activity.

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7. Decision-Making Module I: Marketing
Single visit; August 1988; all 300 households in the two survey areas. Collect information on household marketing behavior since 1980. Emphasis on amount, where, and to who the households marketed. Also attitudes toward transportation, storage and pricing policies.

8. Decision Making Module II: Policy Options
Single visit; September 1988; all 300 households in the two survey areas. Collect information about behavior and attitudes towards transfers (private and governmental), credit, purchased inputs, land usage (crop vs pasture) and major expenses (ie. school expenses).

9. Coping Strategies (geography)
Single visit; April 1988; all 25 households in two villages in each of the two survey areas.
Collect information on how households allocate their resources when faced with chronic and transitory rainfall deficits.

10. Village characteristics
Single visit; August 1988; all village councilors in all 12 wards in the two survey areas.
Collect information on the other villages in our survey areas. The data to collect are the crop mix, access to markets, non-agricultural opportunities, proximity to extension trials and proximity to a small grain dehuller of each village.

11. Marketing Module I: GMB/Approved Buyers/Unapproved
Single visit; October 1988; GMB, Approved buyers, village buyers. Collect information on prices, the quantity the handle by crop, the seasonal nature of their purchases, the number of farmers they serve, and their grading system.

12. Marketing Module II: Transporters
Single visit; October 1988; local transporters.
Collect information on transporters operating in our survey areas. The data to collect are the number of operating vehicles, where they collect, and their grain collecting strategies.

13. Farm Practices Module
Single visit; May 1988; all 300 households in the two survey areas.
Collect information on cropping practices of the major crops by plot, input usage, technology usage, labor usage and timing of the major operations (preplanting/planting, weeding, harvest and post-harvest).

APPENDIX 3:

ANALYSIS OF INVENTORY LEVELS

Since mean inventory holdings in most villages are a large portion of net household receipts (3 to 56 percent), a closer examination of their composition and distribution is warranted. These inventories are composed largely of grains. For example, grains represent 77 percent of inventories in the total sample, 80 percent in Mutoko/Mudzi Districts, and 74 percent in Buhera District. The large percent of inventories held as grain is consistent with the proportion of area allocated to grain production; 79 percent for the total sample, 78 percent in Mutoko/Mudzi District, and 82 percent in Buhera District.

It was not possible to allocate specific grain crops to home consumption and inventories because consumption data were not collected. Key informants report that households prefer maize to small grains, and only consume small grains when the maize stocks are exhausted. Thus, if one assumes that households consume maize before the small grains, only two villages (village 1 in Buhera District and village 2 in Mutoko/Mudzi District) have mean maize inventories larger than 1.5 bags per capita (the rest held as small grains). This result is important since farmers report that they can store small grains longer than maize, without deterioration in quality.

Analysis of the data indicates a large degree of skewness and peakedness in the level of total and grain inventories (per capita) held by households. The skewness and kurtosis coefficients for total inventories (10.8 and 148.6, respectively) and grain inventories (12.2 and 177.9, respectively) imply that both distributions are clustered at the lower end over a narrow range. This result implies that the means, reported in Tables 4.6 and 4.8, are not the best measures of central tendency since a small number of households are biasing the mean upwards. For highly skewed data distributions, the median is the preferred measure of central tendency.

An examination of the median total and grain inventories reveals that in only two villages (same villages as before) do households hold more than 1.5 bags of grain per capita. In both villages, households have limited access to marketing outlets (the closest GMB depot or collection point is more than 45 kilometers) and there are no marketing cooperatives or non-approved buyers in the village. Households in both villages also rated their rainfall as average or above average in the previous two seasons, which would encourage households to allocate more area to maize production--the preferred grain.

Finally, it is possible that part of the large inventory levels are due to farmers overestimating their production or underreporting sales. Underreporting sales is less likely, since recall error is generally low for monetary transactions.

Consequently, although the observed high level of inventories were unexpected, further analysis suggests that the data provides a reliable estimation of farmers' ending inventories.

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