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Constraints in Zambia: What are the Policy Implications?**

by
Munguzwe Hichaambwa and T. S. Jayne

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Indaba Agricultural Policy Research Institute (IAPRI)

Lusaka, Zambia

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**Indaba Agricultural Policy Research Institute (IAPRI)
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The Indaba Agricultural Policy Research Institute is a non-profit company limited by guarantee and collaboratively works with public and private stakeholders. IAPRI exists to carry out agricultural policy research and outreach, serving the agricultural sector in Zambia so as to contribute to sustainable pro-poor agricultural development.

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Any views expressed or remaining errors are solely the responsibility of the authors.

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EXECUTIVE SUMMARY

Introduction

Though Zambia has considerable agricultural potential, the sector's contribution to growth and poverty reduction has been limited. The sector remains one of the most important employers of labour and remains the main source of livelihood for most rural households in Zambia. Thus key development challenge facing Zambian agriculture over the past two decades has been how it can effectively contribute to poverty reduction and broad-based economic growth. Agricultural commercialisation and surplus production, as revealed by nationally representative farm surveys, in the country has remained concentrated with only about 5% of Zambia's small- and medium-scale farmers produce half of the marketed surplus. Meanwhile at least half of the smallholder farms sell little or no crops and hence derive virtually no cash income from agriculture.

Analysis has found very significant correlation between smallholder production and marketed output with farm size. Farm size in this paper is defined as the amount of land under the control of the household as understood according to the norms of the customary tenure system. Although there are certainly many factors that constrain Zambian farmers' potential to increase their incomes from farming, including the low productivity of the resources that they do possess, there is increasing evidence that in spite of vast expanses of the country's land currently being uncultivated, a large proportion of rural smallholder households face land constraints which impede their ability to produce a surplus and participate in agricultural supply chains. This gives rise to the paradox of smallholder rural households facing land constraints in the midst of apparent land abundance. In fact analysis of nationally representative data for the 2010/11 agricultural season shows that 54% of the smallholder households in Zambia cultivated all the land they owned, while only 41% cultivated less land than they owned, and 5% cultivated more land than they owned through renting or borrowing land.

Empirical investigation of the importance of inadequate access to land in constraining smallholder commercialization and farm incomes in Zambia is still lacking. Therefore, the main aims of this study are to investigate the level of smallholder commercialization in Zambia at different levels of farm size, and to assess the potential constraints that farm size may have on the process of smallholder commercialization and the potential policy implications. The specific objectives are to *firstly*, understand the proportion of smallholders in Zambia that meaningfully participate in agricultural markets; *secondly*, to understand how smallholder relationships to markets has changed over the past eleven years; *thirdly*, to determine the relationship between smallholder farm size and agricultural and crop sales; *fourthly*, determine what crops and/or livestock and livestock products are sold by the households with different farm sizes; and *finally*, consider the implications of the findings for agricultural policies to promote broad-based income growth and smallholder commercialization.

Data and Methods

The study employs two main data sources. The surveys of 2004 and 2008 are the nationally representative data from farm surveys carried out by the Central Statistical Office (CSO) in conjunction with the Ministry of Agriculture and Livestock (MAL) and Michigan State University's Food Security Research Project (FSRP) now the Indaba Agricultural Policy

Research Institute (IAPRI). Also used in the study are the Crop Forecast Surveys (CFS), which are also nationally representative and are conducted by MAL in conjunction with CSO with technical support from IAPRI covering the seasons from 2000/1 to 2010/11. This is part of an annual programme to forecast crop production and sales and ultimately estimate the nation's food balance sheet and inform policy on arrangements for the following crop marketing season.

The values of smallholder sales together with the proportion of households selling were used as indicators of the level of commercialization. Another indicator used to measure smallholder commercialization was the Household Commercialization Index (HCI), determined as the value of agricultural product sales as a percentage of the value of agricultural product production.

Key Findings and Policy Implications

- 1) Smallholder commercialization in Zambia as measured by the value of household crop sales, proportion of households selling crops and, indeed, the HCI has been increasing in general terms in the last eleven seasons. This increase is attributed mostly to increase in maize sales as a result of favourable weather and Government input and output market subsidy programmes which make maize production and marketing more attractive to the smallholders.
- 2) Analysis of determinants of smallholder agricultural sales has shown that there is not very great potential for most smallholder households in Zambia to raise their off-farm income under current levels of human capital and demand for off-farm goods and services in the rural areas. Such conditions provide limited opportunities for poverty reduction for land-constrained farm households. By contrast, increasing farm size for the land constrained households would be one of the more promising ways to reduce rural poverty in Zambia, given the supply of unutilized land in the country, but exploiting such potential would require a reorientation of public investment to agriculture. Keeping all other factors constant, increasing household farm size by 1 ha is associated with an increase smallholder agricultural sales by 29% for all households in general, 788% for the households in the least, 319% for those in the second, 62% for those in the third and only 3% for those in the most farm size quartile. The mean household farm size is 0.424 ha, 1.098 ha, 1.976 ha and 6.576 ha for the respective farm size quartiles (categories).
- 3) All indicators of smallholder commercialization used in this study have increased the most among households with greater access to cultivated land. Households with the smallest farms experienced the lowest rate of growth in commercialization.
- 4) The increase in maize-based smallholder commercialization is being achieved at the expense of crop diversification as smallholders are moving out of other cash and food crops into maize. The policy focus on maize in recent years has had questionable impacts on the development of an agricultural sector designed to raise incomes on small farms where a partial shift to higher-value crops will need to be part of the strategy for promoting broad-based agricultural development and poverty reduction.
- 5) Reinforcing the above point, only a minority of smallholder households in Zambia account for most of the maize sales, even during the past two seasons of bumper maize harvests. Evidence has shown that over the period 2000/1 to 2010/11 the proportion of smallholder households accounting for the top 50% of the value of maize sales has ranged from 1.3% to 8.6% with an average of 3.6% over the entire period. The proportion of those accounting for the rest of the maize sales ranged from 13.0% to 34.1% with an average of 19.9%, and the proportion of those not selling ranged from 57.3% to 85.5%

with an average of 76.5%. Clearly, this shows that the recent maize commercialization policies have been unable to convert at least 60% of the rural farm population into surplus producers of maize. Hence, they have not been able to benefit from the Food Reserve Agency's maize support prices. In fact, about 30% of the relatively poor smallholder households actually had to purchase more maize and maize meal than they produced in order to meet their families' food needs, and hence, were adversely affected by a support price policy that raised maize prices in the countryside.

- 6) The majority of smallholder households accounting for the top 50% of maize sales have substantially larger farm sizes than those not selling maize. Analysis has shown that on average, over the last eleven seasons, less than 4% of the smallholders account for 50% of the maize marketed by the small- and medium-farm sector. Of these highly commercialized farmers, 2% of them were in the quartile of farmers with the smallest farms, whereas 64% of them were in the largest farm size quartile.
- 7) An increasing proportion of smallholder households in the quartile with the largest farms have started selling maize in recent years. This finding corroborates other evidence indicating that the largest farms have been able to respond to and disproportionately capture the benefits of the high maize prices offered by the Food Reserve Agency in recent years.
- 8) All in all, this analysis shows that improving access to land among the most land-constrained smallholder households would be a seemingly effective way to reduce poverty as a very small incremental addition to land access is associated with a large relative rise in commercialization and consequently in income. This calls for basic public goods investments in fertile regions suitable for agricultural commercialization to promote voluntary migration into such areas to stimulate a smallholder-based agricultural system. Such investments would include trunk highways, health care facilities, schools, electrification, etc. to open up more land for cultivation in agro-ecologically suitable areas that are currently under-utilized.

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ACRONYMS

FAO	Food and Agriculture Organization of the United Nations
CFS	Crop Forecast Survey
CSO	Central Statistical Office
FISP	Farmer Inputs Support Programme
FNDP	Fifth National Development Plan
FRA	Food Reserve Agency
FSP	Fertilizer Support Programme
FSRP	Food Security Research Project
GDP	Gross Domestic Product
GRUMP	Global Rural Urban Mapping Project
Ha	Hectare
HCI	Household Commercialization Index
IAPRI	Indaba Agricultural Policy Research Institute
IFDC	International Fertiliser Development Centre
LOWESS	Locally Weighted Sum of Squares
MAL	Ministry of Agriculture and Livestock
PHS	Post-Harvest Survey
PRSP	Poverty Reduction Strategy Paper
SEAs	Standard Enumeration Areas
SNDP	Sixth National Development Plan
SSs	Supplementary Surveys
TNDP	Transnational Development Plan
Zmk	Zambian Kwacha

1. INTRODUCTION

The key development challenge facing Zambian agriculture over the past two decades has been how it can effectively contribute to poverty reduction and broad-based economic growth. Agriculture remains one of the most important employers of labour and remains the main source of livelihood for most rural households in Zambia. The country has considerable agricultural potential. However, the contribution of the sector to growth and poverty reduction has been limited.

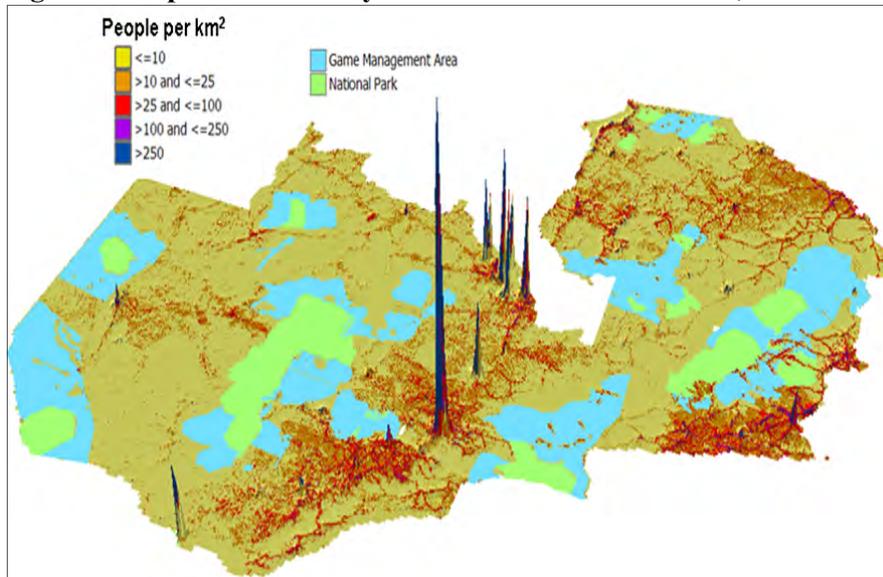
Nationally representative farm surveys in Zambia consistently reveal a highly concentrated pattern of agricultural commercialization and surplus production. Roughly five percent of Zambia's small- and medium-scale farmers produce half of the marketed surplus. Meanwhile at least half of the smallholder farms sell little or no crops and hence derive virtually no cash income from agriculture.

The pattern of smallholder production and marketed output is found to be highly correlated with farm size. Farm size in this paper is defined as the amount of land under the control of the household as understood according to the norms of the customary tenure system. Certainly, a number of factors constrain Zambian farmers' potential to increase their incomes from farming, including the low productivity of the resources that they do possess. However, there is increasing evidence that in spite of vast expanses of the country's land currently being uncultivated, a large proportion of rural smallholder households face land constraints which impede their ability to produce a surplus and participate in agricultural supply chains. This gives rise to the paradox of smallholder rural households facing land constraints in the midst of apparent land abundance.

There is increasing evidence that in spite of vast expanses of the country's land currently being uncultivated the majority of rural smallholder households face land constraints which negatively hamper their productivity and participation in agricultural supply chains. For example, a recent IAPRI study by Jayne et al. (2009) indicate that in many areas where the majority of the rural population live, unallocated land appears to be unavailable, particularly in areas close to urban areas and district towns, and along major highways. They further showed that Zambia's rural population is relatively densely clustered in certain areas, such as the Eastern Province plateau around Chipata, the areas of Southern Province along the line of rail and the areas surrounding the main roads in Northern Province as is shown in Figure 1. The main road network in Zambia can be clearly seen by the concentration of rural population in the figure. In addition, considerable tracts of land are national parks and game management areas not to mention surface areas unavailable in lakes, forests, wetlands, and mining concessions that limits practical areas onto which cultivated land can be expanded. This gives rise to the paradox of smallholder rural households facing land constraints in the midst of land abundance in other parts of the country.

In fact analysis of nationally representative data for the 2010/11 agricultural season has shown that more than half of the smallholder households in Zambia cultivated all the land they owned, while only 41% cultivated less land than they owned, about 3% cultivated more land than they owned and about 2% cultivated even if they did not own land. The situation exhibited provincial variation with the greatest proportion of households utilizing all of their land in the relatively densely populated Southern, Eastern, and Lusaka Provinces and the lowest proportion of households utilizing all their land in the relatively sparsely populated Luapula, Northern, and Western Provinces (Table 1).

Figure 1. Population Density and Distribution in Zambia, 2007



Source: Hichaambwa and Kabaghe (2009).

The Government of Zambia's development strategy for the past two to three decades has been to promote economic diversification and exports. Agriculture has been seen as an engine for economic growth and poverty reduction starting from the period of the Transitional National Development Plan (TNDP) through that of the Poverty Reduction Strategy Paper (PRSP) and the Fifth National Development Plan (FNDP). All of these development plans have called for the development of a sustainable and competitive agricultural sector that ensures food security, maximizes the sectors' contributions to the Gross Domestic Product (GDP), and increases agricultural exports to help national balance of payments. In the Sixth National Development Plan (SNDP), the agricultural sector is again seen as being crucial in poverty reduction and contributing to the country's Vision 2030 of attaining middle-income status by the year 2030.

Table 1. Relative Smallholder Land Utilization in 2010/11 Season by Province

Province	Percent smallholders who				Total
	Cultivated land equals land owned	Cultivated less land than owned	Cultivated more land than owned	Does not own land but cultivated	
Southern	64.2	24.9	7.4	3.5	100.0
Eastern	60.9	35.0	2.6	1.5	100.0
Lusaka	58.1	28.5	4.2	9.3	100.0
Northwestern	56.6	40.6	1.8	1.0	100.0
Central	55.4	39.8	1.3	3.6	100.0
Copperbelt	55.4	38.7	2.4	3.5	100.0
Western	49.1	48.4	1.8	.7	100.0
Northern	48.8	48.2	2.0	1.0	100.0
Luapula	32.9	63.1	1.9	2.1	100.0
Total	53.5	41.3	2.9	2.3	100.0

Source: MAL/CSO Crop Forecast Survey, 2010/11 and authors' computations.

The Government of Zambia's development strategy for the past two to three decades has been to promote economic diversification and exports. Agriculture has been seen as an engine for economic growth and poverty reduction starting from the period of the Transitional National Development Plan (TNDP) through that of the Poverty Reduction Strategy Paper (PRSP) and the Fifth National Development Plan (FNDP). All of these development plans have called for the development of a sustainable and competitive agricultural sector that ensures food security, maximizes the sectors' contributions to GDP, and increases agricultural exports to help national balance of payments. In the Sixth National Development Plan (SNDP), the agricultural sector is again seen as being crucial in poverty reduction and contributing to the country's Vision 2030 of attaining middle-income status by the year 2030.

Population density is quite low in most of Zambia's rural areas. This fact has given rise to a widespread perception that Zambia is land abundant and that few of its rural inhabitants could be experiencing land shortages.

However, the recent availability of detailed satellite image data tells a different story. Estimates of rural population density can now be derived from the Global Rural-Urban Mapping Project (GRUMP) at Columbia University.¹ This spatial data set provides gridded estimates of local population densities, starting with sub-national census data and allocating the population across a set of grid cells corresponding to one square kilometer units for all of Zambia. We excluded all pixels categorized as rural that contained less than 10% arable land or exceeded 2,000 persons per km² based on the assumption that populations over this level were approaching peri-urban status or were mis-categorized. Use of this data allows for much greater localized variation in rural population densities than would be possible if estimated at more aggregated spatial units.

Table 2 presents the resulting distribution of rural population density in Zambia. The findings indicate great variation in rural population densities. The bottom 25% of the rural population live in relatively sparsely populated areas, under 23 persons per square kilometer of arable land. Fifty percent of Zambia's rural population resides in areas exceeding 330 persons per km² of arable land. However, 25% of the rural population lives in areas exceeding 944 persons per km² of arable land. And 10% of the rural population lives in areas over 1186 persons per km² of arable land. Because rural population growth is rising faster than land under cultivation in most countries, these proportions are most likely rising over time. According to a joint Food and Agriculture Organisation/ International Fertiliser Development Centre (FAO/IFDC) report, the maximum carrying capacity of land suitable for intensive cultivation with one growing season per year is 500 persons per km² (Henao and Baanante 1999). While this threshold cannot be considered to be precise for all areas, e.g., those with multiple cropping seasons and/or irrigation potential, it does give a first-order approximation of land supporting capacity for the dry land farming conditions on which the vast majority of Zambia's rural population is located.

Hence, despite the fact that Zambia in 2011 contains great tracts of unutilized and underutilized arable land, a significant and growing share of its farm households are living in relatively densely populated areas. These areas are characterized by small and gradually declining farm sizes and reduced fallows. Ironically, inadequate access to land and inability to exploit available unutilized land are issues that almost never feature in Zambia's national

¹ Data available from <http://sedac.ciesin.columbia.edu/gpw/index.jsp> See Balk et al. (2004) for a description of the methods used to compile the dataset.

Table 2. Rural Population Density Distribution on Land Categorized as Arable, GRUMP 2010

	Percentiles of all pixels with arable land ranked by population density							Mean across all pixels
	5 th	10 th	25 th	50 th	75 th	90 th	95 th	
Zambia	7	12	23	332	944	1186	1210	450

Sources: Year 2010 population estimates from GRUMP; arable land is the share of all pixels classified as cultivated in the GAEZ 3.0 database.

Note: These estimates are based on all 1 km² grid cells (pixels) categorized as rural and with at least 10% of the grid cell being arable land and below 2000 persons per km².

development plans or poverty reduction strategies. To our knowledge, there has been little recognition of the potential obstacles to broad-based agricultural-led growth in increasingly densely populated and land-constrained areas of rural Africa, despite the fact that a sizeable and increasing share of its rural population live in such areas.

The primary objective of this study, therefore, is to assess the potential for broad-based smallholder commercialization in Zambia in the presence of potential land constraints in some areas where a large proportion of the rural population reside. The specific objectives are to:

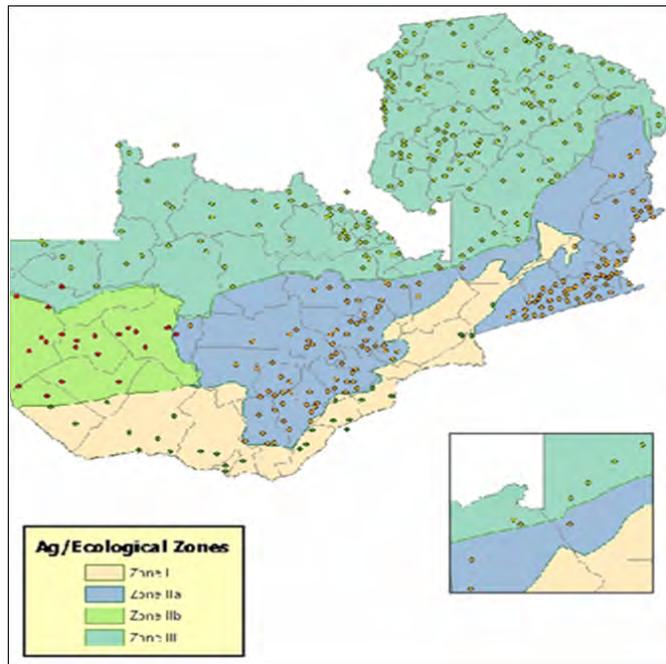
- 1) Understand the proportion of smallholders in Zambia that meaningfully participate in agricultural markets;
- 2) Understand how smallholder relationships to markets has changed over the past eleven years;
- 3) Determine the relationship between smallholder farm size and agricultural and crop sales;
- 4) Determine what crops and/or livestock and livestock products are sold by the households with different farm sizes; and
- 5) Consider the implications of our findings for agricultural policies and investment programmes to promote broad-based income growth and smallholder commercialization.

2. DATA AND METHODS

The study employs two main data sources. Firstly, are the nationally representative data from surveys carried out in 2004 and 2008 by the Central Statistical Office (CSO) in conjunction with the Ministry of Agriculture and Livestock (MAL) and Michigan State University's Food Security Research Project (FSRP), now the Indaba Agricultural Policy Research Institute (IAPRI)². These are the second and third panel surveys linked to the 1999/2000 Post Harvest Survey (PHS) conducted by the CSO in conjunction with MAL in 2004 and 2008. They are commonly known as Supplemental Surveys (SSs). In addition to crop production and marketing data, these surveys capture data on different livelihood aspects of the rural smallholder households including livestock production and marketing and off-farm income generating activities, asset ownership, and other related socio-economic activities. These sets of data were used to estimate all agricultural sales for the 2003/4 and 2007/8 marketing seasons. A total of 5,420 and 8,094 households were interviewed in the respective surveys.

Secondly, is the nationally representative Crop Forecast Survey (CFS) conducted by MAL in conjunction with CSO with technical support from IAPRI covering the seasons from 2000/1 to 2010/11 as part of an annual programme to forecast crop production and sales, and ultimately estimate the nation's food balance sheet and inform policy on arrangements for the following crop marketing season. The sampling and sample size for the CFS have evolved over the years. Currently, the survey covers about 13,374 smallholder households across the country. The national representativeness of the surveys is reflected by the map of CSO Standard Enumeration Areas (SEAs) sampled in the CSO/MAL/IAPRI surveys, as shown in Figure 2. Each dot on the map representing one of the 394 SEAs surveyed, containing 20 randomly selected smallholder households as shown in the figure.

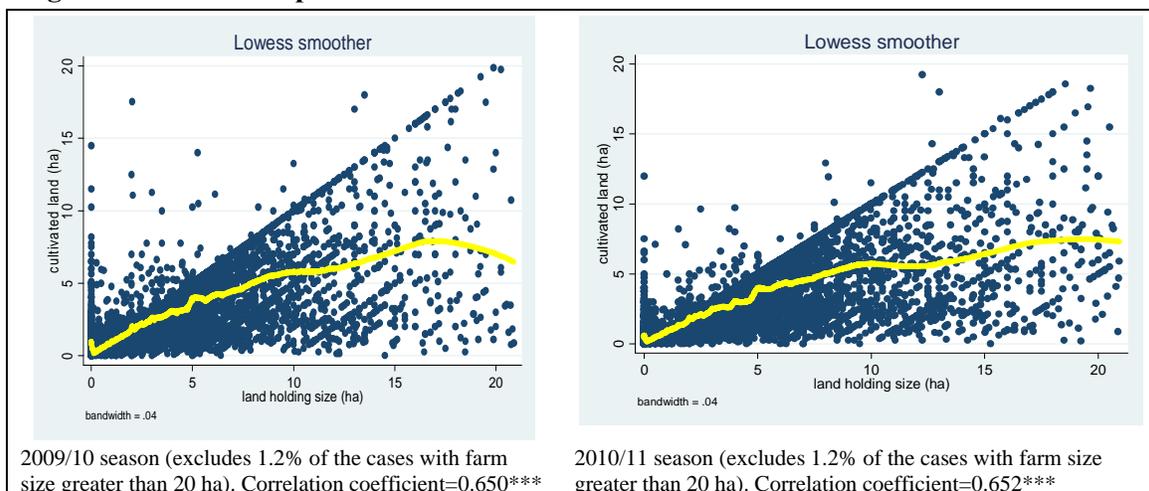
Figure 2. Map of Sampled SEAs in National Surveys



Source: Hichaambwa and Kabaghe (2009).

² For sampling procedures, see Megill 2004.

Figure 3. Relationship between Smallholders Cultivated Land and Farm Size



Source: MAL/CSO Crop Forecast Surveys 2000/01 to 2010/11).

The CFS only captures the forecasted production and marketing of field crops (not fruits and vegetables or horticultural crops) and does not capture any data on livestock production and marketing or off-farm income generating activities or asset ownership. Thus trends in agricultural sales were only compared between the 2003/4 and 2007/8 seasons while that of crop sales were compared across all the last eleven seasons of CFS data.

Unfortunately, the CFS data collection instrument has only been collecting the quantity of land cultivated by each smallholder household until the last three seasons. Starting in 2008/09, the CFS instrument was modified to also obtain information on farm size (land owned). In order to study the commercialization trends over a longer period of eleven seasons, this study uses cultivated land as a proxy for farm size based on a premise that the two are closely related as is shown in Figure 3 for the last two seasons³.

The data points above the 45 degrees line to the right represent households that are cultivating more land than they own through borrowing or renting in, and these are concentrated amongst households with farms of less than one ha. The proportion of smallholders that cultivate more land than they owned accounted for between 3% and 7% of all smallholders during the last three seasons, owned an average of about half a hectare and over 60% of these did not own any land at all as can be seen in Table 3.

Table 3. Farm Characteristics of Smallholders Cultivating More Land than Farm Size

Season	%smallholders cultivating more land than owned	% of these owning no land	Farm size (ha)	
			Mean	Median
2008/9	6.4	62.9	0.4	0.0
2009/10	5.7	61.0	0.5	0.0
2010/11	3.7	61.9	0.6	0.0

Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

³ Note that the correlation coefficients are close to unity and highly significant (p=0.001).

In order to assess the level of and trends in smallholder commercialization it was important to estimate the values of the commodities that entered the market over the entire 11-season period. The forecasted quantity of sales for each season were obtained from the CFS, though these were only available in 2003/4, 2005/6, 2006/7 and 2007/8 seasons for cassava. The CFS, however, does not capture commodity prices and these are normally captured in the PHS but these have not been conducted for several years now. In order to derive commodity prices that could be applied for all the seasons under study, the crop prices available in the two SSs (2004 and 2008) were inflated to 2011 Zambian kwacha (Zmk) price levels using appropriate consumer price indices. The average of these two prices for each commodity was used as the market price for all the seasons.

These values of sales together with the proportion of households selling were used as indicators of the level of commercialization. Another indicator used to measure smallholder commercialization was the HCI, determined as the ratios of total value of farm commodities sold to the total value of farm commodities produced.

The next chapter discusses the main findings of this study starting with the distribution of smallholder sales and their trends in the last eleven seasons, followed by the relationship between smallholder farm size (using cultivated land as its proxy) and agricultural sales. We finally identify the commodities/crops that are predominantly grown by smallholders of varying levels of farm sizes. The chapter is followed by a synthesis of key issues and policy implications.

3. RESULTS

3.1. Trends in Smallholder Participation in Markets

This section uses nationally representative Supplemental Survey (SS) data from the 2003/04 and 2007/08 marketing years to examine trends and patterns of agricultural commercialization in Zambia's small- and medium-scale farm sector. The SS surveys recorded information on all sources of farm sales, including those not collected in normal CFS surveys such as horticultural products and animal products. Later in this section, we will compare commercialization patterns between the SS and CFS surveys for comparability.

Analysis of the 2004 and 2008 SS data shows that the distribution of smallholder agricultural sales largely remained the same in 2003/4 and 2007/8 seasons, though the inflation-adjusted value of sales declined slightly in 2007/8. Agricultural sales in 2003/4 ranged from Zmk 0 (for 23.6% of all farm households in the small- and medium farm sector) to Zmk239,344,224 with the mean and median sales being Zmk1,585,089 and Zmk345,213 respectively. In the 2007/08 marketing season, 27.7% of all farm households sold no crop or animal products. The maximum household agricultural sales value in 2007/8 was slightly higher than in 2003/04 at Zmk302,147,000, but the mean and median were lower at Zmk1,423,823 and Zmk208,412 respectively.

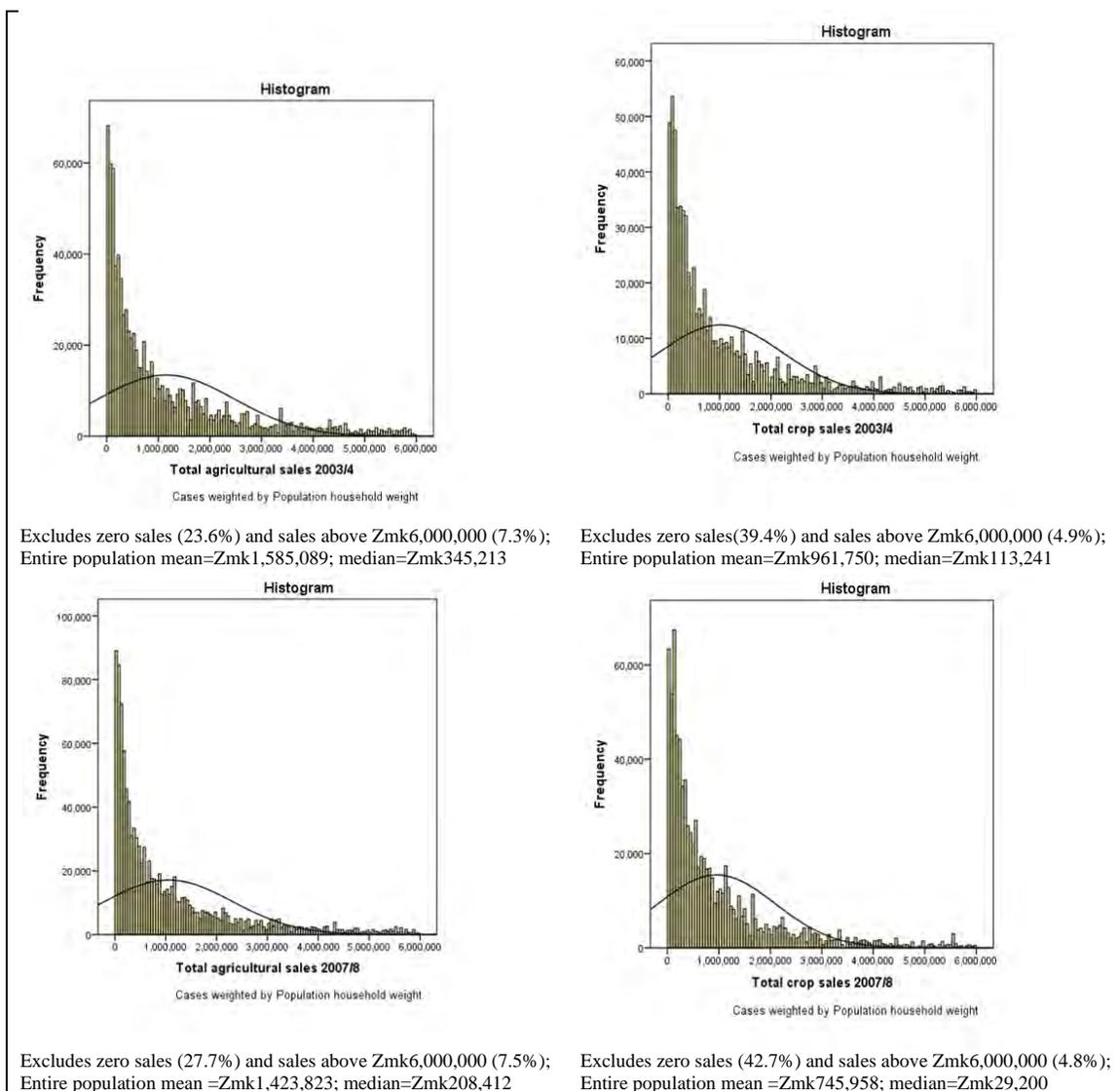
Similarly, crop sales in 2003/4 ranged from Zmk 0 to Zmk 88,592,800 with the mean and median sales falling at Zmk 961,750 and Zmk 113,241. The maximum crop sale in 2007/8 was slightly higher at Zmk 123,483,365 but the mean and median were lower at Zmk 745,958 and Zmk 29,200 respectively.

Figure 4 below shows the distribution of agricultural and crop sales for the two seasons excluding zero sales and sales above Zmk6,000,000 (this maximum was imposed on all four quadrants of Figure 4 to remove outlying cases and to focus on the sales distribution up to the 90th percentile of the distribution). The excluded cases accounted for 30.9% and 35.2% of the households in 2003/4 and 2007/8 seasons respectively for agricultural sales and 44.3% and 47.5% respectively for crop sales. All in all, the distribution of agricultural and crop sales between the two years remained similar, with only slight differences in magnitude. Crop sales accounted for the largest share of agricultural sales at 85% and 72% in 2003/4 and 2007/8 seasons respectively.

Table 4 shows the decomposition of the smallholder agricultural sales in the two respective seasons together with their mean sales at constant 2011 Zmk prices and relative percent shares. Maize accounts for the largest share of agricultural sales in both 2003/4 and 2007/8 seasons at 22% and 33% respectively followed by horticulture at 20% and 23% respectively. The only other agricultural sale, with a share greater than 10%, was cotton in 2003/4 (17%) and cattle in 2007/8 (11%).

Maize's share of the total value of agricultural sales increased by 50% between the two seasons in response to the Government's policy of providing subsidized inputs and marketing support for maize through the Farmer Input Support Programme (FISP), then known as the Fertilizer Support Programme (FSP) and the Food Reserve Agency (FRA) respectively. In spite of these policy efforts to support maize production, the share of horticultural sales in total farm sales increased from 20% to 23%. The rising importance of horticulture is

Figure 4. Distribution of Agricultural and Crop Sales in 2003/4 and 2007/8 at Constant 2011 Zmk Prices



Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008 and authors' computations.

especially apparent among land constrained smallholders in areas with access to urban markets. The sales share of all other major smallholder cash crops declined: the share of cotton sales decreased from 17% to 9% and that of tobacco from 7% to about 1%. The shares of soybeans and sunflower also decreased. The appreciation of the kwacha during this period also contributed to the reduction in cotton and tobacco sales among smallholder farmers in Zambia.

The sales shares of the staple crops cassava, millet, and sorghum also declined between the two seasons, from 2.5% to 0.3%, 0.3% to 0.1%, and 0.6% to 0.3% respectively. That of sweet potatoes marginally increased from 1.1% to 1.3%. However, that of livestock, especially poultry and small livestock, increased as a proportion of total CPI-adjusted farm sales value. In 2003/04, 33% of smallholder households sold poultry, although this declined to 26% in 2007/8.

Table 4. Decomposition of Agricultural Sales in 2003/4 and 2007/8 at Constant 2011 Zmk Prices

Agricultural sales	2003/4 season			2007/8 season		
	Mean (Zmk/hh)	%Share	%hh selling	Mean	%Share	%hh selling
Maize	352,992	22.3	28.4	463,134	32.5	29.3
Horticulture	321,026	20.3	16.3	333,212	23.4	17.8
Cotton	272,637	17.2	10.3	124,227	8.7	9.0
Cattle	146,615	9.2	4.7	153,039	10.7	4.6
Tobacco	103,466	6.5	1.4	12,550	0.9	0.4
Groundnuts	66,617	4.2	20.1	48,003	3.4	17.4
Small livestock	55,934	3.5	14.6	62,428	4.4	14.3
Milk	49,065	3.1	2.6	55,458	3.9	3.2
Poultry	42,821	2.7	33.6	64,307	4.5	25.6
Cassava	39,371	2.5	11.2	4,360	0.3	1.8
Mixed beans	36,294	2.3	8.9	31,712	2.2	6.3
Rice	19,182	1.2	2.2	20,938	1.5	2.3
S/potatoes	17,382	1.1	7.7	18,763	1.3	6.0
I/potatoes	13,996	0.9	0.7	3,040	0.2	0.3
Sunflower	11,873	0.7	2.9	5,967	0.4	2.5
Soybeans	11,356	0.7	2.0	6,567	0.5	1.8
Millet	9,329	0.6	4.9	4,327	0.3	2.8
Eggs	6,466	0.4	1.6	8,506	0.6	2.9
Sorghum	5,456	0.3	2.0	1,483	0.1	0.3
Fish	1,412	0.1	0.2	916	0.1	0.2
Green beans	1,317	0.1	0.7	261	0.0	0.2
Cowpeas	456	0.0	0.5	1,066	0.1	0.5
Coffee	27	0.0	0.0	-	-	-
Livestock and products*	245,370	15.5		399,965	28.1	
Total	1,585,089	100.0	75.4	1,423,823	100.0	68.7

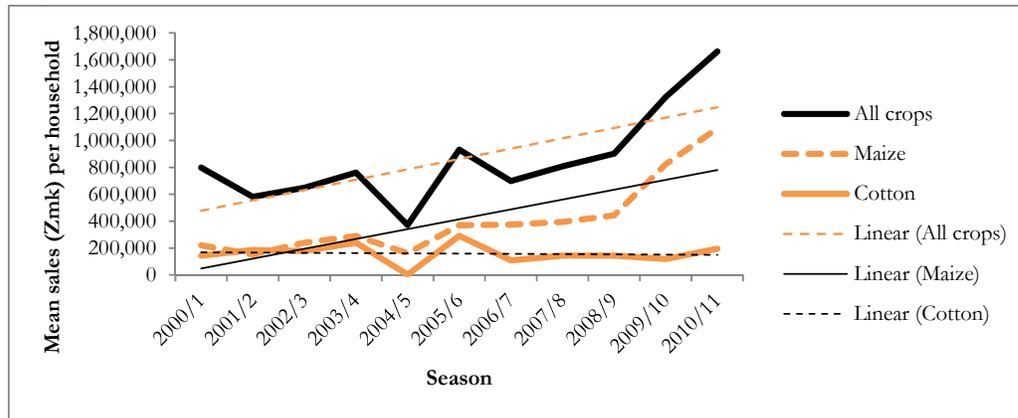
Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008 and authors' computations.

* This is the sum of cattle, small livestock, milk, and poultry put here for illustrative purposes and is not repeated into the 100.0% total share.

Turning to the CFS data (which does not report horticulture crop or animal product sales), there appears to have been a gradual rise in the inflation-adjusted value of crop sales over the period from 2000/1 to 2010/11 with drops in total crop sales occurring in 2004/5 and 2006/7 seasons. The increase in crop sales is largely attributed to the increase in maize sales while sales of most other crops except tobacco, rice, groundnuts and cowpeas have stagnated or declined. Figure 5 shows that the trends in smallholder crop (all) sales is identical to that of maize while smallholder cotton sales have by and large remained almost the same, though the sales declined in 2004/5 following the appreciation of the local currency (Zmk).

The proportion of smallholder households selling crops has also been rising over the seasons under review, with most of the increase being accounted for by maize. The proportion of farmers selling cotton has slightly declined as shown in Figure 6. Figures 7 and 8 show the trends in smallholder crop sales, and the proportion of households selling selected crops over the last eleven seasons. From the figures, notable increases in both sales and proportion of households selling have been recorded for tobacco, rice, and bambara nuts. While groundnut sales have fluctuated over the seasons with no definite trend, the proportion of households selling has exhibited an increasing trend. The rest of the crops show stagnant or declining trends in both mean sales and proportion of households selling.

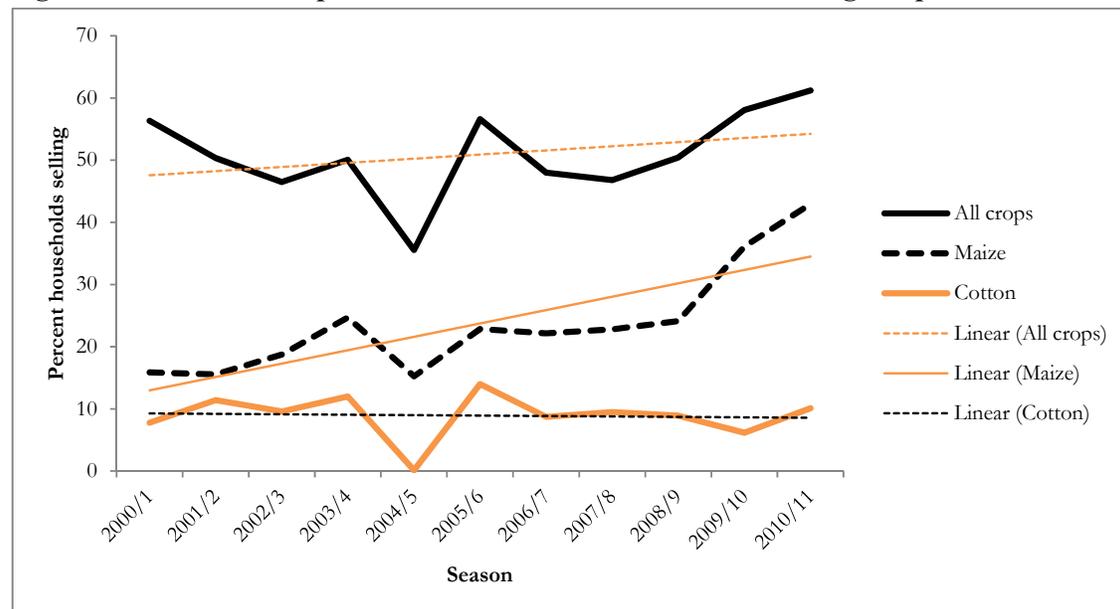
Figure 5. Trends in Smallholder Crop Sales at Constant 2011 Zmk Prices



Source: Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Other IAPRI studies such as Chapoto (2010a) have shown that mean maize production per household has been increasing during the period under review, and so this has translated into increased sales. The production of groundnuts and sweet potatoes was reported by the same workers to have exhibited an upward trend, but sales have generally remained more or less constant. The production of sorghum, millet, and rice has reportedly remained constant while these sales have been found by this study to have actually declined except for rice for which sales have been increasing. Sunflower and soybean production has reportedly remained constant while their sales have been declining to insignificant levels.

Figure 6. Trends in Proportion of Smallholder Households Selling Crops



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Figure 7. Trends in Selected Smallholder Crop Sales at Constant 2011 Zmk Prices



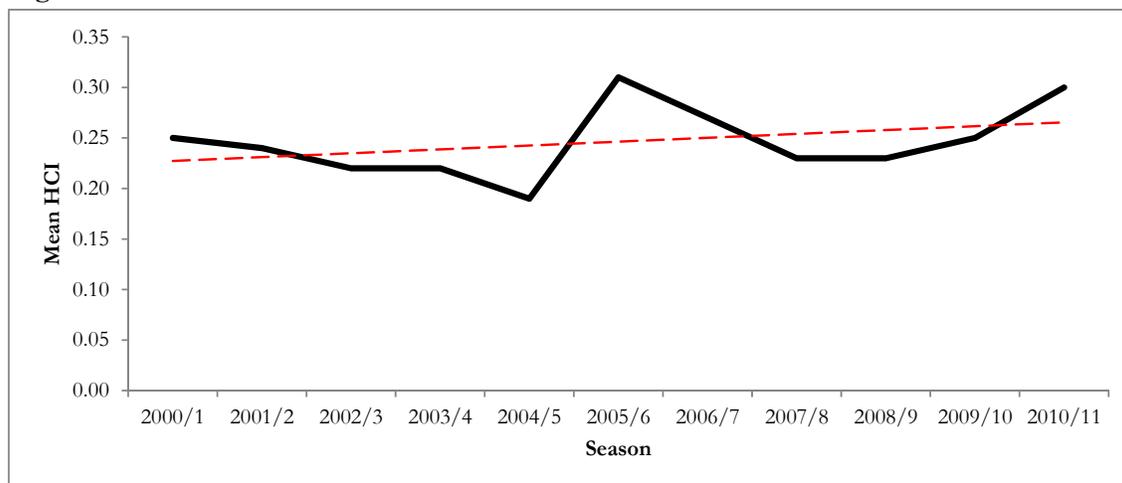
Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Figure 8. Trends in the Proportion of Smallholder Householders Selling Selected Crops



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Figure 9. Trends in Smallholder Household Commercialization Index

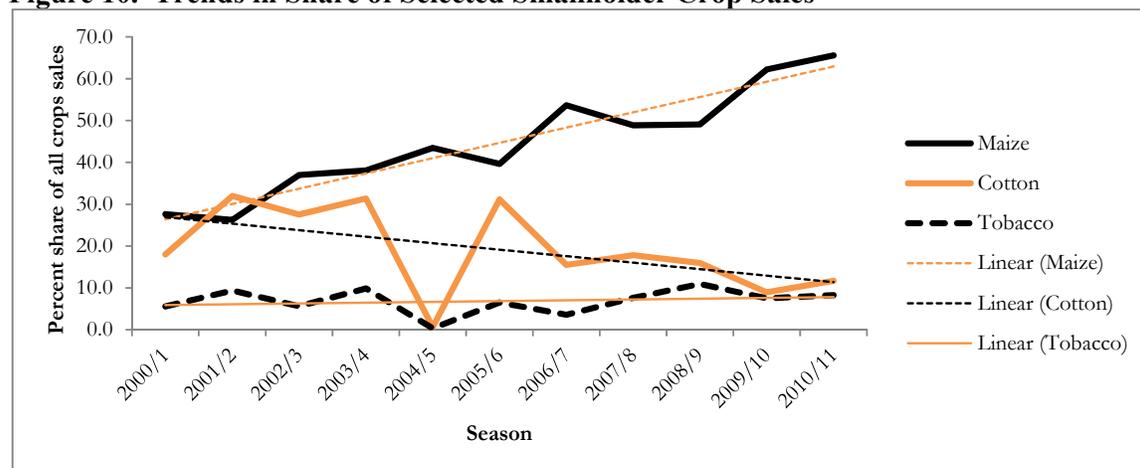


Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Looking at trends in the Household Commercialization Index (again, defined as the sum of the value of household crop sales as a proportion of the value of crop production, expressed in percentage terms), Figure 9 shows that there has been a general increase in the HCI across the seasons, the lowest having been recorded in 2004/5 season and the highest in the 2006/7 season, with a steady increase in the last two seasons.

Overall, smallholder commercialization has since 2000/1 been increasing as shown by increasing smallholder crop sales, proportion of households selling as well as the HCI. However, this is largely attributed to increased production and sales of maize facilitated by Government input and output marketing subsidy programmes as well as favourable weather (Burke, Jayne, and Chapoto 2010). This is further explained by the increasing share of maize in smallholder total crop sales and decreasing shares of other crop sales as is shown in Figure 10 below.

Figure 10. Trends in Share of Selected Smallholder Crop Sales



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

3.2. Relationship between Farm Size, Cultivated Land, and Agricultural Sales

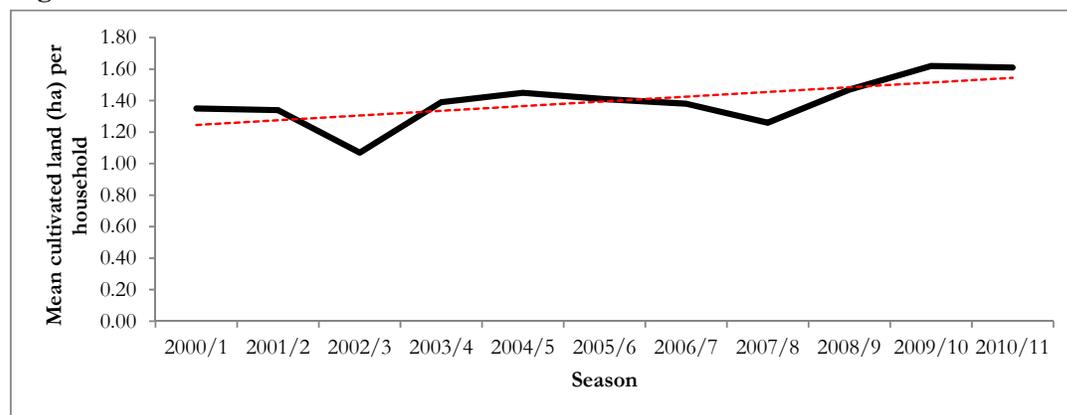
Having established that smallholder commercialization has been increasing over the last eleven seasons, albeit mostly due to increasing maize sales and the proportion of households selling, this section explores what role smallholder access to land measured as cultivated land has played in the process. Analysis of CFS data has shown that the mean smallholder cultivated land across the eleven seasons has ranged from 1.07 ha to 1.62 ha per household with the trend pointing towards a general increase (Figure 11).

However, when the national sample of smallholder farms is ranked into four equal groups or quartiles based on cultivated land, we find that only the smallholders in the largest farm size or cultivated quartile (the top 25%) have been able to significantly increase their cultivated land over the past eleven seasons, from roughly 3.0 to 3.5 hectares, as can be seen in Figure 12. Smallholders in the third and second farm size quartiles have also slightly increased their cultivated land while the mean cultivated land for smallholders in the least farm size quartile (the lowest 25%) has remained roughly constant over the 11-year period. Mean cultivated land per farm size group or quartile over the eleven season period is 0.31 ha, 0.76 ha, 1.33 ha and 3.17 ha per household for the least, second, third and largest quartile, respectively, with the overall mean being 1.40 ha per household.

But, how are agricultural/crop sales related to cultivated land and/or farm size? Figure 13 shows the distribution of crop sales against farm size as well as cultivated land in 2003/4 and 2007/8 seasons using Locally Weighted Sum of Squares (LOWESS) in Stata. The figure shows that:

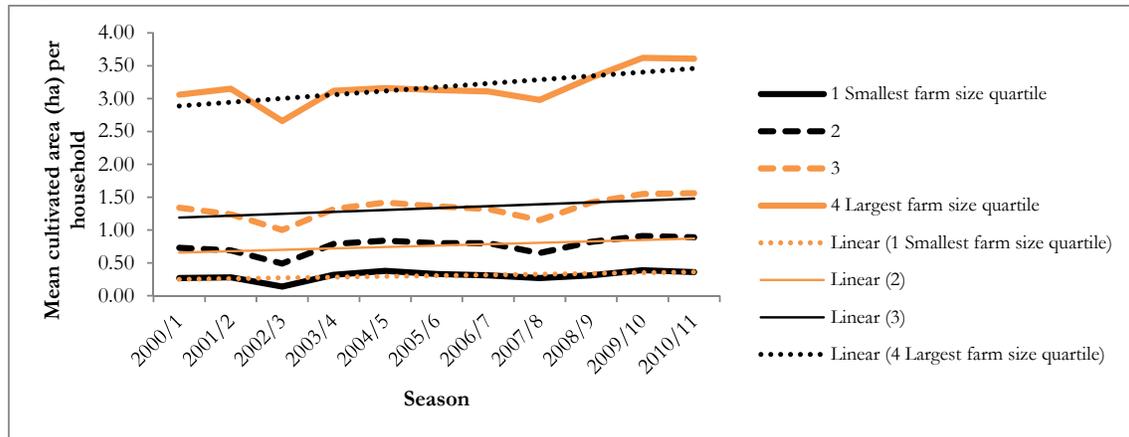
- 1) The distribution of crop sales against farm and against cultivated land is similar, but the graph based on cultivated land is on a much higher plane; and
- 2) Increasing cultivated land or farm from 0-3 ha is associated with a large increase in the value of crop sales. Thereafter, the increase is much reduced.

Figure 11. Trends in Smallholder's Cultivated Land



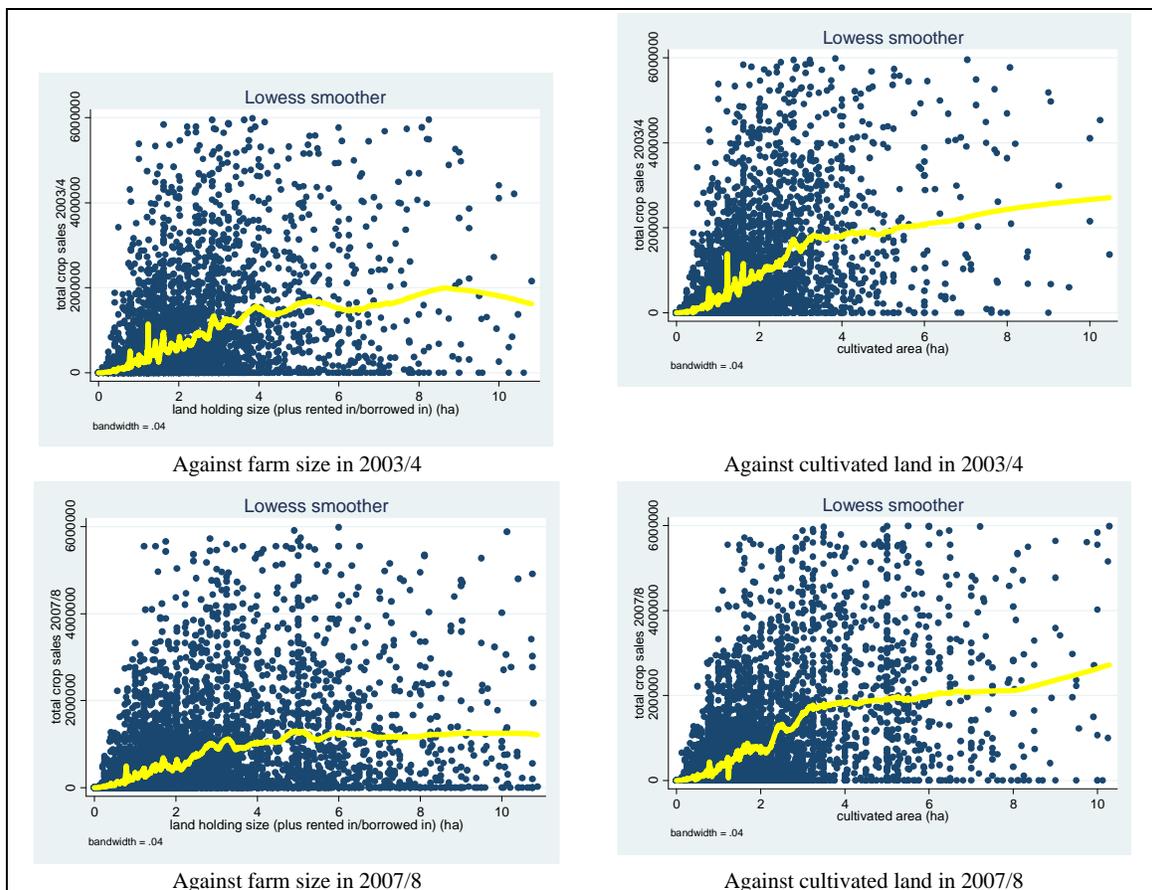
Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Figure 12. Trends in Smallholder Mean Cultivated Land per Farm Size Quartile



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

Figure 13. Distribution of Crop Sales against Farm Size (including Borrowed/rented in) and Cultivated Land



Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008.

Further to the foregoing, the importance of farm size in influencing smallholder agricultural sales was determined using SS data for 2003/4 and 2007/8 pooled together in a regression framework:

$$\ln(y) = \beta_0 + \beta_1 \text{offinc} + \beta_2 \text{asset} + \beta_3 \text{aehh} + \beta_4 \text{land} + \beta_5 \text{age} + \beta_6 \text{agesq} + \beta_7 \text{female} + \beta_8 \text{educat2} + \beta_9 \text{educat3} + \beta_{10} \text{year2008} + \beta_{11} \text{zone2a} + \beta_{12} \text{zone2b} + \beta_{13} \text{zone3} + \mu$$

Where:

y is the household total agricultural sales in Zmk;
ln is the natural logarithm;
offinc is the household off farm income in Zmk;
asset is the total value in Zmk of household productive assets including livestock and farm implements;
aehh is the total number of household adult equivalents;
land is the household farm size in ha;
age is the age of the household head;
agesq is the quadratic term for the age of the household head;
female is a binary variable representing female headed households (compared to male headed ones=0);
educat2 and *educat3* are the binary variables representing the category of household head secondary school and tertiary level respectively (compared up to primary school level=0);
year2008 is the binary variable representing the 2007/8 season (compared 2003/4 season=0) and *zone2a*, *zone2b* and *zone3* are the binary variables representing the agro-ecological zones IIA, IIB and III respectively compared to zone I, and μ represents the other unobserved factors.

The β_0 is the estimated regression line intercept while the β_1 to β_6 and β_7 to β_{13} are the estimated regression coefficients for the respective explanatory variables. The results of the regression analysis are shown in Table 5 while the summary statistics of the quantitative variables used in the model are given in Appendix 1.

Analysis of the above regression model shows two salient features with regard to smallholder agricultural sales in the context of land constraints. First is that off farm income is not a significant alternative income source for smallholder households in Zambia more especially the land constrained ones; and second is that increasing farm size for the land constrained households would be one of the most promising ways to increase their agricultural sales. Keeping all other factors constant, increasing household farm size by 1 ha would increase agricultural sales by 29% for all households in general, 788% for the households in the least, 319% for those in the second, 62% for those in the third and only 4% for those in the most farm size quartile. For at least the bottom two farm size quartiles, access to additional land appears to be a major constraint on farm commercialization.

Table 5. Regression Model of Factors Affecting Smallholder Total Agricultural Sales (Log) per Farm Size

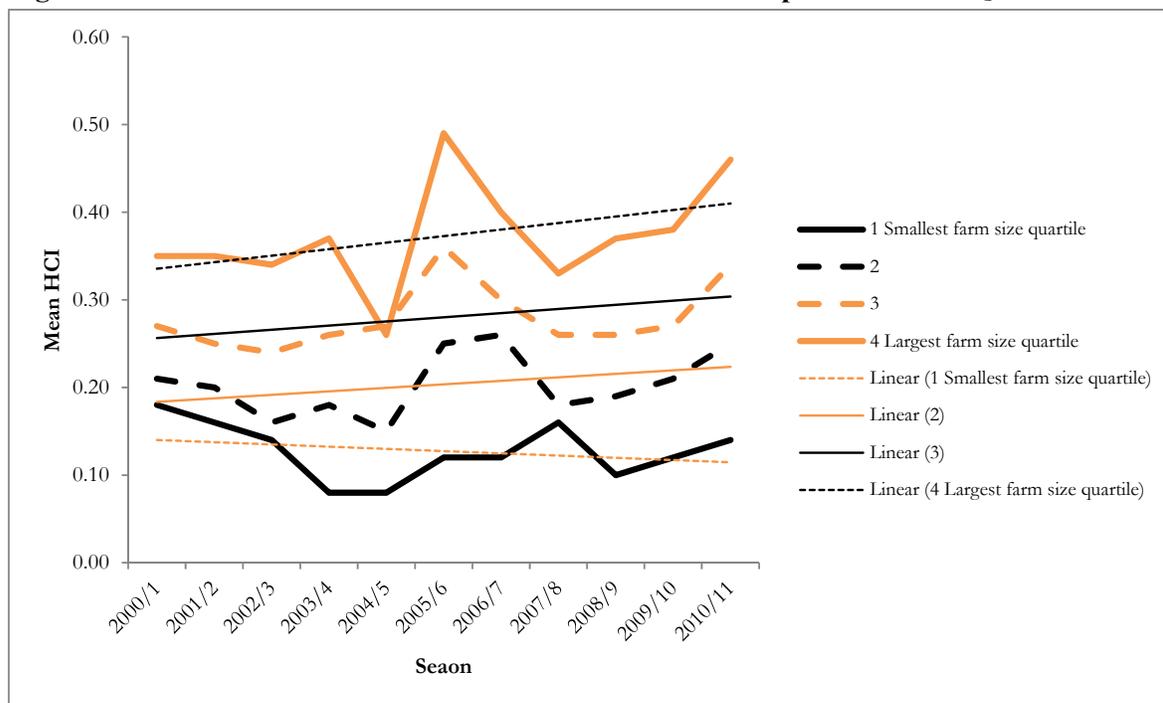
Explanatory variables	Coefficients per household farm size quartile				
	All households (2.819 ha)	Least (0.424 ha)	Second (1.098 ha)	Third (1.976 ha)	Most (6.576 ha)
Off farm income (Zmk)	-6.85e-08	-1.36e-08	2.93e-08	-3.15e-09	1.41e-08**
Productive assets (Zmk)	3.38e-09**	1.05e-07**	2.27e-08	8.99e-08***	3.12e-08***
Adult equivalents	0.278***	0.175***	0.206***	-0.009	0.131***
Farm size (ha)	0.292***	7.879***	3.190***	0.615**	0.038***
Age of head in years	0.119***	0.004	-0.010	0.129***	0.042
Age of head in years squared	-0.001***	-0.000	-0.000	-0.002***	-0.000
Female compared to male head	-1.101***	-0.162	-0.187	-0.722***	-1.110***
Education of head (to up to primary excluded)					
Secondary	0.457***	0.465	0.669**	0.580**	0.424**
Tertiary	-1.754***	-1.262**	0.622	-0.360	0.127
2007/8 compared to 2003/4 season	-1.045***	-0.096	-0.672***	-0.569***	-0.452***
Ecological zone compared to I					
Zone IIA	2.133***	0.250	2.493***	2.854***	1.740***
Zone IIB	-1.597***	-1.390***	-0.276	-1.240**	-2.495***
Zone III	1.030***	0.179	1.635***	2.042***	0.802
Constant	4.532***	1.609	4.032***	5.445***	10.119***
	Model Summary				
Number of observations	13,400	2,839	3,259	3,267	4,035
Prob>F	0.000	0.000	0.000	0.000	0.000
R-Squared	0.145	0.144	0.082	0.099	0.126

Note: ** and *** denote significance at P0.05 and P=0.01 respectively.

Source: CSO, MACO, IAPRI Third Supplemental Survey, 2008 and authors' estimation.

Having established that smallholder sales are highly correlated with cultivated land/farm size and that smallholder cultivated land has over the eleven seasons been increasing only for about a quarter of the smallholders in the largest farm size quartile, we examine further the smallholder commercialization indicators per farm size quartile or quartile of cultivated land. For a start, the smallholder HCI over the eleven seasons has been directly related to the land cultivated. The HCI for the lowest farm size quartile ranged from 0.08 to 0.18 with the mean being 0.13; while that of the second ranged from 0.15 to 0.26 with the mean being 0.20; that of the third ranged from 0.24 to 0.36 with the mean being 0.28; and that of the fourth and largest farm size quartile ranged from 0.26 to 0.40 with a mean of 0.37. The overall mean HCI over the entire period was 0.25. With regard to the trends in the HCI over the period, Figure 14 shows that while the HCI was generally increasing, it increased most among smallholders in the largest farm size quartile, and has actually been declining among smallholders in the least farm size quartile.

Figure 14. Trends in Smallholder Commercialization Index per Farm Size Quartile



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

3.3. The Composition of Agricultural Sales by Farm Size Category

Table 6 shows the different smallholder agricultural sales at constant 2011 Zmk prices per farm size quartile for 2003/4 and 2007/8 seasons while Table 7 shows their relative shares in percentages during each season. We have seen before that maize followed by horticulture, cotton, cattle, and tobacco were the most important sources of smallholder commercialization in 2003/4 season, cumulatively accounting for 76% of the sales. These were also the main sales for the smallholders in the largest farm size quartile, accounting for 79% of all the sales. The five main sales items for the largest farm size quartile changed slightly in the 2007/8 season to maize, horticulture, cattle, cotton, and small livestock, which accounted for 85% of the sales.

Table 6. Smallholder Agricultural Sales in 2003/4 and 2007/8 Seasons at Constant 2011 Zmk Prices per Farm Size Quartile

Agricultural sales	2003/4					2007/8				
	Cultivated land quartile					Cultivated land quartile				
	1 Least	2	3	4 Most	Total	1 Least	2	3	4 Most	Total
Maize	27,982	96,165	222,669	1,102,063	352,992	35,686	115,811	237,946	1,493,768	463,134
Horticulture	175,141	184,712	212,172	732,807	321,026	138,260	199,621	200,256	809,843	333,212
Cotton	16,401	102,455	227,814	767,384	272,637	360	20,794	104,316	379,951	124,227
Cattle	64,267	71,209	127,015	333,807	146,615	22,249	77,980	117,315	404,096	153,039
Tobacco	4,082	34,448	82,724	302,168	103,466	0	1,339	6,009	43,777	12,550
Groundnuts	9,577	35,128	73,807	151,848	66,617	3,967	23,046	50,976	116,995	48,003
Small livestock	30,710	39,083	59,810	96,118	55,934	18,945	41,539	50,725	141,688	62,428
Milk	31,893	16,550	35,060	116,891	49,065	2,909	17,511	18,212	187,282	55,458
Poultry	23,744	33,307	46,918	68,445	42,821	13,778	29,868	158,004	57,612	64,307
Cassava	9,529	27,290	46,475	75,648	39,371	631	1,700	4,828	10,523	4,360
Mixed beans	1,771	11,948	39,161	95,239	36,294	1,900	11,619	43,867	71,302	31,712
Rice	2,378	6,974	23,784	44,929	19,182	2,280	12,589	26,843	43,253	20,938
S/potatoes	5,473	12,311	24,242	27,944	17,382	1,845	10,123	25,912	38,235	18,763
I/potatoes	0	4,006	3,102	50,575	13,996	0	0	2,366	10,000	3,040
Sunflower	96	626	5,941	42,411	11,873	0	1,646	4,270	18,379	5,967
Soybeans	0	2,805	8,476	35,321	11,356	94	590	4,612	21,424	6,567
Millet	519	2,575	11,333	23,640	9,329	434	2,715	4,721	9,703	4,327
Eggs	241	697	23,069	1,869	6,466	5,636	442	23,308	4,565	8,506
Sorghum	707	2,358	8,062	10,986	5,456	135	1,899	1,103	2,904	1,483
Fish	0	112	3,437	2,173	1,412	0	447	2,115	1,150	916
Green beans	266	514	1,376	3,207	1,317	146	356	354	196	261
Cowpeas	56	49	1,001	745	456	16	201	604	3,518	1,066
Coffee	0	102	0	0	27	0	0	0	0	0
Livestock and products*	118,721	143,598	233,742	498,370	245,370	114,769	221,078	417,923	690,729	399,965
Total	404,831	685,425	1,287,446	4,086,217	1,585,089	249,272	571,639	1,088,147	3,870,165	1,423,823

Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008 and authors' computations.

* This is the sum of cattle, small livestock, milk, and poultry put here for illustrative purposes and is not repeated into the 100.0% total share.

Table 7. Percent Share of Smallholder Agricultural Sales in 2003/4 and 2007/8 Seasons by Farm Size Quartile

Agricultural sales	2003/4					2007/8				
	Cultivated land quartile					Cultivated land quartile				
	1 Least	2	3	4 Most	Total	1 Least	2	3	4 Most	Total
Maize	6.9	14.0	17.3	27.0	22.3	14.3	20.3	21.9	38.6	32.5
Horticulture	43.3	26.9	16.5	17.9	20.3	55.5	34.9	18.4	20.9	23.4
Cotton	4.1	14.9	17.7	18.8	17.2	0.1	3.6	9.6	9.8	8.7
Cattle	15.9	10.4	9.9	8.2	9.2	8.9	13.6	10.8	10.4	10.7
Tobacco	1.0	5.0	6.4	7.4	6.5	0.0	0.2	0.6	1.1	0.9
Groundnuts	2.4	5.1	5.7	3.7	4.2	1.6	4.0	4.7	3.0	3.4
Small livestock	7.6	5.7	4.6	2.4	3.5	7.6	7.3	4.7	3.7	4.4
Milk	7.9	2.4	2.7	2.9	3.1	1.2	3.1	1.7	4.8	3.9
Poultry	5.9	4.9	3.6	1.7	2.7	5.5	5.2	14.5	1.5	4.5
Cassava	2.4	4.0	3.6	1.9	2.5	0.3	0.3	0.4	0.3	0.3
Mixed beans	0.4	1.7	3.0	2.3	2.3	0.8	2.0	4.0	1.8	2.2
Rice	0.6	1.0	1.8	1.1	1.2	0.9	2.2	2.5	1.1	1.5
S/potatoes	1.4	1.8	1.9	0.7	1.1	0.7	1.8	2.4	1.0	1.3
I/potatoes	0.0	0.6	0.2	1.2	0.9	0.0	0.0	0.2	0.3	0.2
Sunflower	0.0	0.1	0.5	1.0	0.7	0.0	0.3	0.4	0.5	0.4
Soybeans	0.0	0.4	0.7	0.9	0.7	0.0	0.1	0.4	0.6	0.5
Millet	0.1	0.4	0.9	0.6	0.6	0.2	0.5	0.4	0.3	0.3
Eggs	0.1	0.1	1.8	0.0	0.4	2.3	0.1	2.1	0.1	0.6
Sorghum	0.2	0.3	0.6	0.3	0.3	0.1	0.3	0.1	0.1	0.1
Fish	0.0	0.0	0.3	0.1	0.1	0.0	0.1	0.2	0.0	0.1
Green beans	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Cowpeas	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Coffee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Livestock and products *	29.3	21.0	18.2	12.2	15.5	46.0	38.7	38.4	17.8	28.1 ⁱ
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008 and authors' computations.

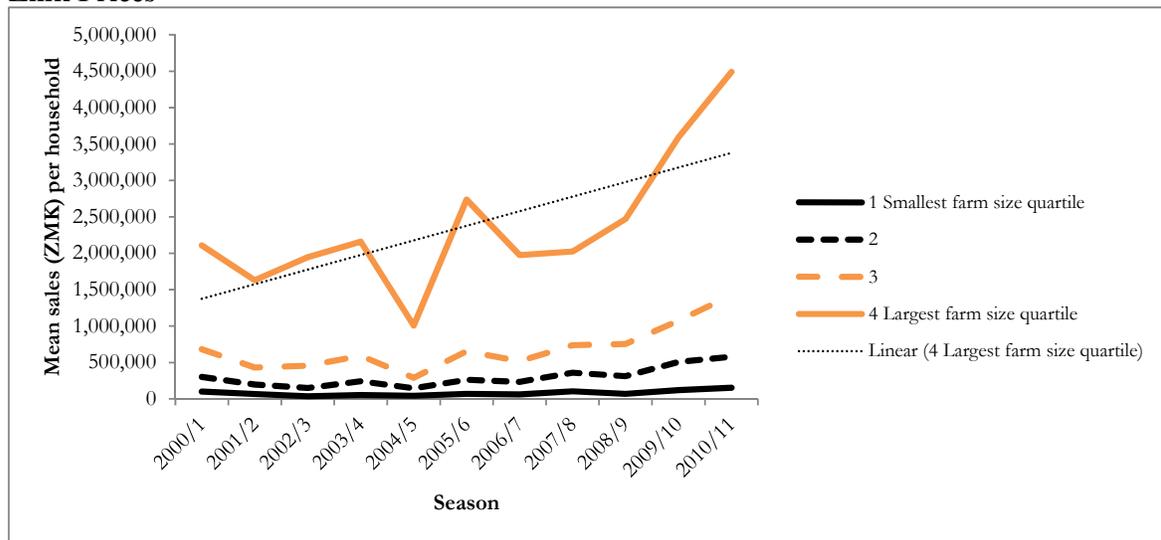
* This is the sum of cattle, small livestock, milk, and poultry put here for illustrative purposes and is not repeated into the 100.0% total share.

Though the absolute mean horticultural sale among smallholders in the least farm size quartile were much less compared to that of their counterparts in the higher farm size quartiles, this was the most important sale in both seasons accounting for 43% and 56% respectively. The main five sales items among smallholders in the least farm size quartile in the 2003/4 season were horticulture followed by cattle, milk, small livestock, and maize accounting for 82% of all the sales. The list changed in the 2007/8 season to horticulture, maize, cattle, small livestock and poultry accounting for 92% of all sales.

Having examined the relative importance of the different agricultural sales per smallholder farm size based on 2003/4 and 2007/8 season, we now look at the different attributes of smallholder crop sales based on CFS data for the past eleven seasons. Details of smallholders mean sales for the various crops at constant 2011 Zmk price per farm size quartile are shown in Appendix 4 while those of the proportion of smallholders selling are given in Appendix 5. This section looks at sales and proportion of households selling per farm size quartile of all crops, maize, and cotton as the main crops.

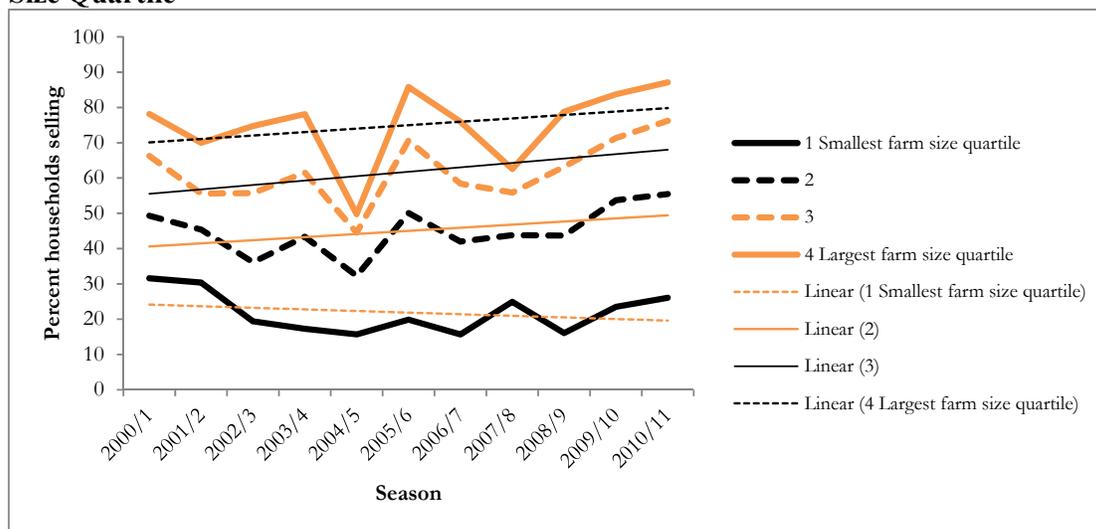
Analysis shows that smallholders in the largest farm size quartile have accounted for 69% of all the crop sales over the period from 2000/1 to 2010/11 while the least, second and third quartiles accounted for only 2%, 9% and 20% respectively. The mean annual sales at constant 2011 Zmk prices were Zmk80,233, Zmk299,670, Zmk692,594, and Zmk2,376,707 for the respective farm size quartiles. Figure 15 shows that the crop sales have been largely increasing mostly among the smallholders in the largest farm size quartile. While the proportion of smallholders selling at least one crop has been increasing in the second up to the largest farm size quartile, it has been declining for those in the bottom farm size quartile (Figure 16).

Figure 15. Trends in Smallholder Crop Sales per Farm Size Quartile at Constant 2011 Zmk Prices



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

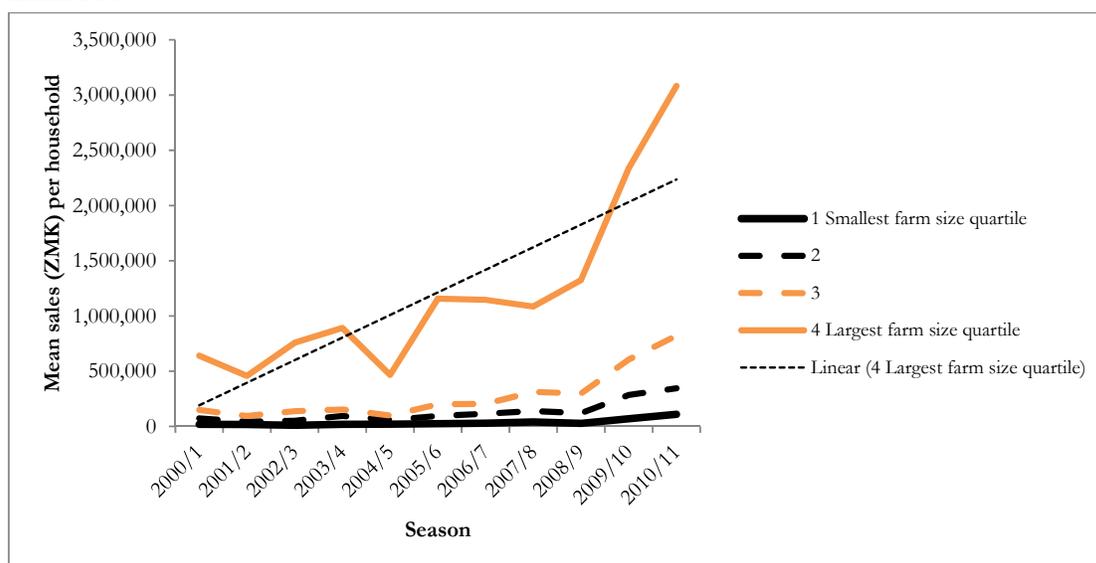
Figure 16. Trends in Proportion of Smallholder Households Selling Crops by Farm Size Quartile



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

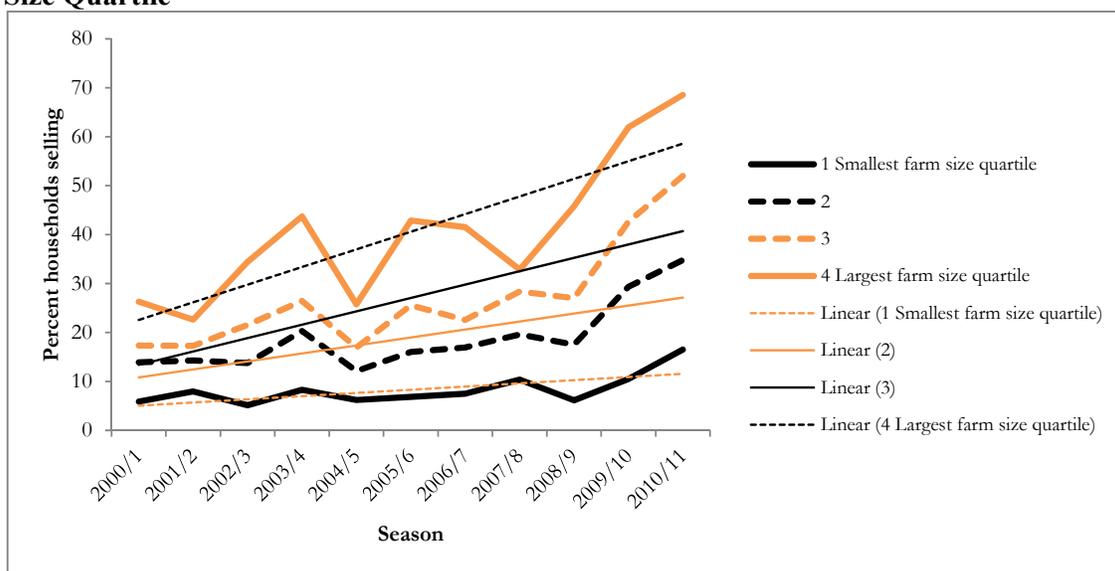
With regard to maize, the largest farm size quartile accounted for 73% of the sales with least farm size quartile accounting for 2%, the second 7%, and the third 17%. The mean sales per household at constant 2011 Zmk prices for the respective farm size quartiles were Zmk35,197, Zmk129,033, Zmk279,894, and Zmk1,213,603. As is the case with all crops, maize sales were largely increasing the most among households in the largest farm size quartile as is shown by Figure 17. Only 8% of the smallholders in the least farm size quartile sold maize compared to 19%, 27%, and 41% in the second, third, and largest farm size quartile respectively. The proportion of smallholders selling maize has increased most in the largest and least in the least farm size quartile (Figure 18).

Figure 17. Trends in Smallholder Maize Sales per Farm Size Quartile at Constant 2011 Zmk Prices



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

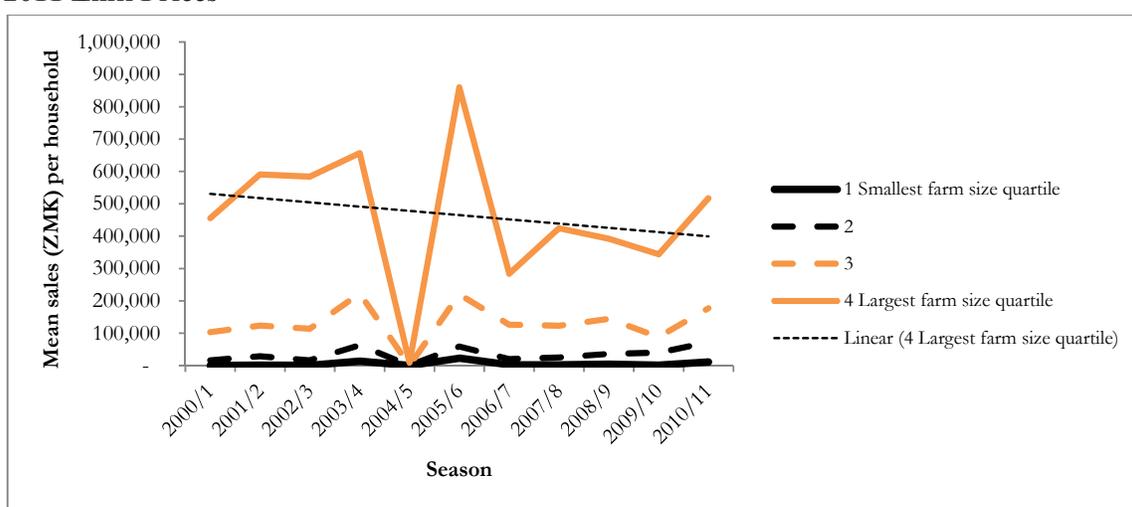
Figure 18. Trends in the Proportion of Smallholder Households Selling Maize by Farm Size Quartile



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

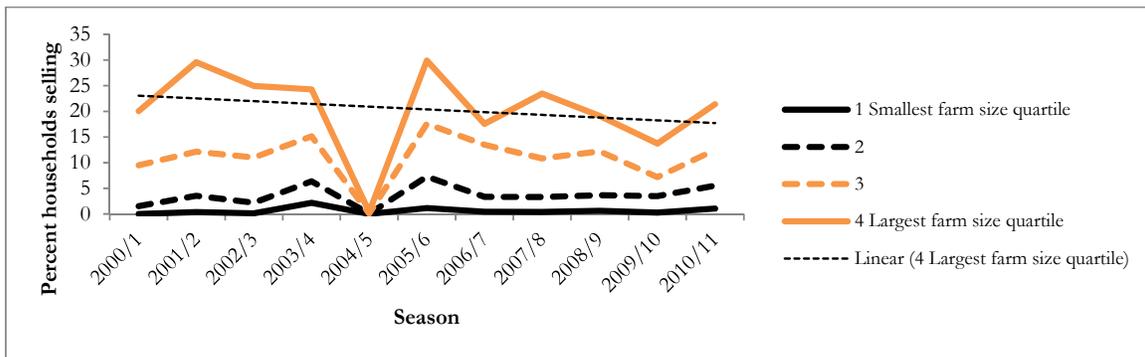
The situation was similar with cotton, as an example of one of the major smallholder cash crops; in as far as the differential smallholder commercialization between the farm size quartiles is concerned. The least farm size quartile accounted for less than 1% of the sales while the second one accounted for 5%, the third 21%, and the largest 73%. Unlike the case with maize, however, cotton sales have been declining the most among smallholders in the largest farm size quartile (Figure 19). The situation was similar with regard to the proportion of smallholders selling cotton (Figure 20).

Figure 19. Trends in Smallholder Cotton Sales per Farm Size Quartile at Constant 2011 Zmk Prices



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

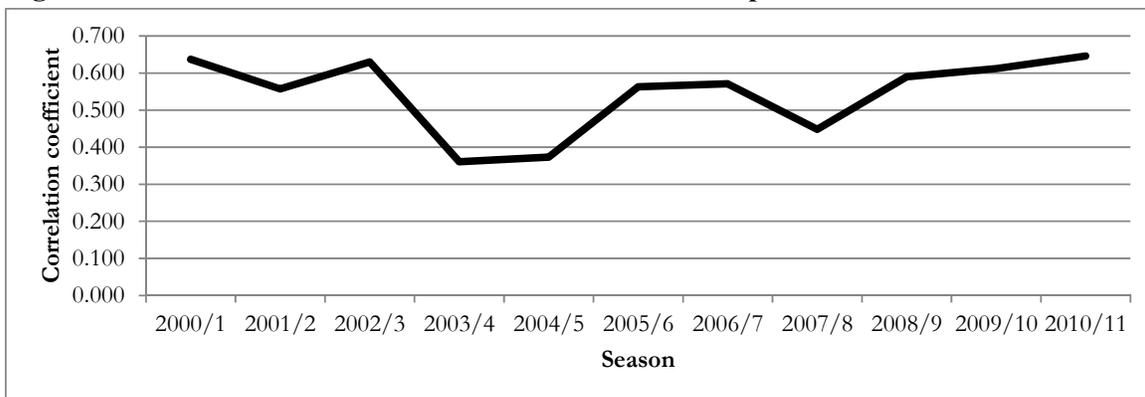
Figure 20. Trends in the Proportion of Smallholder Households Selling Cotton by Farm Size Quartile



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

The situation was similar with most of the crops, but overall, the value of crop sales is found to be significantly and positively related to farm size (Figure 21).

Figure 21. Trends in Correlation Coefficient between Crop Sales and Farm Size



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

4. SUMMARY OF KEY ISSUES AND POLICY IMPLICATIONS

The foregoing analysis highlights six major findings:

- First, the degree of smallholder commercialization in Zambia as measured by household crop sales, the proportion of households selling crops and, indeed, the Household Commercialization Index, has been generally rising over the last eleven seasons. This increase is attributed mostly to increase in maize sales as a result of favourable weather and Government input and output market subsidy programmes, which has made maize production and marketing more attractive to the smallholders.
- Second, the rise in all indicators of smallholder commercialization over time reflects major increases among households in the top farm size quartile. Modest increases in agricultural commercialization have been registered by farmers in the second and third farm size quartiles. By contrast, almost no increases have been registered in the proportion of households selling crops or animal products and the value of farm sales among the 25% of Zambia farmers in the bottom farm size quartile. Clearly, the recent growth in agricultural production and marketed output has been driven by farmers in the top farm size category.
- Third, off-farm income is not a significant alternative income source for the majority of smallholder households in Zambia, and especially not for the most land-constrained ones. While off-farm income makes up a fairly sizeable portion of total income overall, this is highly concentrated among a relatively small proportion of households. Only 27% and 40% of the smallholder households in Zambia earned off-farm income of at least Zmk1 million per annum at 2011 prices in 2003/04 and 2007/08 respectively.
- Fourth, in the absence of a dynamic non-farm engine of growth to pull rural households off their farms, then at least in the medium-run and perhaps the long-run, broad-based agricultural productivity growth will be crucial for structural transformation and poverty reduction. This implies that increasing farm size for the land constrained households would be one of the most promising ways to allow them to raise their agricultural incomes. Keeping all other factors constant, increasing household farm size by 1 hectare is associated with an increase in agricultural sales of 29% for all households in general, 788% for the households in the bottom farm size quartile, 319% for those in the second farm size quartile, 62% for those in the third, and only 4% for those in the top farm size quartile. The mean household farm size is 0.424 ha, 1.098 ha, 1.976 ha and 6.576 ha for the respective farm size quartiles (categories).
- Fifth, the increase in maize based smallholder commercialization in recent years has been achieved at the expense of crop diversification, as smallholders are moving out of growing other cash and food crops into maize. This has hindered progress toward achieving the government's policy objective of diversification of the agricultural sector.
- Sixth, in spite of the above, only a minority of smallholder households in Zambia account for most of the maize sales. Evidence has shown that over the period 2000/01 to 2010/11 the proportion of smallholder households accounting for the top 50% of the value of maize sales has ranged from 1.3% to 8.6% with an average of 3.6% over the entire period. The proportion of those accounting for the rest of the maize sales ranged from 13.0% to 34.1% with an average of 19.9%, and the proportion of those not selling ranged from 57.3% to 85.5% with an average of 76.5%. Clearly, this shows that the maize

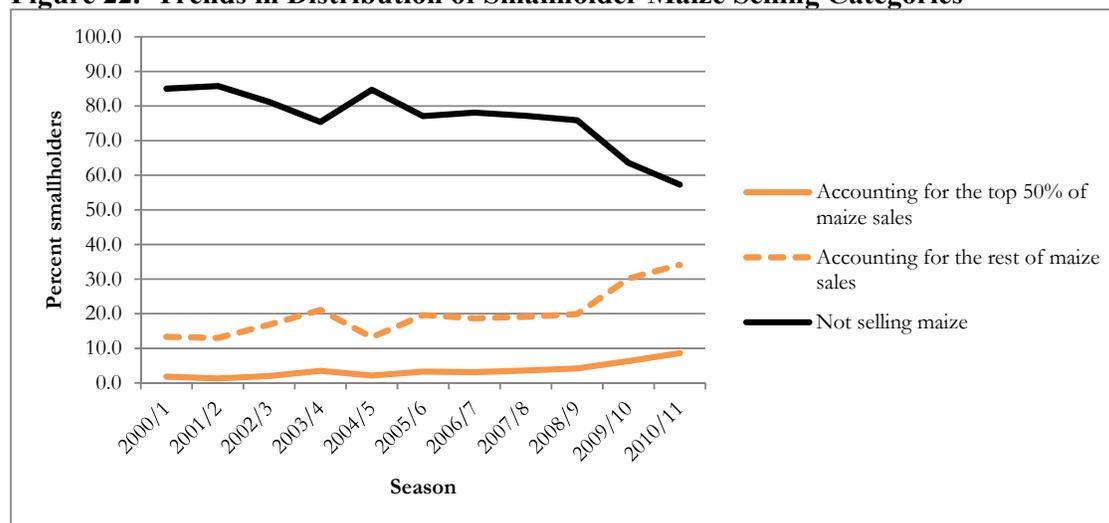
commercialization has only benefited about a quarter of the smallholder households. The proportion of smallholder households not selling maize has declined slightly in the last two seasons from about 76% in 2008/9 to 64% in 2009/10 to 57% in 2010/11, but the figure *is still very high* (see Figure 22).

In conclusion, smallholder commercialization based on increased price and subsidy incentives will tend to mainly benefit the farmers with relatively large farms. Any measures promoting increased crop commercialization should go hand in hand with those aimed at increasing access to land for the more land-constrained smallholders. The fact that very little change in rural poverty rates has been registered in the past six years in spite of massive public resources having been spent on Government poverty reduction programmes such as FISP and FRA marketing to raise food production calls for re-orientation of these programmes.

In addition: the promotion of certain agricultural support activities that feature prominently in the activities of the more land constrained smallholders such as horticulture, small livestock and poultry, would go a long way in improving smallholders' meaningful participation in agricultural markets. Unfortunately data on such smallholder sales are not contained in the CFS, and hence these activities cannot be monitored, nor trends be established, using conventional Government monitoring systems. Government intentions to cover these under the rejuvenated annual PHS should be lauded and supported, as these data will go a long way in monitoring broad based smallholder commercialization and offer timely opportunities for policy actions.

And last, but not least, this analysis also shows that improving access to land among the most land-constrained smallholder households would be a seemingly effective way to reduce poverty as a very small incremental addition to land access is associated with a large relative rise in commercialization and consequently in income. This calls for basic public investments in feeder roads linked to trunk highways, health care facilities, schools, electrification, etc. to induce voluntary migration and open up more land for cultivation in currently underutilized yet agro-ecologically suitable areas of the country.

Figure 22. Trends in Distribution of Smallholder Maize Selling Categories



Source: MAL/CSO Crop Forecast Surveys 2000/1 to 2010/11 and authors' computations.

APPENDICES

A1. Summary Statistics of Variables Used in the Regression Model of Agricultural Sales

Variable	N	mean	sd	min	p1	p5	p10	p25	p50	p75	p90	p95	p99	max
Sales (Zmk)	13,401	1,447,662	5,563,631	0	0	0	0	0	231,765	1,054,725	,140,000	5,806,010	19,000,000	207,000,000
Off farm income (Zmk)	13,401	2,149,807	8,261,762	0	0	0	0	0	15,000	,298,000	,850,000	10,300,000	29,700,000	300,000,000
Value of assets (Zmk)	13,401	3,896,177	15,000,000	0	0	0	0	2,381	90,000	,623,600	,370,000	8,200,000	7,700,000	41,000,000
Farm size (Ha)	13,401	2.8	4.6	0.0	0.0	0.3	0.4	0.9	1.6	3.1	6.0	8.4	20.2	60.0

A2. Agricultural Sales in 2003/4 at Constant 2011 Zmk Prices per Percentile of Farm Size

	Percentile of farm size																			
	1 Least	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20 Most
Maize	2,663	6,091	65,432	37,136	37,509	60,435	66,216	81,595	133,878	120,241	144,259	163,149	203,760	227,759	345,690	354,849	373,811	673,389	1,081,410	2,947,619
Sorghum	0	0	494	2,066	289	3,416	1,049	4,129	1,896	2,843	4,065	1,469	4,965	6,021	21,745	6,571	12,111	1,593	2,410	30,771
Rice	0	4,394	0	18	6,817	1,506	9,414	9,436	10,661	3,479	9,510	15,806	18,440	30,504	38,900	9,474	27,406	26,072	8,139	146,420
Millet	239	135	0	1,510	106	1,960	3,257	1,026	1,594	4,041	4,633	12,357	6,023	10,754	21,123	11,490	23,361	22,808	10,732	47,072
Sunflower	0	0	0	219	183	1,735	134	0	124	1,091	1,353	3,831	3,427	7,475	11,822	17,908	17,087	34,198	41,776	98,680
Groundnuts	864	3,700	2,433	14,217	22,560	20,324	34,069	28,596	32,652	53,802	39,203	99,520	56,238	86,063	81,571	93,495	106,542	130,988	171,103	251,736
Soybeans	0	0	0	0	0	1,427	1,072	2,784	2,936	5,738	1,424	12,906	4,260	13,067	8,915	24,302	4,248	28,543	47,695	72,761
Cotton	0	1,436	4,013	38,994	23,964	59,140	111,685	117,319	58,418	173,846	73,487	228,797	173,082	377,077	229,402	432,663	357,856	703,329	937,118	1,389,447
I/potatoes	0	0	0	0	0	2,592	0	5,940	10,897	852	0	2,536	1,702	830	9,845	3,817	25,542	8,363	105,402	106,841
Tobacco	0	0	0	0	22,281	3,098	14,172	0	46,456	81,633	11,184	151,162	5,160	96,959	134,451	328,086	448,390	148,464	312,013	266,689
Mixed beans	73	361	0	3,479	3,694	4,851	12,859	13,866	15,062	12,382	23,924	34,934	39,822	27,888	67,074	49,420	52,733	67,154	126,351	177,596
Green beans	256	0	1,481	54	107	131	0	19	1,762	125	631	3,477	2,057	191	978	338	157	14,109	0	1,150
Cowpeas	0	0	0	194	0	0	0	0	188	0	867	0	0	1,728	1,988	729	280	0	1,332	1,437
Coffee	0	0	0	0	0	0	0	1,236	0	0	0	0	0	0	0	0	0	0	0	0
S/potatoes	0	1,937	334	5,393	18,539	14,065	9,028	31,054	8,435	12,153	7,718	19,620	39,802	22,627	29,652	41,718	21,412	21,759	25,132	31,998
Cassava	1,045	6,043	5,869	12,108	19,709	23,826	16,458	32,164	37,672	28,295	69,764	41,099	30,831	30,013	64,478	33,601	37,382	62,606	105,074	137,099
Horticulture	84,759	85,609	172,928	271,131	223,791	254,046	118,200	197,632	118,676	275,229	250,400	221,080	130,234	144,469	321,868	282,997	253,307	197,941	1,062,977	1,839,257
Milk	23,259	1,675	0	9,961	137,883	557	7,079	0	19,892	42,529	22,203	16,438	28,214	34,967	66,899	32,107	250,113	28,873	9,821	233,322
Eggs	0	186	4	558	184	179	309	24	1,024	1,425	1,616	590	116,487	526	3,345	4,814	1,233	2,092	429	1,193
Fish	0	0	0	0	0	0	0	0	428	0	0	19,037	0	87	0	967	582	313	6,684	2,491
Cattle	82,194	54,475	57,992	50,448	89,776	59,634	62,716	12,505	74,019	108,736	185,379	90,132	155,811	64,613	156,467	193,404	350,237	218,057	234,387	641,507
Poultry	12,481	19,064	12,804	29,264	38,420	28,990	32,512	22,870	40,573	33,083	50,580	39,678	52,757	41,823	50,692	68,751	43,129	75,641	58,337	97,505
Small livestock	14,568	23,639	17,982	18,223	81,888	56,106	20,656	15,183	45,958	46,597	78,946	44,171	53,616	60,334	62,251	79,808	91,975	93,173	80,010	132,237
Livestock/products	109,242	97,178	88,778	97,935	210,084	144,730	115,884	50,558	160,550	188,416	314,906	173,981	262,184	166,770	269,410	341,963	485,341	386,871	372,734	871,249
Total	222,401	208,745	341,765	494,974	727,699	598,021	520,884	577,378	663,200	1,008,121	981,144	1,221,791	1,126,688	1,285,774	1,729,155	2,071,309	2,498,896	2,559,464	4,428,331	8,654,829

Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008.

A3. Agricultural Sales in 2007/8 at Constant 2011 Zmk Prices per Percentile of Farm Size

	Percentile of farm size																			
	1 Least	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20 Most
Maize	0	7,701	28,740	66,881	65,898	49,072	96,467	122,954	67,783	222,006	181,248	194,400	187,377	268,028	337,316	460,732	429,811	780,292	1,285,463	4,201,063
Sorghum	0	0	269	425	0	0	133	8,648	2,987	45	1,159	0	678	2,640	694	495	3,722	5,118	268	4,662
Rice	0	3,880	1,233	2,065	5,310	10,916	5,915	0	7,596	34,009	6,460	12,441	34,599	26,868	44,079	33,568	25,807	22,155	48,843	81,623
Millet	0	203	149	534	1,138	897	3,986	4,991	1,378	2,131	4,222	2,581	6,771	5,371	3,613	6,682	7,387	10,760	13,836	9,781
Sunflower	0	0	0	0	0	597	1,585	6,308	738	81	1,174	10,294	2,439	5,858	3,284	4,997	10,076	14,254	18,526	41,297
Groundnuts	0	6,071	2,617	4,162	8,655	13,707	32,654	15,732	29,074	19,353	38,388	30,910	55,466	60,531	59,600	75,578	99,992	100,212	102,819	196,879
Soybeans	0	0	0	0	379	0	142	2,839	575	66	3,727	10,131	1,309	4,848	5,133	5,431	19,188	12,592	37,544	30,999
Cotton	0	0	0	1,711	84	6,274	4,225	57,583	29,828	19,649	54,729	109,939	59,666	111,821	182,020	140,886	257,523	308,411	405,875	742,926
I/potatoes	0	0	0	0	0	0	n	0	0	0	615	0	1,820	0	8,280	2,441	0	7,532	22,064	17,070
Tobacco	0	0	0	0	0	0	0	8,706	0	0	4,658	18,801	0	0	11,434	36,348	48,720	28,470	18,255	82,720
Mixed beans	0	623	2,741	2,710	3,194	10,507	8,612	5,314	22,394	11,969	30,439	66,016	33,558	59,847	35,619	37,117	50,751	70,103	83,822	109,845
Green beans	0	0	0	740	0	297	297	0	1,145	104	0	0	1,107	292	105	16	572	0	201	188
Cowpeas	0	0	0	82	0	102	293	683	0	0	187	0	508	1,519	516	857	234	4,779	6,685	4,842
Coffee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S/potatoes	0	1,245	1,520	2,050	4,224	9,921	11,874	2,740	17,943	7,206	33,764	12,599	24,651	33,906	21,549	13,050	38,471	59,924	48,384	31,465
Cassava	0	960	318	44	1,946	592	1,773	0	3,554	2,196	4,807	8,776	2,871	5,579	3,683	24,102	2,986	9,817	10,092	6,398
Horticulture	105,774	83,171	107,558	81,647	261,781	188,077	202,325	347,953	125,296	162,472	161,761	225,482	160,354	208,479	250,415	378,835	418,190	221,671	1,834,277	1,152,351
Milk	0	0	416	7,947	5,060	4,663	1,726	756	1,055	69,849	7,334	4,336	23,532	23,057	25,271	18,920	77,969	54,053	77,573	654,164
Eggs	94	103	28,936	374	213	825	222	660	418	273	1,006	1,295	278	2,788	101,340	1,368	3,798	2,721	6,911	7,630
Fish	0	0	0	0	0	0	1,614	0	95	0	1,165	2,127	4,424	272	2,195	0	4,444	297	0	990
Cattle	17,041	48,379	23,094	19,149	21,376	21,243	43,649	65,599	51,571	190,679	71,256	119,105	79,463	81,346	230,842	164,081	420,006	197,244	344,192	842,475
Poultry	8,692	17,280	10,977	21,224	14,604	20,310	55,336	19,023	22,057	20,822	30,034	22,534	30,828	24,203	622,345	39,266	36,817	35,655	44,524	124,279
Small livestock	12,411	12,381	24,380	27,465	17,608	42,805	37,004	27,058	42,136	55,165	40,672	35,768	55,646	51,541	62,298	102,932	105,140	157,307	135,749	200,182
Livestock/products	131,827	173,388	103,945	119,888	93,800	124,793	212,746	177,518	163,515	373,310	178,289	211,003	220,775	215,830	1,127,845	366,266	673,778	436,845	605,452	1,253,308
Total	144,011	181,997	232,948	239,211	411,470	380,804	509,833	697,547	427,068	817,810	678,806	887,535	766,588	978,794	2,009,795	1,547,702	2,061,603	2,103,366	4,545,903	8,543,829

Source: CSO/MAL/IAPRI Supplemental Surveys, 2004 and 2008

A4. Crop Sales at Constant 2011Zmkprices per Quartile of Farm Size

All crops

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	100,765	67,282	37,621	52,658	42,492	69,199	62,169	104,076	70,687	120,775	154,842
2	302,439	196,951	150,820	242,862	146,918	263,862	234,405	359,478	312,504	507,385	578,746
3	681,554	432,506	456,831	591,169	288,850	656,056	518,597	738,608	755,196	1,075,388	1,423,775
4 Most	2,108,350	1,629,394	1,946,380	2,160,185	1,006,464	2,737,104	1,975,741	2,025,418	2,471,259	3,593,310	4,490,177
Total	798,277	581,533	647,913	761,718	371,181	931,555	697,728	806,895	902,412	1,324,214	1,661,885

Maize

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	18,380	17,115	11,473	19,248	20,352	23,878	30,286	40,659	28,010	68,628	109,140
2	73,441	41,628	51,391	94,962	58,881	94,762	115,473	138,972	120,013	284,892	344,951
3	149,676	94,719	138,067	152,910	99,452	200,986	204,598	312,667	298,032	606,309	821,417
4 Most	640,564	457,532	757,464	892,285	466,710	1,157,861	1,146,921	1,085,081	1,326,043	2,335,929	3,083,245
Total	220,515	152,748	239,599	289,851	161,349	369,372	374,320	394,345	443,025	823,940	1,089,689

Cotton

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1	0	955	392	13,300	0	22,825	2,338	2,368	4,166	1,629	11,130
Least											
2	16,096	28,662	16,081	63,006	277	58,602	19,917	24,897	36,214	39,758	72,318
3	103,360	123,543	113,777	223,219	262	220,029	126,315	123,202	144,170	88,222	177,329
4 Most	455,589	590,626	584,002	656,657	9,066	860,057	283,496	424,231	392,053	343,739	517,317
Total	143,761	185,946	178,563	239,045	2,401	290,378	108,016	143,674	144,151	118,337	194,523

Tobacco

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	0	266	1,045	2,839	0	10	0	10,765	14,219	4,078	7,774
2	6,967	8,380	2,001	16,032	2,003	16,907	8,733	54,240	34,736	26,203	45,990
3	33,626	46,046	14,147	67,974	123	28,176	27,986	81,660	116,789	86,202	180,575
4 Most	138,215	163,575	128,658	214,550	3,387	198,210	63,616	99,886	229,868	280,866	315,718
Total	44,702	54,567	36,463	75,349	1,378	60,826	25,084	61,638	98,903	99,337	137,514

Sunflower

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	220	236	0	1,238	151	121	223	0	0	0	0
2	3,045	1,563	563	2,168	1,288	762	870	0	0	0	0
3	10,638	8,349	2,779	14,872	3,901	7,637	4,770	0	0	0	0
4 Most	104,092	64,286	29,245	30,336	11,196	21,975	14,691	0	0	0	23
Total	29,499	18,609	8,147	12,153	4,134	7,624	5,139	0	0	0	6

Soybeans

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	106	0	3	133	852	626	44	0	0	0	317
2	1,163	179	229	4,620	5,418	7,158	3,057	0	0	0	2,030
3	5,729	4,570	3,279	6,203	13,243	12,583	9,265	0	13	0	9,422
4 Most	25,887	23,350	25,387	35,265	89,849	75,004	47,273	0	225	0	45,709
Total	8,221	7,025	7,225	11,555	27,341	23,843	14,910	0	59	0	14,370

Mixed beans

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1	14,254	6,878	1,036	903	4,200	4,247	597	7,675	2,513	4,846	3,792
Least											
2	41,102	31,836	8,198	8,888	14,274	14,115	7,647	22,706	19,905	22,626	23,675
3	91,138	40,700	34,592	21,467	34,220	36,266	17,187	58,368	36,391	56,081	42,964
4	171,883	112,237	75,614	78,966	133,701	136,883	103,026	144,859	142,190	149,275	134,080
Most											
Total	79,594	47,913	29,860	27,556	46,599	47,878	32,114	58,402	50,250	58,207	51,127

Groundnuts

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	40,911	28,986	15,343	5,147	9,952	7,585	6,194	21,040	9,013	19,789	12,273
2	83,279	47,181	53,006	28,777	44,676	33,640	25,598	52,966	51,883	74,312	47,954
3	161,450	60,485	93,394	54,730	98,215	84,335	56,982	80,380	102,288	130,738	118,295
4 Most	322,163	122,742	226,639	156,057	221,564	163,805	146,503	164,172	241,259	295,222	237,061
Total	151,951	64,848	97,095	61,178	93,602	72,341	58,819	79,639	101,111	130,015	103,896

Bambara nuts

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least		0	38	12	333	689	660
2		0	99	643	2,234	2,895	2,253
3		592	165	832	858	992	3,821
4 Most		2,043	1,450	4,711	2,243	4,221	9,344
Total		659	438	1,549	1,417	2,199	4,020

Cowpeas

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	74	0	0	0	0	0	0	0	0	6	0
2	298	0	476	946	58	0	314	66	976	45	0
3	901	0	180	1,889	785	657	363	430	555	613	142
4 Most	7,765	0	1,030	5,657	974	2,672	1,478	3,184	6,401	1,799	450
Total	2,260	0	421	2,123	454	832	539	920	1,983	616	148

Rice

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	2,593	2,017	832	1,731	410	1,254	951	6,851	4,907	6,615	3,944
2	20,835	9,510	1,273	2,959	3,390	4,611	7,695	18,540	14,169	13,182	19,373
3	24,575	14,713	6,594	3,145	12,660	7,021	14,043	22,012	15,935	36,957	27,363
4 Most	68,022	24,531	14,386	8,095	11,200	20,338	34,934	24,838	50,492	53,875	64,279
Total	29,006	12,693	5,771	3,983	6,915	8,306	14,406	18,060	21,376	27,657	28,740

Sweet potatoes

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	18,699	6,908	6,686	4,568	5,577	4,215	2,085	6,022	6,640	11,647	5,215
2	38,112	11,152	12,644	10,215	12,595	19,586	8,776	17,444	27,271	29,645	15,070
3	55,385	17,053	34,085	14,347	13,492	24,627	18,860	23,290	28,904	46,060	28,314
4 Most	105,821	29,184	72,243	25,287	25,710	34,176	31,003	34,385	50,124	71,683	46,223
Total	54,504	16,074	31,415	13,604	14,343	20,651	15,181	20,285	28,235	39,759	23,706

Sorghum

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	367	696	245	351	441	409	167	5	170	467	172
2	2,806	4,755	585	1,497	1,011	390	687	747	1,055	3,207	1,449
3	3,619	6,368	2,964	2,005	2,432	2,434	1,026	836	1,716	3,501	1,813
4 Most	10,236	12,069	7,511	7,578	7,437	4,355	4,632	2,484	4,573	10,294	4,378
Total	4,257	5,972	2,826	2,858	2,830	1,897	1,628	1,018	1,879	4,367	1,953

Millet

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	3,672	3,225	565	1,448	426	493	580	1,437	360	1,248	668
2	15,200	10,902	4,374	1,879	2,908	1,975	3,826	5,199	3,305	9,572	2,378
3	25,950	15,416	11,611	10,947	8,104	8,182	7,258	14,530	8,816	13,883	9,025
4 Most	29,777	27,372	18,585	31,428	21,432	22,134	23,942	13,752	21,461	22,959	22,272
Total	18,650	14,229	8,784	11,426	8,217	8,196	8,902	8,730	8,486	11,915	8,586

Cassava

	2003/4	2005/6	2006/7	2007/8
1 Least	1,676	3,391	3,138	6,922
2	6,822	10,943	15,477	21,225
3	7,751	17,065	15,427	18,787
4 Most	10,456	29,974	46,495	18,291
Total	6,677	15,343	20,134	16,306

*****Note: sales were not forecasted in the missing seasons.

Irish potatoes

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	1,489	0	0	0	131	0	238	0	0	53	7
2	97	1,203	0	0	126	152	382	241	82	0	1,235
3	15,508	544	0	0	1,241	5,389	964	1,587	596	806	1,660
4 Most	28,335	1,891	0	0	874	3,974	1,345	8,011	2,350	1,637	4,847
Total	11,357	909	0	0	593	2,379	732	2,460	757	624	1,937

Paprika

	2002/3	2004/5	2005/6	2004/5	2006/7	2007/8	2008/9	2009/10	2010/11	2007/8
1 Least	0	74	0	0	0	0	0	0	0	0
2	0	91	15	146	0	0	0	0	0	0
3	452,753	9,711	128	380	0	0	0	0	0	0
4 Most	691,199	7,568	1,084	1,236	0	0	0	0	0	0
Total	381,317	4,361	307	440	0	0	0	0	0	0

Popcorn

	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least				1,108	63
2				1,689	579
3				2,195	1,964
4 Most				16,678	9,018
Total				5,417	2,906

MAL/CSO 2000/1 to 2010/11 Crop Forecast Surveys

A5. Proportion of Smallholders Selling Crops per Quartile of Farm Size

All crops											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	31.61	30.39	19.38	17.26	15.70	19.91	15.68	24.93	16.07	23.49	26.09
2	49.32	45.39	36.13	43.35	32.29	50.09	41.99	43.83	43.68	53.69	55.47
3	66.26	55.61	55.74	61.56	44.52	70.64	58.42	55.87	63.21	71.36	76.23
4 Most	78.14	69.98	74.72	78.14	49.74	85.81	75.95	62.57	78.81	83.73	87.11
Total	56.33	50.34	46.49	50.08	35.56	56.61	48.01	46.80	50.44	58.06	61.23
Maize											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	5.88	7.96	5.14	8.31	6.23	6.85	7.50	10.39	6.15	10.50	16.52
2	13.93	14.30	13.78	20.31	12.11	16.04	16.94	19.60	17.54	29.37	34.80
3	17.35	17.30	21.58	26.47	16.91	25.57	22.57	28.38	27.00	42.64	51.99
4 Most	26.31	22.65	34.44	43.73	25.77	42.90	41.54	32.85	45.79	61.94	68.53
Total	15.87	15.55	18.74	24.70	15.25	22.84	22.14	22.81	24.12	36.11	42.96
Cotton											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.00	.35	.13	2.17	.00	1.14	.45	.38	.63	.27	1.07
2	1.54	3.55	2.20	6.38	.07	7.29	3.35	3.30	3.65	3.49	5.52
3	9.48	12.16	11.00	15.16	.07	17.56	13.48	10.82	12.19	7.18	12.49
4 Most	20.05	29.60	24.94	24.27	.35	29.92	17.56	23.47	19.12	13.71	21.39
Total	7.77	11.41	9.57	11.99	.12	13.98	8.71	9.49	8.90	6.16	10.12
Tobacco											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.00	.07	.06	.18	.00	.00	.00	.16	.30	.27	.01
2	.23	.33	.23	.92	.03	.74	.35	.40	.79	.62	1.03
3	1.13	1.58	.69	2.01	.02	.95	.61	1.09	1.88	1.55	2.67
4 Most	2.70	2.20	2.48	3.91	.20	2.84	.83	1.64	3.22	3.40	3.59
Total	1.02	1.05	.87	1.76	.06	1.13	.45	.82	1.55	1.46	1.82
Sunflower											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.14	.10	.00	.39	.25	.09	.24	.00	.00	.00	.00
2	.98	.79	.50	.58	.94	.72	.65	.00	.00	.00	.00
3	4.00	3.20	1.53	3.42	2.02	3.88	2.65	.00	.00	.00	.00
4 Most	11.00	9.02	6.34	6.92	4.07	7.22	4.58	.00	.00	.00	.03
Total	4.03	3.28	2.09	2.83	1.82	2.98	2.03	.00	.00	.00	.01
Soybeans											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.06	.00	.01	.13	.38	.18	.10	.00	.00	.00	.12
2	.57	.06	.13	2.11	1.92	2.29	1.49	.00	.00	.00	.97
3	1.69	1.35	1.75	2.49	4.33	3.43	2.90	.00	.00	.00	2.21
4 Most	4.59	3.59	4.15	5.66	8.91	8.14	5.73	.00	.05	.00	5.22
Total	1.73	1.25	1.51	2.60	3.89	3.51	2.55	.00	.01	.00	2.13
Mixed beans											

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	3.98	3.06	.78	.65	1.47	1.98	.41	3.21	1.65	1.80	1.82
2	9.24	9.01	3.35	4.29	4.67	5.72	3.73	7.19	6.96	6.75	6.00
3	14.05	10.06	7.93	7.58	9.92	10.99	6.65	11.30	11.70	13.01	10.52
4 Most	16.95	10.84	11.03	12.64	12.72	17.83	14.64	11.22	17.53	16.62	16.36
Total	11.06	8.24	5.77	6.29	7.20	9.13	6.36	8.23	9.46	9.54	8.67

Groundnuts

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	14.12	13.85	8.29	2.68	4.86	4.65	2.85	7.99	4.20	7.38	5.47
2	19.83	16.11	16.22	9.81	13.70	14.95	12.12	16.01	16.80	21.75	17.06
3	28.47	18.60	20.45	15.33	23.67	27.03	19.04	19.93	28.80	33.35	30.65
4 Most	36.51	23.41	30.79	24.61	26.11	34.20	29.76	24.09	38.62	43.43	40.40
Total	24.73	17.99	18.94	13.11	17.09	20.21	15.94	17.01	22.11	26.48	23.40

Cowpeas

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.12	.00	.00	.00	.00	.00	.00	.00	.00	.01	.00
2	.42	.00	.19	.38	.04	.00	.13	.02	.30	.19	.00
3	.63	.00	.14	.91	.30	.37	.22	.22	.64	.25	.17
4 Most	2.46	.00	.63	1.78	.25	1.09	.67	.55	1.46	.65	.32
Total	.91	.00	.24	.77	.15	.36	.25	.20	.60	.28	.12

Bambara nuts

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.00	.05	.02	.12	.34	.66	.23
2	.00	.33	.34	.62	1.12	1.03	.84
3	.19	.37	.35	.27	.54	1.40	1.35
4 Most	.61	.75	1.43	.61	.96	1.72	1.99
Total	.20	.37	.53	.40	.74	1.20	1.10

Rice

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.46	.89	.51	.83	.32	.40	.34	1.31	1.37	1.60	1.08
2	2.06	2.05	.73	.88	1.50	1.11	1.57	1.77	2.66	2.34	3.43
3	1.93	2.33	1.34	1.15	2.42	1.12	1.94	2.08	2.38	3.88	3.12
4 Most	2.95	2.04	.85	1.62	1.51	2.18	1.90	1.15	3.14	2.95	3.60
Total	1.85	1.83	.86	1.12	1.44	1.20	1.44	1.58	2.39	2.69	2.81

Sweet potatoes

	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	12.84	7.70	5.39	2.54	3.86	2.27	1.24	3.95	3.49	4.72	2.36
2	21.33	10.88	7.23	4.67	6.85	7.72	4.51	7.50	9.11	9.17	6.77
3	24.90	11.92	12.51	6.62	4.96	7.56	7.05	7.93	9.00	11.27	7.64
4 Most	27.30	11.95	14.59	8.06	6.48	8.77	8.07	8.59	8.76	12.08	10.14
Total	21.59	10.61	9.93	5.47	5.54	6.58	5.22	6.99	7.59	9.31	6.73

Sorghum											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	.30	.52	.28	.43	.30	.55	.15	.01	.13	.29	.17
2	1.34	1.99	.64	1.16	.86	.54	.53	.40	.55	.70	.74
3	1.83	1.79	1.30	.84	1.11	1.36	.89	.47	.75	.76	.62
4 Most	2.56	2.73	1.99	2.19	1.11	1.71	1.69	.81	1.18	1.79	1.01
Total	1.51	1.76	1.05	1.15	.85	1.04	.81	.42	.65	.88	.63

Millet											
	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
1 Least	2.74	2.68	.72	.73	.70	.37	.72	1.46	.21	.70	.48
2	6.93	6.20	3.80	1.71	2.65	2.09	2.60	2.99	2.59	3.93	1.92
3	8.51	6.79	6.03	5.94	6.11	5.41	3.98	6.25	4.73	4.93	3.84
4 Most	7.11	6.42	6.06	7.73	6.96	7.49	8.79	4.05	7.28	6.80	6.75
Total	6.32	5.52	4.15	4.03	4.11	3.84	4.02	3.69	3.70	4.09	3.25

Cassava											
	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11			
1 Least	.79		4.28	3.42	4.64						
2	1.49		8.12	7.61	7.60						
3	1.99		9.84	8.86	8.30						
4 Most	1.37		13.26	13.33	3.96						

MAL/CSO 2000/1 to 2010/11 Crop Forecast Surveys.

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