FOOD SECURITY RESEARCH PROJECT

Zambian Farmers' Access to Maize Markets

by

Antony Chapoto and T.S. Jayne

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EXECUTIVE SUMMARY

Smallholder farmers' access to markets and agricultural support services has been a major concern of Zambian policy makers. As with many governments in Sub-Saharan Africa, the Zambian government's agricultural policies, particularly for maize, have fundamentally been conceived of as a response to perceived market failure and weak access to markets for rural smallholder farmers. However, the conventional wisdom of poor market access is based on extremely limited empirical evidence. This study is motivated by the need to overcome this paucity of empirical evidence and provide policy makers with an up-to-date assessment of smallholder farmers' market access conditions for maize, the primary food grain in Zambia.

This study uses national representative post-harvest data of 2010/11 marketing season collected during the annual Government of Zambia's Crop Forecast Survey of 2011data to examine the distance traveled by smallholder farmers to the point of maize sale and the number of traders buying maize directly in farmers' villages. The 2009/10 Crop Forecast data is a nationally representative sample of over 14,000 small- and medium-scale farm households. Analysis is also drawn from nationally representative Supplemental Surveys to the Post Harvest Survey, conducted by the Central Statistical Office in earlier years to examine changes over time in famers' market access conditions.

The study highlights five salient findings. First, over 50% of smallholder farmers are within 3 km of a feeder road that is accessible by vehicular transport. This in itself does not ensure good access to markets but allows for clear interpretation of the other main findings. There is a high degree of correlation between the distance traveled to the point of maize sale and the distance to the nearest place where vehicular transport can be accessed. Proximity to feeder roads hence appears to be an important determinant of traders' willingness and ability to enter into otherwise remote areas to provide markets for smallholder farmers' surplus production.

The second main finding is that despite the poor condition of many feeder roads in Zambia, most smallholder farmers either sell their maize directly on their farms or travel very short distances to sell their maize to private buyers. Over 60% of the farmers selling maize to assembly traders sold their maize right on their farms. Another 20% traveled up 3 km or less for their major maize sales transaction. Roughly 10% of farmers, typically those with larger quantities of maize to sell, chose to travel long distances of 30 km or more to sell their maize to larger buyers such as millers and brewers and hence the long distances that they traveled represents a deliberate marketing strategy on their part to bypass assembly traders. Farmers choosing to employ this strategy tended to be located in the same areas as other farmers selling on their farms to assembly traders. Therefore the long distances traveled by about 10% of the smallholder population to sell maize is generally not reflective of severe market access problems, but more indicative of a deliberate marketing strategy. An apparent exception to this conclusion is farmers in some areas of Southern Province, where even those farmers selling to assembly traders faced somewhat longer distances travelled.

A third major finding concerns the degree of competition in village-level maize assembly markets. Smallholder farmers who sold maize indicated that the mean number of traders buying maize directly in their villages during the 2009/10 season was 9.0. The number of assembly traders was statistically significantly higher in areas of surplus maize production and lower in the less productive areas where only a small number of households were surplus maize producers. These findings indicate a reasonable degree of competition in village-level maize buying in most areas of rural Zambia, and that the transport and market failure problems commonly attributed to smallholder conditions in Zambia are much less of an issue

than commonly thought. There are some exceptions however. In about 15% of the areas covered by the survey, the number of assembly traders was below five, but these tended to be maize deficit areas where very little surplus production was generated. Further research is required to obtain a more comprehensive understanding of why some areas of Zambia have few maize traders operating there, but the results of this study can unquestionably rule out distance from the district town and remoteness as a major cause.

The fourth main finding is that the distance traveled from the farm to the point of maize sale was statistically unrelated to the farmers' distance to district town. Hence, distance to the district town appears to be a misleading indicator of farmers' access to private traders and markets. In fact, the distance to the nearest district town was an insignificant variable in models of the price received by farmers selling to private maize traders, the distance traveled by farmers who sell their maize to private traders, as well as in models of the number of traders operating in farmer respondents' villages. These findings indicate that farmers' market access conditions for maize are roughly the same regardless of farmers' degree of remoteness as defined by distance to the nearest district town. As mentioned above, there is a much higher correlation between the distance traveled to the point of maize sale and the distance to the nearest place where vehicular transport can be accessed as well as the percentage of surplus maize producing households in the area.

The fifth major finding is that farmers selling their maize to the Food Reserve Agency (FRA) are more likely to be located close to a district town. Over 57% of all smallholder households selling to FRA were located within 9 km of a district town. The probability that the FRA buys maize from a farmer diminishes as the household's location becomes further away from the district towns. This finding contrasts markedly with the commonly held contention that the FRA's role is crucial in providing market access to farmers in the remote areas where the private sector will not go. In fact, the vast majority of maize sales by farmers in remote areas (over 30 km from the district town) are by assembly traders. Ironically, these traders are often derogatorily branded as 'briefcase buyers' but it appears that they provide a valuable service to farmers in remote areas. Clearly, if these traders were not operating in the remote areas, a large proportion of smallholder farmers in Zambia would face much more serious problems in marketing their maize than they currently do.

Regarding the modeling of market access conditions by researchers, the findings of this study question the use of conventional market access measures such as the distance or travel time from the farm to the nearest district town. Such conceptualizations of market access do not take into consideration the broader range of factors that determine the degree to which traders operate in rural areas and the degree of competition among them.

Turning to policy implications, the findings of this study seriously question the notion that state operations are necessary in all remote rural areas of Zambia to provide smallholder farmers with viable access to strategic food markets. Certainly smallholder farmers continue to suffer from a variety of constraints to smooth marketing of their products. Serious efforts to encourage market development and to ameliorate market failure will require an increased commitment to investment in public goods, e.g., more widespread use of grades and weight measures, strategic investment in road, rail and port infrastructure, research and development of crop varieties and agricultural extension systems to raise smallholders' productivity to enable them to produce a surplus in the first place. The Zambian government may wish to consider prioritizing agricultural investment in these productivity and market-enhancing public goods which currently receive a very small proportion of overall government spending on agriculture.

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ACRONYMS

CFS	Crop Forecast Surveys
CSO	Central Statistical Office
FISP	Farmer Input Support Programme
FRA	Food Reserve Agency
FSRP	Food Security Research Project
MACO	Ministry of Agriculture and Cooperatives.
MSU	Michigan State University
OLS	Ordinary Least Squares
PHSs	Post Harvest Surveys
SEAs	Standard Enumeration Areas

1. INTRODUCTION

Smallholder farmers' access to markets and agricultural support services has been a major concern of Zambian policy makers. As with many governments in Sub-Saharan Africa, the Zambian government's agricultural policies, particularly for maize, have fundamentally been conceived of as a response to perceived market failure and weak access to markets for rural smallholder farmers. There is a widespread perception that private traders and input suppliers are not able to service rural farmers located in remote areas, and for these reasons the state must directly invest in marketing board infrastructure to provide a market for smallholders' surplus production.

However, the conventional wisdom of poor market access is based on extremely limited empirical evidence. To our knowledge, there has been no comprehensive analysis of smallholder farmers' access to markets in Zambia to support or refute this conventional wisdom. This dearth of evidence provides the motivation for this study. Our objectives are to assess the current status of smallholder farmers' access to markets for maize and fertilizer, two strategic commodities in Zambia for which market failure is commonly attributed. In particular, we examine the distance traveled from the farm to the point of maize sale and point of fertilizer acquisition as well as the degree of competition in the maize assembly markets serving smallholder areas. The findings from this study provide important information to policy makers and a foundation for influencing appropriate public investments and policy choices to support smallholder farmers' access to markets, farm productivity and poverty reduction.

The remainder of this paper is organized as follows. Section 2 describes the data and methods used in the analysis. Section 3 describes the conditions of smallholders' access to maize markets on the basis of several indicators and then examines the changes over time in these indicators using nationally representative farm panel survey data. Section 4 present results from econometric analysis concerning the factors influencing the distance traveled by farm households' to sell their maize and the price received. The last section presents the main conclusions and implications for policy.

2. DATA AND METHODS

This study uses data collected under the nationally representative 2010 and 2011 Crop Forecast Surveys, conducted annually by the Central Statistical Office and Ministry of Agriculture and Cooperatives. Over 14,000 small- and medium-scale farm households were surveyed in each year, mainly to provide information about the area, production and yield outcomes for a set of nine field crops. Starting in 2010, these surveys asked farmers who sold maize to indicate how far they traveled from their farm to the point of maize sale. Questions were also asked regarding the number of buyers who came into their village to buy maize as well as the distance traveled to the nearest fertilizer retailer.

In order to track changes in these market access indicators over time, it is necessary to use a panel data set that collects comparable indicators of market access conditions. For this purpose, we drew upon the Supplemental Surveys to the Post Harvest Survey, implemented by the Central Statistical Office and the Food Security Research Project in 2004 and 2008. This is another nationally representative survey, but in this case, the households revisited in 2008 were the same households initially interviewed in 2004. This provides the means to assess changes in market access conditions for 4,284 small- and medium-scale farm households in areas stratified by their degree of remoteness. These surveys covered 393 standard enumeration areas (SEAs)[1] in Zambia's nine provinces. Figure 1, shows the distribution of SEAs sampled throughout the country. Readers interested in more detail about the survey design and sampling procedures of these surveys are referred to Megill (2009).

In both surveys, the respondent-reported indicators of access to markets included the kilometer distance to the nearest district town, the nearest wholesale maize market, the point of sale for the largest maize sales transaction, the nearest private fertilizer retailer, the nearest buying point of the Food Reserve Agency (the national maize marketing board in Zambia), and the kilometer distance to the collection point for subsidized fertilizer offered under the state Farmer Input Support Programme (FISP). The market access indicators used in this study are summarized in Table 1.

Almost all of these variables have a highly skewed distribution in which 1-2% of the observations in the right-side tail of the distribution appreciably affect the mean values. For this reason, we report both the mean value of market access indicators as well as the values at various percentiles of the distribution of these variables.

[1] SEAs are the lowest geographic sampling unit in the Central Statistical Office's sampling framework for its annual Post Harvest Surveys (PHSs) and most other surveys. Each SEA contains roughly 100 to 150 rural households, from which 20 households are randomly selected.

Figure 1. Map of Central Statistical Office Statistical Enumeration Areas (SEAs) Sampled in the Supplemental Surveys in 2004 and 2008 by Zambia's Agro-Ecological Zones

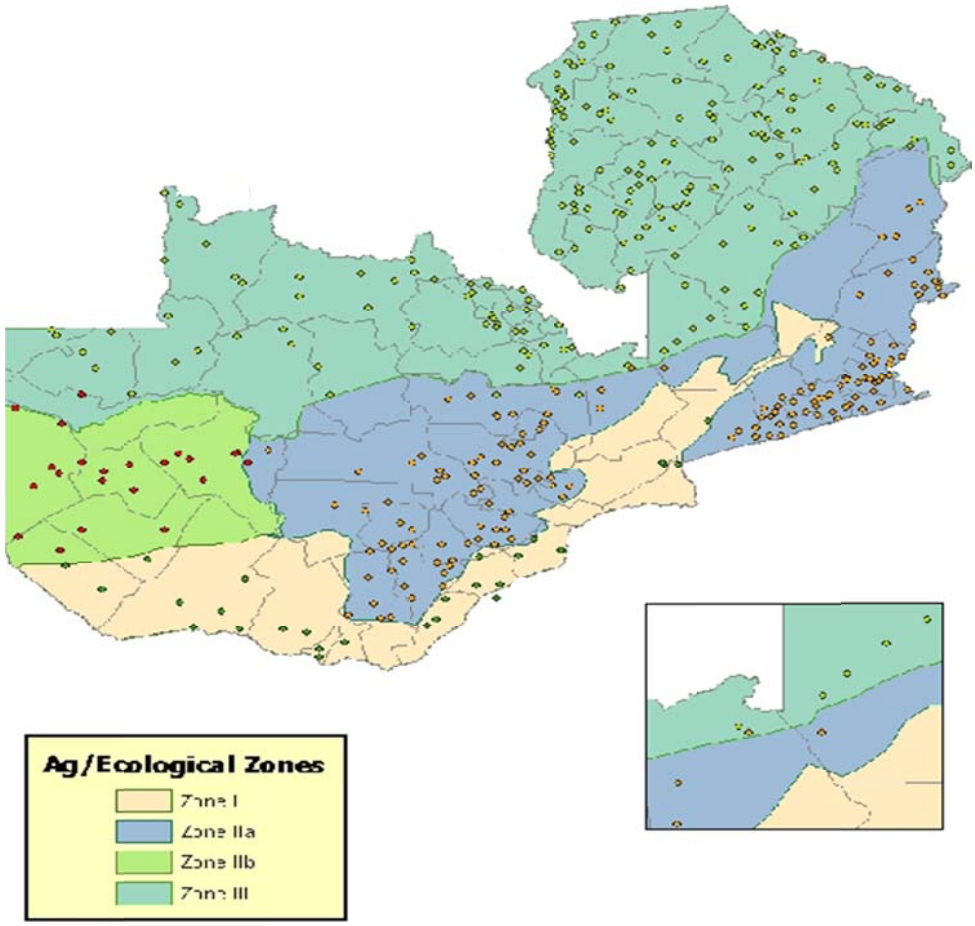


Table 1. Access Indicators Used in this Study

Variable	Investment type
Km to point of maize sale transaction with private trader	Private
Km to the nearest maize wholesale market	Private/Public
Km to nearest private fertilizer retailer[a]	Private
Km to nearest collection point of government FISP fertilizer[a]	Public
Km to nearest Food Reserve Agency depot[b]	Public
Km to a motorable road	Public
Km to the nearest district town	Public

Notes: [a] Distances to the nearest private fertilizer retailer and government subsidized fertilizer were collected only for households who acquired fertilizer [b] In the 2010 and 2011 Crop Forecast Surveys, this variable was collected for all households in the survey. In the 2004 and 2008 Supplemental Surveys, this variable was collected only for households selling maize to the FRA.

A combination of descriptive and econometric analysis is used to examine rural smallholder farmers' market access in Zambia. Section 3 presents basic descriptive information on various market access indicators. In Section 4, we are interested in examining the factors associated with the distance travelled by farmers to sell their maize, specifically for the largest transaction to commercial maize buyers (assembly traders, millers, and breweries). For this purpose, we use the 2010 and 2011 Crop Forecast Survey (CFS) data to estimate reduced form models of the distance traveled by farmers to sell their maize. These models take the general form of

$$y_i = \alpha + X_i\beta + \mu_i \quad (1)$$

where y_i is the distance from farmer *i*'s maize field to the location of his/her largest maize sale transaction to private commercial maize buyers, α is a constant, β is a set of coefficients to be estimated and X_i is a set of predetermined explanatory variables which are hypothesized to influence the distance travelled to a private maize buyer. The explanatory variables include household demographic factors, household total land cultivated, maize production, variables indicative of farmer *i*'s market access conditions, the month of sale, and provincial dummy variables to control for variations in geographical location. The demographic variables include the gender, age and education of the household head. The market access variables include the number of private maize traders operating in farmer *i*'s village (the median reported number from all households in the village) and the distance from the farm to the district town. We do not include the type of buyer (e.g., assembly trader, miller, brewer, neighbor, or Food Reserve Agency) because this is in most cases a decision by the farmer that might be influenced by relative distances and transaction costs to alternative buyers and is therefore likely to be endogenous. Equation (1) is estimated using ordinary least squares (OLS). Using Stata 11, we control for heteroskedacity by estimating models with robust standard errors.

3. FARM HOUSEHOLD MAIZE MARKETING BEHAVIOR AND DISTANCES TRAVELED TO BUYER

3.1. Maize Market Participation

Maize is the dominant staple food in Zambia. Its share in total gross farm income in the small- and medium-scale farm sector (hereafter *smallholder sector*) has risen from 26% in the early 2000s to nearly 40% in 2010/11. Maize also accounts for 60% of the total area cultivated by the smallholder sector (Hichaambwa and Jayne 2011). However, in the 2009/10 and 2010/11 marketing years, only about 40% of the small- and medium-scale farmers in Zambia sold maize. While there is a widely held notion that the recent maize promotion efforts of the Government, namely input subsidies for maize production under the Farm Input Support Programme (FISP) and the Food Reserve Agency's (FRA) purchase of maize at $275 per metric ton, have helped the majority of smallholder farmers to become surplus maize producers, this appears not to be the case. As shown in Table 2, the proportion of smallholder farmers selling maize has risen from 32.2% in the 2007/08 marketing season to 39.6% in 2009/10. National representative Post-Harvest and Supplemental Surveys carried out earlier in the 2000-2008 period consistently show that 31% to 35% of Zambia's small- and medium-scale farmers sold maize, depending on the year. The more recent CFS findings that the proportion of farmers selling maize is now around 40% represents the impact of the recent policy efforts to promote maize production as well as favorable weather (Burke, Jayne, and Chapoto 2011).

The data in Table 2 also show the extremely concentrated nature of surplus maize production in Zambia. Half of all the maize sold by the small- and medium-scale farm sector has been accounted for by between 2.0% and 5.4% of the farmers in this sector. Previous research has shown that this group has substantially larger farms, more animal draft power, and other productive assets than the smaller maize sellers.

Figure 2 (panels A to J), shows that in all regions, most households selling maize chose to sell to private traders. In the 2007/08 marketing season, private traders accounted for 70.1%

Table 2. Maize Sales by Small/medium Scale Farmers by Marketing Year

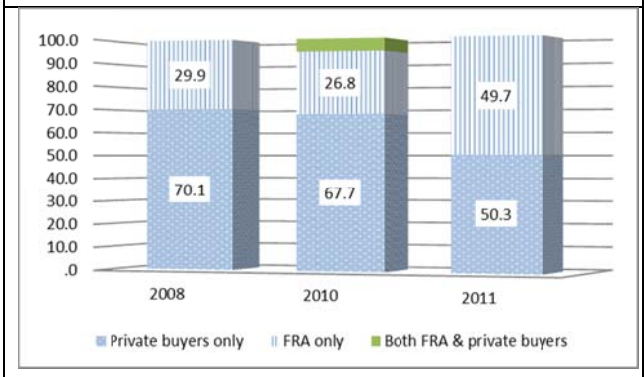
	----------Maize Marketing Year ----------		
	2007/08	**2009/10**	**2010/11**
Households selling maize	497,470	418,590	590,734
	(32.2%)	(30.2)	(39.6%)
Top 50% of maize sales	*30,150*	*35,139*	*80,177*
	(2.0%)	*(2.5%)*	*(5.4%)*
Rest of maize sellers	*467,320*	*383,451*	*510,557*
	(30.2%)	*(27.7%)*	*(34.2%)*
Households not selling maize*	1,048,349	966,001	903,414
	(67.80%)	(69.8%)	(60.40%)

* Percentage based on all rural smallholder (i.e., small-scale and medium-scale) farmers including non-maize producers. Sources: 2007/08 marketing season from Central Statistical Office/Food Security Research Project (CSO/FSRP) Supplemental surveys 2009/10 and 2010/11 marketing seasons from CFS surveys 2010 and 2011 respectively.

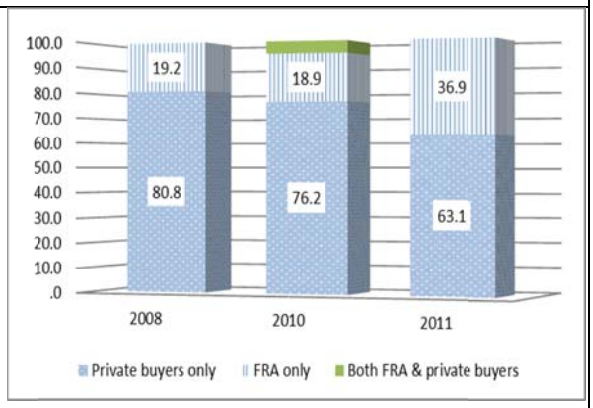
of all maize transactions with farmers (see appendix A1 for the number and percent y province). As the FRA has increased its purchase activity in recent years, the proportion of farmers' sales to private traders has declined to 67.7% of transactions in 2009/10 and 50.3% of transactions in 2010/11. Regional variation is also discernable. For example, in Northern Province during the 2009/10 marketing season, almost as many smallholders sold maize to FRA as to private traders. Northern Province was a major focus of the FRA's maize buying operations in 2009/10, accounting for 14% of total FRA maize purchases in this year.

Figure 2. Percent of Households Selling Maize by Province and Buyer Type, 2007/08, 2009/10, and 2010/11 Marketing Seasons

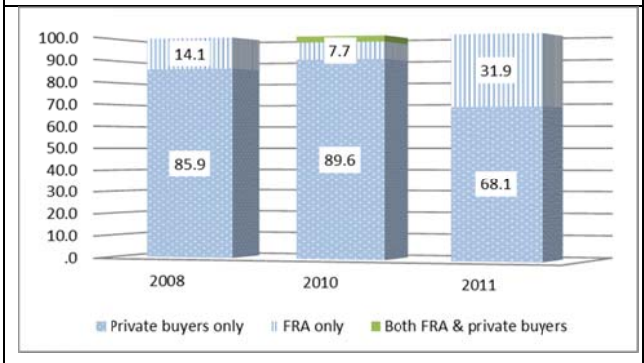
A. National



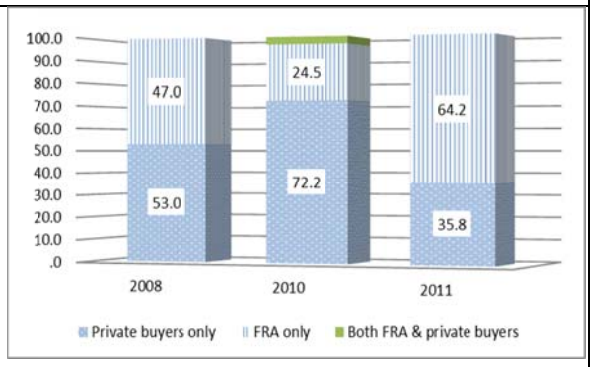
B. Central Province



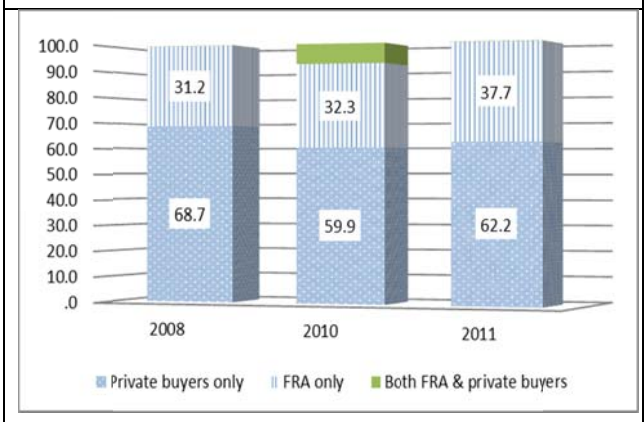
C. Copperbelt



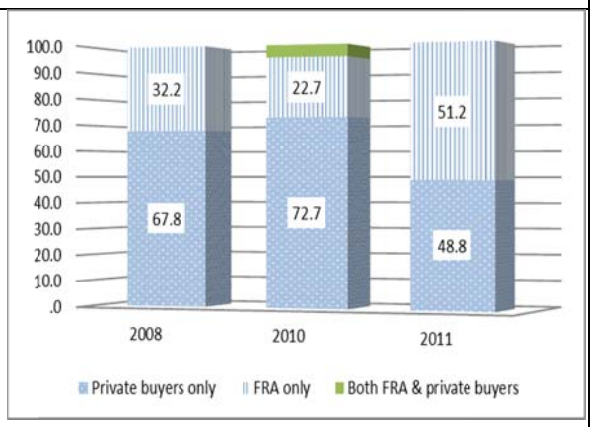
D. Eastern



E. Luapula

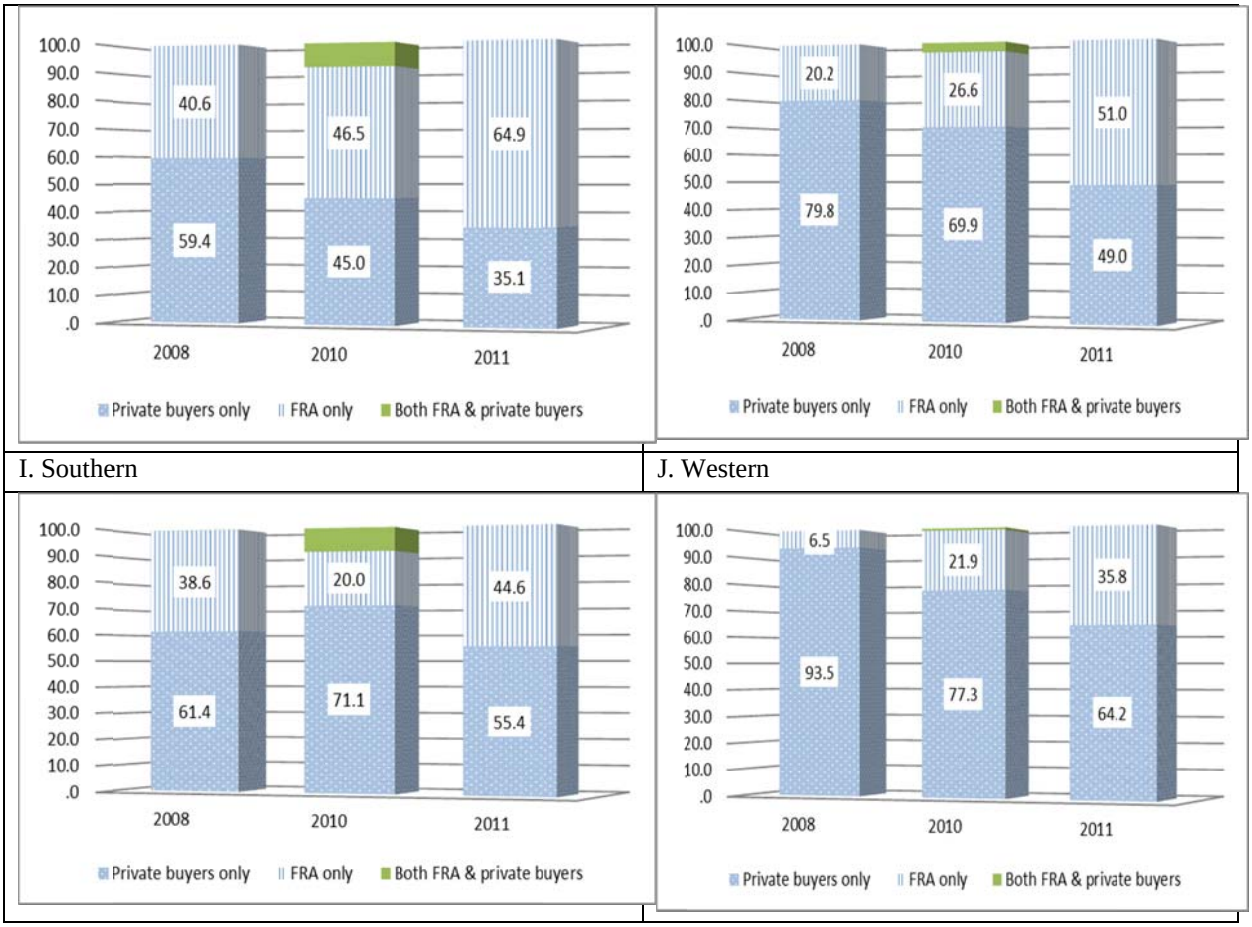


F. Lusaka



G. Northern

H. Northwestern



Source: Supplemental Survey 2008; CFS surveys 2010 and 2011.

To examine the robustness of these findings, we compare the weighted quantities of maize sold to the FRA according to respondents surveyed in the Crop Forecast Surveys with the official FRA statistics on the quantity of maize purchased. In the 2009/10 marketing season, the weighted quantity of maize sold by small- and medium-scale farmers according to the CFS was 267,784 tons compared to 198,360 tons according to FRA statistics. Therefore, if anything, the CFS figures might overestimate the quantity of maize sold by smallholder farmers to the FRA and underestimate the quantity of maize sold to private traders. In the 2010/11 marketing year, the CFS and FRA estimates of smallholder maize sales to the FRA are very close, at 825,622 and 878,570 tons, respectively. Because the maize sold by farmers to FRA according to the CFS are fairly close to those reported by the FRA, this indicates that the proportion of farmers' maize sales to private traders vs. the FRA as reported by the CFS are likely to be fairly accurate.

Amongst farmers selling to private buyers, assembly traders operating in and around the villages are the dominant private buyer of maize. Table 3 shows that in the 2009/10 marketing year, assembly traders accounted for 80.0% of the transactions between farmers and private maize buyers. In the most recent 2010/11 marketing year, farmers' maize transactions with assembly traders declined to 65.8% of total transactions with private buyers. The share of farmers' sales to neighboring households increased to 29.2%. These results show the importance of private buyers especially assembly traders in providing a market outlet for smallholder farmers.

Table 3. Percent of Households Selling Maize to Private Buyers by Province and Buyer Type 2009/10 and 2010/11 Marketing Season

Province	---------- 2009/10 marketing season ----------			---------- 2010/11 marketing season ----------		
	Assembly traders	Millers and breweries	Other households	Assembly traders	Millers and breweries	Other households
Central	82.0	12.0	6.0	79.8	4.9	15.3
Copperbelt	72.1	10.9	17.0	62.3	8.7	29.0
Eastern	93.2	1.1	5.7	65.9	3.4	30.7
Luapula	73.5	3.1	23.4	55.8	1.4	42.9
Lusaka	56.7	25.2	18.1	37.2	8.7	54.2
Northern	81.9	3.9	14.1	73.6	2.5	23.9
Northwestern	85.6	0.1	14.3	73.4	2.3	24.2
Southern	70.7	7.7	21.6	54.5	9.1	36.4
Western	70.0	6.3	23.7	64.7	4.3	30.9
National	80.0	6.4	13.6	65.8	5.0	29.2

Source: MACO/CSO Crop Forecast Surveys, 2010 and 2011.

3.2. Market Access Indicators

This section examines the market access conditions of smallholder households according to recent Crop Forecast and Supplemental Surveys. Table 4 presents the kilometer distances from the farm to various indicators of market access for households at different percentiles of the distribution. For example, the first row of Table 4 shows that the mean distance travelled from the farm to the nearest district town, according to the 2004 Supplemental Survey, was 34.9 km, however this distance was 9.5 km or less for 10% of the population, 16 km for households at the 25th percentile of the distribution, 29.9 km at the 50th percentile (median), and 71 km at the 90th percentile, meaning that 10% of the rural farm population faced distances to the nearest district town that were even greater than this. The distributions of the distance from farm to district town are quite consistent for each of the four surveys for which this variable was collected (rows A, B, and C of Table 4). At least half of the smallholder farm households in Zambia were at least 28 km from a district town, and 25% of the households were at least 46 km away.

However, distance to the nearest town, or even distance to the nearest wholesale market, appears to be a misleading indicator of smallholders' market access conditions for selling maize. Rows I through L report the distances traveled from the farm to the point of maize sale to a private trader for households selling maize. In all four surveys for which this variable was collected in rows I, J, K, and L, at least half of the respondents reported that they traveled zero distance to sell their maize; in other words, maize traders came directly to their farms to buy their maize. At the 75th percentile of the distribution, maize selling farmers were transporting their maize between 2 km and 4 km to the point of maize sale. For about 10% of the farmers – those at the 90th percentile of the distribution and higher – the distances traveled to a private buyer was much greater, being over 19 km and in some cases considerably more than that. Hence, the mean distances to the point of maize sale as show in Column (1), which range from 5.7 km to 10.7 km, mask a great deal of variability across households. Results by province are presented in the appendix, Table A2.However, distance to the nearest town, or even distance to the nearest wholesale market, appears to be a misleading indicator of smallholders' market access conditions for selling maize. Rows I through L report the

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Table 4. Smallholder Market Access Conditions, 2004, 2008, 2010, and 2011

Distance to the nearest --- (in Km)	Survey, year		Weighted sample size	Mean	Percentile of farm household distribution				
					10	25	50	75	90
				(1)	(2)	(3)	(4)	(5)	(6)
				Kilometer distance					
Distance to nearest district town	SS 2004	(A)	1,253,977	34.9	9.5	16.0	29.9	47.9	71.0
	SS 2008	(B)	1,652,641	34.1	9.8	15.4	28.7	46.0	69.2
	CFS 2010	(C)	1,476,610	37.1	6.0	13.0	30.0	58.0	80.0
	CFS 2011	(D)	1,253,977	-	-	-	-	-	-
Motorized/vehicular transport	SS 2004	(E)	1,253,977	7.8	.0	.7	3.0	9.0	21.0
	SS 2008	(F)	1,652,641	7.2	.0	.3	2.0	8.0	20.0
	CFS 2010	(G)	1,476,610	8.2	.0	.8	3.0	8.0	21.0
	CFS 2011	(H)	-	-	-	-	-	-	-
Km from farm to location of largest maize sale transaction to private assembly traders	SS 2004	(I)	242,107	5.74	.0	.0	.0	4.0	19.0
	SS 2008	(J)	213,506	10.72	.0	.0	.0	4.0	25.0
	CFS 2010	(K)	244,005	8.99	.0	.0	.0	2.0	24.0
	CFS 2011	(L)	191,138	6.88	.0	.0	.0	3.0	20.0
Km distance to maize wholesale market	SS 2004	(M)	-	-	-	-	-	-	-
	SS 2008	(N)	-	-	-	-	-	-	-
	CFS 2010	(O)	1,476,610	14.4	.4	2.0	7.0	18.0	39.0
	CFS 2011	(P)	-	-	-	-	-	-	-
Fertilizer private seller	SS 2004	(Q)	169,519	16.2	.0	2.0	9.0	20.0	40.0
	SS 2008	(R)	267,607	25.3	2.0	6.0	15.0	35.0	65.0
	CFS 2010	(S)	318,913	27.7	1.0	4.0	15.0	38.0	65.0
	CFS 2011	(T)	324,781	28.0	1.0	4.0	14.0	40.0	65.0
Government fertilizer channel	SS 2004	(U)	146,555	7.8	.0	1.0	2.0	6.0	19.0
	SS 2008	(V)	146,315	9.2	.2	1.0	3.0	8.0	20.0
	CFS 2010	(W)	299,459	8.0	.0	1.0	3.0	6.0	16.0
	CFS 2011	(X)	439,148	8.3	.0	1.0	2.0	5.0	13.0
Food Reserve Agency Depot	SS 2004	(Y)	13,688	16.2	.0	.5	7.0	30.0	45.0
	SS 2008	(Z)	146,024	8.	1.0	2.0	4.2	12.0	19.0
Maize non-sellers	CFS 2010	(AA	1,084,860	16.6	1.5	4.0	10.0	21.0	41.0
Maize sellers	CFS 2010	(AB)	116,122	12.6	1.0	3.5	8.0	16.0	30.0
	CFS 2011	(AC)	287,107	8.03	.0	1.5	4.0	8.0	20.0

Source: CSO/FSRP Supplemental Surveys, 2004 and 2008; MACO/CSO Crop Forecast Surveys 2010 and 2011.

A major conclusion from the findings in Table 4 is that most farmers either sell their maize directly on their farms or travel very short distances to sell their maize to private buyers, and that therefore their distance to district towns is a misleading indicator of their access to private traders and markets. The distance traveled by farmers to the nearest place where vehicular transport can be secured is also highly consistent with the distances traveled by farmers to sell their maize (rows, E, F, G, and H of Table 4). This is to be expected because most assembly traders use motorized transport to move the grain out of the area after buying it from farmers. Hence the consistency between the distances reported to point of maize sale and to motorized transport adds to the confidence of these findings that most farmers travel very short distances to sell their maize to private grain traders. Nevertheless, a small proportion of farmers did travel great distances to sell their maize to private buyers, resulting in a mean distance traveled of 5 km to 10 km to the point of sale.

Rows Q to T in Table 4, show that the distance from farms to the nearest private fertilizer retailer has increased between 2004 and 2011. This is not consistent with the apparent improvements in market access for grain buyers. The mean distance to the nearest fertilizer retailer rose for all reported points in the distribution; mean distance rose from 16 km in 2004 to almost 28 km in 2011. Possible reasons for the rise in the kilometer distance to private retailers may be related to the FISP program. In 2004 only 41,696 tons of subsidized fertilizer were distributed under FISP (formerly Fertilizer Support Programme- FSP). The quantities distributed progressively expanded since 2004 to 79,200 tons in 2008, 108,000 tons in 2009, to 178,000 tons in 2010, based on the Ministry of Agriculture and Cooperatives (MACO) fertilizer distribution statistics. As increasing quantities of fertilizer were distributed in rural areas at a price of 25% of the full commercial price, it is likely that many commercial fertilizer retailers experienced a decline in demand for their commercial fertilizer. To avoid having their working capital tied up in slow-moving products, it is likely that many commercial fertilizer retailers in 2004 stopped stocking fertilizer as the government fertilizer programme expanded. Evidence of crowding out of commercial fertilizer by the Fertilizer Support Programme has been documented by Xu et al. (2009) and by Mason (2011). Therefore, a rise in the distances traveled to the nearest commercial fertilizer retailer shown in Table 4 is likely to reflect the decisions of many rural retailers to stop stocking fertilizer and exit from the business over this time period.

By contrast, distances travelled by farmers to the point of collection of government fertilizers did not change much between 2004 and 2008. The mean distance travelled from the farm to the point of FISP fertilizer acquisition rose from 7.8 km to 9.2 km, whilst the median distance rose from 2 km 2004 to 3 km in 2008.

Distance to nearest FRA depot declined between 2004 and 2008 from a mean of 16.2 km to 8.1 km. This is mainly due to the expansion of the FRA buying program over this period. The FRA has been provided with much larger budgets for buying maize in recent years and has also expanded its buying stations in rural areas. This has resulted in a six-fold increase in the number of smallholder farmers selling maize to the FRA, from 13,592 farmers in 2004 to 97,152 in 2008. This expansion explains why distances to the nearest FRA buying station have declined between 2004 and 2008. Similar to the results on distance to the nearest private buyer, there is a perception among those who did not sell that FRA depot are farther away compared to those who actually sold maize, a mean distance of 16.6 km and 12.6 km respectively (Rows AA and AB).

Table 5. Distribution of Distance to the Location of the Largest Maize Sale Transaction to Assembly Traders by Province

Province		Distance to the location of the largest maize sale transaction to private assembly traders (Kilometers)					
		Mean	Percentile				
			10	25	50	75	90
Central	2007/08	16.43	.00	.00	.00	6.00	34.00
	2009/10	10.46	.00	.00	1.00	4.00	25.00
	2010/11	11.02	.00	.00	1.00	6.00	25.00
Copperbelt	2007/08	4.60	.00	.00	.00	1.00	22.00
	2009/10	3.57	.00	.00	.00	.00	7.00
	2010/11	6.97	.00	.00	.30	5.00	20.00
Eastern	2007/08	7.74	.00	.00	.00	.50	10.00
	2009/10	5.37	.00	.00	.00	2.00	15.00
	2010/11	6.70	.00	.00	.00	3.00	30.00
Luapula	2007/08	4.98	.00	.00	.00	2.00	10.00
	2009/10	28.15	.00	.00	.00	.00	2.00
	2010/11	2.31	.00	.00	.00	1.00	3.00
Lusaka	2007/08	2.36	.00	.00	.00	.00	4.00
	2009/10	3.09	.00	.00	.00	.00	2.00
	2010/11	1.88	.00	.00	.00	.00	3.00
Northern	2007/08	5.58	.00	.00	.00	2.00	8.00
	2009/10	5.42	.00	.00	.00	1.00	5.00
	2010/11	3.90	.00	.00	.00	2.00	13.00
Northwestern	2007/08	9.64	.00	.00	.00	3.50	15.00
	2009/10	3.26	.00	.00	.00	.00	2.00
	2010/11	3.35	.00	.00	.00	1.00	6.00
Southern	2007/08	14.41	.00	.00	1.00	12.00	60.00
	2009/10	19.68	.00	.20	4.00	35.00	52.00
	2010/11	10.65	.00	.00	1.00	7.00	40.00
Western	2007/08	22.41	.00	.00	.00	10.00	100.00
	2009/10	3.08	.00	.00	.50	1.60	4.00
	2010/11	3.03	.00	.00	.00	1.00	5.00
National	2007/08	10.72	.0	.0	.0	4.0	25.0
	2009/10	8.99	.0	.0	.0	2.0	24.0
	2010/11	6.88	.0	.0	.0	3.0	20.0

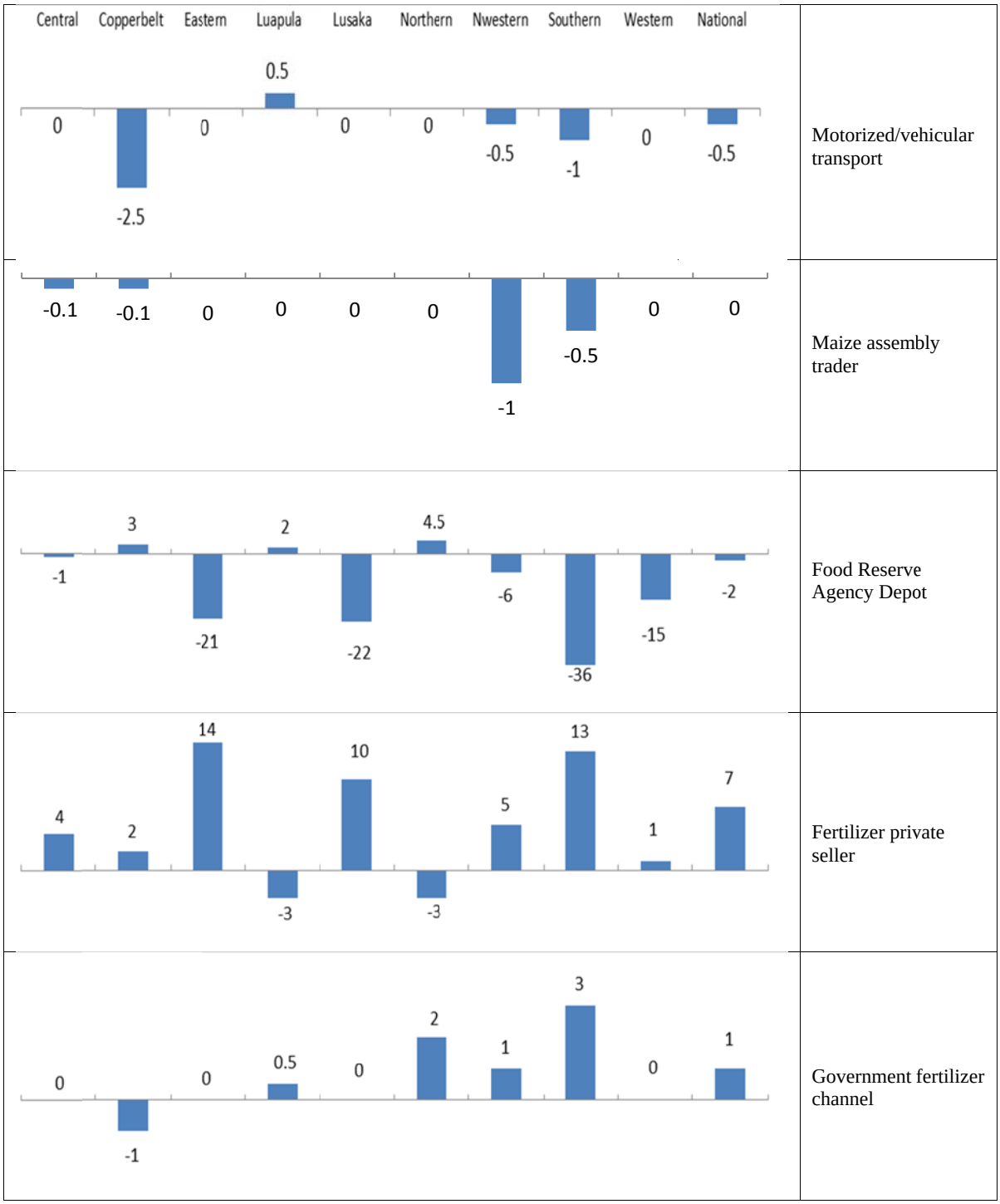
Source: CSO/FSRP Supplemental Surveys, 2004 and 2008; MACO/CSO Crop Forecast Surveys 2010 and 2011.

Table 5 shows that farmers' market access conditions are broadly consistent across provinces, although there is a somewhat higher proportion of farmers in Southern Province that tend to go long distances to sell their maize. As will be shown below, these farmers are more likely to have access to transport and have relatively large farms and choose to sell directly to millers, thereby incurring greater distances to sell their maize as a matter of choice in order to bypass village-level assembly traders.

3.3. Changes and Geographic Differences in Access Indicators

Figure 3 categorizes the percentage reduction in the distance to market variables by province. On the whole, the patterns of change shown in Figure 3 convey greater uniformity across all provinces with a few exceptions. Distance to the nearest motorized transport marginally declined or remained the same across all provinces, with the exception of Luapula where the distance increased by 0.5 km. This result indicates very little improvement in feeder road conditions that would alter the distance from farms to places where vehicular transport could be mobilized.

Figure 3. Change in Median Kilometer Distance by Province, 2004 to 2008



Source: CSO/FSRP Supplemental Surveys, 2004 and 2008.

Copperbelt Province experienced the greatest decline (-2.5 km) in distance to the nearest motorized transport. Figure 3 also shows that in the areas where the distance to vehicular transport has declined the most, we also see a decline in the distance traveled from the farm to the point of maize sale. Greater investment and availability of motorized transport is allowing private traders to more easily go right into the villages to buy.

It is noteworthy, that the distance to assembly traders did not change between 2004 and 2008 except marginal decreases in Central, Copperbelt, Northwestern, and Southern Provinces.

This reinforces our finding that most of the houshelds who sold maize to private traders sold at their farm even back in 2004.

Turning to distance to private fertilizer sellers, results in Figure 3 show that distances to these sellers increased in all provinces except in Luapula and Northern. As discussed before, the rise in distances to private fertilizer sellers is likely associated with the ramping up of FISP that crowded out the private dealer networks. By contrast, distance to the point of collection of government-subsidized fertilizers marginally increased by 1-2 km. Further examination of the degree of correlation between changes in distance to fertilizer seller (district-level mean or median) and changes in the quantity of FSP fertilizer distributed to farmers in each district between 2004 and 2008 (also a district-level variable) show that there is a positive correlation between the two, providing further support for the view that the ramp-up in FISP fertilizer distribution between 2004 and 2008 may be accounting for the exit of commercial retailers and hence the greater distances to private fertilizer retailers being reported in 2008. A simple ordinary least squares model where we regress distance to fertilizer retailer on changes in quantity of fertilizer distributed to the district shows that a 1% increase in the district-level quantity of government fertilizer distributed increased the distance to the nearest fertilizer retailer increases by 0.004 kilometers.

3.4. Degree of Competition in Village Assembly Markets

Table 6 presents the number of private assembly traders coming into the village to buy maize from surplus small- and medium-scale farmers. The results show that farmers generally have a number of options for selling grain to different assembly traders in their villages. Nationwide, the CFS respondents who sold maize in the 2009/10 marketing year indicated that there was an average of 9.0 traders buying maize in their village. CFS respondents who did not sell maize indicated that there were only 6.4 traders operating in their village. In the 2010/11 marketing year, maize selling households indicated that there were 7.4 traders buying maize in their village compared to only 4.9 among non-maize sellers.

Perhaps surprisingly, the number of traders operating in farmers' villages was virtually unrelated to the distance from the farm to the nearest district town. An OLS model of the number of traders in the village regressed on the distance to the nearest district town was not close to being statistically significant at any reasonably level, despite trying a number of alternative functional forms. There was, however, a stronger correlation between the number of maize traders operating in the village and the surplus-producing potential of the area. The same OLS regression analysis with number of buyers as the dependent variable and the percentage of households selling maize in the villages shows that a 1% increase the number of households selling maize in the village increases the number of private assemblers coming into the village by 3%.[2] This might explain why there are relatively few maize traders operating in Southern and Western Province (where a relatively small proportion of households sold maize) and why the number of traders is relatively high in Copperbelt, Central, and Lusaka Provinces.

[2] Using data from the CFS 2010, OLS results for the number of assemblers=7.57+ 3.18% of households in village selling maize, t=11.2 (p=0.000) for the constant and t=1.67 (p=0.095) for proportion of sellers, R^2 = 0.074.

Table 6. Number of Private Assembly Buyers Coming to Village to Buy Maize

Province	Marketing year	Households selling maize	Number of private buyers who come into village	
			Among maize sellers	Among non-maize sellers
		%	mean	mean
Central	2009/10	41.6	8.5	6.4
	2010/11	52.5	6.9	4.3
Copperbelt	2009/10	31.4	16.0	16.8
	2010/11	42.3	15.1	15.2
Eastern	2009/10	25.1	9.3	6.5
	2010/11	35.6	6.6	5.7
Luapula	2009/10	16.1	11.3	9.2
	2010/11	29.3	8.5	6.4
Lusaka	2009/10	22.5	8.0	7.4
	2010/11	35.1	2.7	2.6
Northern	2009/10	29.9	8.9	6.6
	2010/11	41.7	5.4	3.1
Northwestern	2009/10	36.4	11.9	7.8
	2010/11	43.0	13.2	2.1
Southern	2009/10	24.7	4.5	3.4
	2010/11	43.8	5.5	2.3
Western	2009/10	12.8	3.5	1.6
	2010/11	18.8	5.4	2.8
National	2009/10	26.8	9.0	6.4
	2010/11	38.4	7.4	4.9

Source: MACO/CSO Crop Forecast Survey, 2009-2010 and 2010-2011 marketing season.

There are three noteworthy points from these results in Table 6. First, the fact that maize sellers estimated that there were from 7.4 to 9.0 traders buying maize directly in their villages points to a reasonable degree of competition in village-level maize buying and that the transport and market failure problems commonly attributed to smallholder conditions in Zambia are much less of an issue than commonly thought. Second, the degree of competition in maize assembly markets tends to be positively associated with areas of surplus maize production. More traders are moving into villages where surplus maize production is greatest. Third, neither the number of traders operating in the area nor the distance travelled by farmers to sell their maize is correlated with the distance of the farm to the nearest district town. Distance to town is a potentially misleading indicator of farmers' market access conditions. Proximity to the nearest feeder road appears to be a more meaningful indicator.

3.5. Is the Distance Travelled to Assembly Traders Influenced by the Volume of Maize Sales?

Table 7 shows the distribution of farmers' distance to the location of the largest maize sale transaction to assembly traders. The distance traveled to the point of maize sale increases with the quantity of maize that a farmer has to sell. The farmers with 25 or more bags to sell tend to be those that travel long distances to sell. It is likely that they do this as a deliberate strategy to get a higher price, not due to lack of markets in their villages, since most other farmers are selling directly to assembly traders in their villages.

Table 7. Distribution of Distance to the Location of the Largest Maize Sale Transaction to Maize Assemblers by Number of Bags of Maize Sold

Bags of maize sold	Marketing Year	Number of households	Distance to the location of the largest maize sale transaction to private maize assemblers					
			Mean	Pctile10	Pctile25	Pctile50	Pctile75	Pctile90
			----------Kilometers----------					
less than 5 bags	2009/10	92,556	6.8	.0	.0	.0	1.0	5.0
	2010/11	45,370	2.9	.0	.0	.0	1.0	9.0
5 - 25 bags	2009/10	104,181	7.8	.0	.0	.0	3.0	30.0
	2010/11	105,134	6.2	.0	.0	.0	3.0	18.0
25-50 bags	2009/10	22,693	13.7	.0	.0	1.0	10.0	50.0
	2010/11	20,796	11.4	.0	.0	1.0	11.0	25.0
50 or greater	2009/10	24,575	18.2	.0	.0	1.0	21.0	65.0
	2010/11	19,839	14.5	.0	.0	1.0	10.0	46.0
All maize sellers maize assemblers	2009/10	244,005	9.0	.0	.0	.0	2.0	24.0
	2010/11	191,138	6.9	.0	.0	.0	3.0	20.0

Source: MACO/CSO Crop Forecast Survey, 2009-2010 and 2010- 2011 Marketing Seasons.
Notes: pctile = percentile

3.6. Does Distance to Point of Sale Differ by Type of Private Buyer?

As expected, we find that, on average, households selling their maize directly to millers tend to travel greater distances compared to other private buyers (Table 8). For example, during the 2009-2010 marketing season, the median distance traveled by households selling their maize to millers and breweries was roughly 15 km compared to 0 km for those selling to assembly traders. However, as mentioned earlier, more than 75% of those selling to private buyers sell to assembly traders whilst only 6.5% sell to millers, breweries and non-household buyers. A further examination of these households who sold directly to millers, breweries and other private buyers show that these farmers were primarily located in Southern, Central, and Copperbelt Provinces.

The results from 2010-2011 marketing show an improvement in the distance travelled to the nearest buyer with millers, breweries and other commercial buyers. Compared to the previous marketing season, we find that 50% of the households selling to millers and breweries travel about 1km in 2010-2011 marketing season compared to 15 km the previous season. The results for those selling to assembly traders are consistent across all the survey years (Table 8).

3.7. Does Distance Differ by when Transactions Take Place?

There is a general perception that smallholder farmers sell maize soon after harvest, results from the 2009/2010 and 2010/2011 marketing season in Table 9 show that 31.7% and 26.8% of the households made their largest maize sales transaction between May and July, while another 23.2% and 32.6% sold in August 2009 and 2010, respectively. However, 57% and 37% of all the maize sold by the smallholder farms during the 2009/2010 and 2010/2011 marketing years took place between September and December, indicating that there is some on-farm storage taking place in rural areas.

Table 8. Distribution of Distance to the Location of the Largest Maize Sale Transaction to Private by Type of Private Buyer

Type of commercial buyer	Marketing Year	Number of households	Distance to nearest commercial buyers					
			Mean	Pctile 10	Pctile 25	Pctile 50	Pctile 75	Pctile 90
			---------- kilometers ----------					
Assembly traders	2003/04	242,107	5.74	.0	.0	.0	4.0	19.0
	2007/08	213,506	10.72	.0	.0	.0	4.0	25.0
	2009/10	244,005	8.99	.0	.0	.0	2.0	24.0
	2010/11	191,138	6.88	.0	.0	.0	3.0	20.0
Millers, breweries and other commercial buyers	2003/04	-	-	-	-	-	-	-
	2007/08	18869	36.47	.00	1.60	12.00	55.00	96.00
	2009/10	19803	43.44	.00	2.00	15.00	75.00	120.00
	2010/11	14546	20.39	.00	.00	1.00	10.00	40.00

Source: CSO/FSRP Supplemental Surveys, 2004 and 2008, MACO/CSO Crop Forecast Surveys 2010 and 2011. Notes: pctile = percentile.

It is noteworthy that the percentage of households selling their maize to assembly traders between September and December declined between 2009/10 and 2010/11, from 57% to 37% of total sales, most likely because of increased FRA activity in the 2010/2011 marketing season, suggesting a crowding out effect of assembly traders. The FRA's buying price was not only above market prices in these two years, but it is also pan-seasonal, which provides no incentive for on-farm storage.

In terms of distance travelled to the point of sale with private assemblers, Table 9 shows that 50% of the households selling to assembly traders did so from their farms irrespective of the month of sale, with months closer to the next harvest as an exception.

3.8. Does Distance to Market Differ by Distance to the Nearest District Town?

Table 10 ranks maize selling households according to their distance to the nearest district town and then stratifies them into four quartiles. We define the bottom 25% as "accessible" according to conventional market access criteria, the next 25% as "mid-accessible", the next 25% as "mid-inaccessible" and 25% with the greatest distance to the district town as "inaccessible". Please note that these groups are defined only in terms of their distance from the farm to the district town, which *a priori* may or may not be indicative of the distance they travel to sell their maize. In fact, the results in Table 10 show that there are no differences in the distances traveled to the location of the largest maize sales transaction to private traders and marketers for 75% of the households who sold maize. Across all four groups ranked by their distance to the district town, the median distance traveled is again zero, while farmers at the 75th percentile do not have to travel more than 3 km to sell their maize. This finding reinforces our earlier finding that private traders are penetrating deeply into even the most remote smallholder areas in Zambia and buying maize on the farm even in areas quite far away from the district towns.

Table 10 also shows that the households that sell to FRA are more likely to be located close to a district town with 57.2% of all households selling to FRA being in the most "accessible" group. Thus, the probability that the FRA buys maize from a farmer diminishes as the household's location becomes further away from the district towns. This finding contrasts markedly with the common view that the FRA needs to operate in the remote areas to provide a market for smallholder farmers where the private sector will not go.

Table 9. Month of Sale, Quantity Sold by Month, and Distance to the Location of the Largest Maize Sales Transaction to Private Traders and Marketers

Month of sale	Number and % of households selling to private assemblers this month		Maize sold by month		Distance to nearest maize private assembly traders					
					Mean	Pctile 10	Pctile 25	Pctile 50	Pctile 75	Pctile 90
	Number	%	MT	%	----------Kilometers----------					
May 2009	14,762	6.1	8,965	2.4	9.2	.0	.0	.0	2.0	30.0
Jun. 2009	26,900	11.0	22,324	6.0	8.4	.0	.0	.5	3.0	30.0
Jul. 2009	35,468	14.6	41,143	11.1	9.7	.0	.0	.2	3.0	34.0
Aug. 2009	56,547	23.2	67,004	18.0	15.6	.0	.0	.0	4.0	25.0
Sept. 2009	31,551	12.9	58,423	15.7	6.0	.0	.0	.0	1.5	21.0
Oct. 2009	30,360	12.5	45,708	12.3	5.2	.0	.0	.0	1.6	8.0
Nov. 2009	16,112	6.6	10,236	2.8	5.3	.0	.0	.0	1.0	7.0
Dec. 2009	16,577	6.8	103,179	27.8	6.8	.0	.0	.0	4.0	30.0
Jan. 2010	9,694	4.0	8,893	2.4	3.0	.0	.0	.0	0.5	2.0
Feb. 2010	5,153	2.1	4,843	1.3	6.5	.0	.0	.0	5.0	26.0
Mar. 2010	457	0.2	489	0.1	16.4	.0	.0	9.0	9.0	105.0
Apr. 2010	156	0.1	39	0.0	1.1	.0	.0	.0	0.0	0.0
2009/2010*	**243,737**	**100.0**	**371,246**	**100.0**	**9.0**	**.0**	**.0**	**.0**	**2.0**	**24.0**
May 2010	5,811	3.0	4,778	1.6	4.2	.0	.0	.0	3.0	8.0
Jun. 2010	16,914	8.8	23,392	7.9	9.6	.0	.0	.0	4.0	27.0
Jul. 2010	28,617	15.0	33,160	11.2	8.9	.0	.0	.0	4.0	20.0
Aug. 2010	62,347	32.6	67,985	23.0	6.6	.0	.0	.0	3.5	25.0
Sept. 2010	31,149	16.3	63,423	21.4	7.3	.0	.0	.0	2.0	25.0
Oct. 2010	20,837	10.9	19,883	6.7	6.1	.0	.0	.0	3.0	15.0
Nov. 2010	10,376	5.4	19,529	6.6	4.3	.0	.0	.0	3.0	10.0
Dec. 2010	8,371	4.4	39,664	13.4	3.5	.0	.0	1.0	2.0	7.0
Jan. 2011	4,250	2.2	20,130	6.8	3.8	.0	.0	1.0	4.0	15.0
Feb. 2011	1,994	1.0	2,837	1.0	5.4	.0	.0	1.0	2.0	19.0
Mar. 2011	440	0.2	1,019	0.3	20.7	1.0	8.0	30.0	30.0	30.0
Apr. 2011	34	0.0	8	0.0	.0	.0	.0	.0	.0	.0
2010/11	**191,138**	**100.0**	**295,807**	**100.0**	**6.9**	**.0**	**.0**	**.0**	**3.0**	**20.0**

Source: MACO/CSO Crop Forecast Survey, 2009-2010 and 2010-2011 Marketing Seasons.
Notes: pctile = percentile. *268 households selling to private assembly traders in 2009/10 marketing season did not report month of sale.

Table 10. Distance to Location of the Maize Sales Transaction by Percentile of Distance to the Nearest District Town

Percentile group of distance to the District Town	Distance to location of the maize sales Transaction from homestead						% of households selling to FRA
	Mean	----------Percentile ----------					
		10	25	50	75	90	
	----------Kilometers----------						
Accessible: Bottom 25%	3.61	0	0	0	1.6	8	57.2%
Mid accessible Mid bottom 25%	6.78	0	0	0	3	25	7.2%
Mid inaccessible: Mid 25%	7.33	0	0	0	3	35	19.7%
Inaccessible: Top 25%	10.84	0	0	0	3	60	15.9%
All	7.14	0	0	0	2	23	100.0%

Source: MACO/CSO Crop Forecast Survey, 2009-2010 Marketing Season.

3.9. Characteristics of Households Travelling Long Distances to Sell their Maize to Assembly Traders or Commercial Buyers

Table 11 shows the attributes of households transacting with private traders/ marketers according to the distances they travel to sell their maize. Specifically, we distinguish between farmers selling their maize to private traders/marketers (excluding transactions to FRA and neighboring households) at the 90-94th percentile and 95th percentile or greater of the distance travelled by the household to the location of the largest maize sale transaction to these buyers compared to households that sell their maize on their farm. Generally, we find no differences with regards to age of household head, household ownership of radio, and access to agricultural commodity prices. However, there are some notable differences regarding household income, incomes sources, the farm enterprise and assets.

Compared to the households selling on the farm (column A), households travelling greater distance (columns B and C) possess on average one more year of education, have slightly larger farms (2.6-3.2 hectares compared to 2.2 hectares), cultivate more land, and put a greater share of cultivated land under maize (72% vs. 60% amongst those selling on their farm). These results support our earlier assertion that households travelling larger distances have larger maize sales volumes, which makes it more attractive to them to organize their own transport and travel greater distances to larger-scale maize buyers in the towns. These long distances do not necessarily signify less advantageous market access; rather it tends to indicate a deliberate strategy on the part of the larger maize farmers to sell to industrial buyers in the towns. We will test this premise formally in the next section.

With regards to income and income sources, households travelling greater distances (90-95th percentile of distance to assembly traders to sell their maize have 45% more income that households selling maize on the farm, though there is no huge differences in income composition between households selling on the farm and those travelling greater distances to the transactions with assembly traders. Also, the results show that farmers who did not sell on their farm are more commercialized, with farm sales being 54.7% and 48.2% of the total value of their farm production, compared to 42.5% for households selling at the farm.

Access to cell phones is most likely correlated with both household income and the distance traveled to sell maize. Over 35% of the households traveling the greatest distances to sell their maize (the 90th percentile and above) owned cell phones, compared to 25% among the farmers selling maize on their farms. In terms of assets, households travelling the greatest distances have a higher proportion of households owning motorized transport. This suggests that the availability of transport increases the likelihood of these households traveling greater distances in search of private maize buyers. In general these households are better off and seem to have the means to explore for better price by travelling to urban markets to sell directly to millers and breweries. These findings may help explain econometric results commonly obtained in Sub-Saharan Africa where common market access variables bear little relationship, or sometimes an unanticipated relationship to household indicators of market participation and agricultural commercialization.

Table 11. Characteristics of Households by Distance to Point of Maize Sale to Private Assembly Traders, 2007/08 Marketing Season

Attributes	Distance to the location of the largest maize sale transaction to private traders/marketers		
	Households selling on the Farm N=125,971	90- 94 percentile N=9,804	95 percentile and above N=12,782
	A	B	C
Distance from farm to point of maize sale (km)	0	31	128
Male headed household (%)	80	78	91
Age of household head (years)	48.68	46.25	47.23
Level of education household head (years)	5.74	6.97	6.34
Landholding size-cultivated plus fallow (ha)	2.16	2.63	3.19
Land cultivated (hectares)	1.78	1.90	2.92
Maize area planted (hectares)	1.06	1.41	2.09
Household Commercialization Index	42.49	54.02	48.20
Net household income 'ZMK'	4,877,296	6,855,107	16,525,123
% income from field crops	56.66	54.68	60.90
% income from fruits and vegetables	4.03	7.34	7.88
& income from livestock sales	5.48	7.44	5.41
% income from business, employment and	33.84	30.55	25.81
% from formal and informal business	19.77	11.97	17.08
% from remittances	6.80	5.58	1.92
% from formal and informal employment	7.27	13.00	6.80
HH reporting non-farm income (%)	76.93	78.70	61.96
Household owns a cell phone (%)	24.91	38.27	34.05
Household has access to agricultural commodity price information (% yes)	87.15	94.73	87.37
Household owning (%)			
Radio	65.92	65.77	68.08
Car	1.02	1.73	8.43
Truck truck/pickup/van	0.14	0.38	4.01
Cattle	20.78	26.82	39.09
Trained oxen	12.46	20.48	28.96
Ox-plough	17.32	23.38	36.04
Rail/main road	37.4	28.6	43.7
Distance to nearest district town (km)	39	68	45
Distance to motorized transport	7.0	7.3	10.0
Distance to private fertilizer seller	24.49	24.65	63.73

Source: Supplemental Survey, 2008; 2007/2008 marketing season.

4. ECONOMETRIC ANALYSIS OF FACTORS ASSOCIATED WITH DISTANCE TRAVELLED TO PRIVATE COMMERCIAL MAIZE BUYERS

Using data from the 2009/10 CFS survey, we analyze the factors explaining the distance travelled to private commercial maize buyers. Because the factors influencing distance traveled may depend on the type of buyer to which farmers sell, we ran separate distance models for (i) assembly traders, and (ii) millers, breweries, and other commercial buyers. We only use data from the CFS 2010 survey because of the unavailability of comparable variables in the CFS 2011 survey. Table 12 presents results from the OLS models. The covariates are grouped into four categories: (i) characteristics of the head of household; (ii) market access variables; (iii) month of sale; and (iv) regional dummies to control for unobserved spatial factors influencing farmer maize marketing decisions.

4.1. Head of Household Characteristics

The results in Table 12 show that the gender of household head is an important factor determining the distance travelled to the assembly traders. Older heads of household traveled shorter distances, both in the model for all commercial buyers (Column A) and in the model for assembly traders in particular. An increase in the age of the household head by 10 years reduces the average distance travelled to the market with commercial buyers in general by 0.7 km and with assembly traders by 0.6 km. Male-headed households travelled 1.9 km more on average than female-headed households to sell their maize to assembly traders. The level of education of the household head does not seem to influence the distance to the location of the largest maize sale transaction with commercial buyers in general (column A) or with assembly traders (column B). However, the results in column C show that households headed by a person with post-secondary education, travels substantially lower distances to sell to millers, breweries and other commercial buyers compared to households with no education. Farmers with high educational attainment appear to be able to find opportunities and make the necessary arrangements for selling their maize to industrial buyers at a significantly lower distance traveled than farmers with no formal education.

4.2. Quantity of Maize to Sell

The results in Table 12 also show that those traveling far to sell their maize have higher volumes to sell and cultivate more land. An additional ton of maize sold is associated with an increase in 40 km to the point of sale with commercial buyers in general (Column A) and an increase in 25 km to the point of same with assembly traders in particular. Note that most maize-selling households sell considerably less than a ton.

4.3. Timing of Maize Sale

As the marketing season progresses the distance to the location of sale tends to increase. For example, during the months of November to January the distance travelled from the farm to the point of sale with assembly traders increases by 6.2 km compared to the months of May to July. This may be because the number of assembly traders starts to thin out later in the marketing season when fewer farmers have maize to sell, and hence those that do sell during this period need to travel further to find buyers. Farmers selling to millers and brewers sell their maize considerably closer to the farm during the August-October period than later in the marketing year, possibly because the millers and brewers hire agents to buy on their behalf in

the rural areas whereas later in the season farmers wanting to sell to these commercial buyers must travel to the district towns where their plants are located.

4.4. Market Access

Table 12 shows that as more maize buyers come into the village, a household is less likely to travel long distances to sell its maize to assembly traders. A greater degree of options for selling maize right in the village may increase the degree of competition and reduce the perceived need to travel far away to find a good price. The results in Column B imply that as the number of maize buyers operating in the village increases from five to 15, the mean distance traveled by farmers to the point of maize sale to assembly traders declines by 0.57 km.

As expected, the greater the distance to district town the greater the distance travelled to the location of the largest maize sale transaction with commercial maize buyers , in particular millers, breweries and other commercial maize buyers (Table 12, column A and C). For example, one additional kilometer to the nearest district town, the distance travelled to sell commercial maize buyers in general increases by 0.087 km whilst that to millers, breweries and other commercial buyers increases by 0.69 km. However, assembly traders are by far the most common private buyer of farmers' maize, accounting for 90.1% of the largest maize sales transactions by farmers in the 2009/10 marketing season. For these sales, the relationship between the distance from the farm to the point of sale and the distance from the farm to the district town is statistically insignificant, indicating that assembly traders tend to be penetrating deeply into rural areas regardless of the distance to district towns. And as discussed earlier, there is also no relationship between the distance to the district town and the number of assembly buyers operating in the village. These are major findings because they indicate that farmers' market access conditions for maize are roughly the same regardless of farmers' degree of remoteness as defined by distance to the nearest district town.

Last but not least, the econometric results show that households in Southern and Central Province tend to travel the greatest distances to sell their maize to assembly traders compared to farmers in the other provinces. On average, farmers in Southern Province traveled 12.6 km farther to sell maize to an assembly trader than farmers in Lusaka Province and by similar differences in most other provinces.

Table 12. Factors Explaining Distance to Nearest Largest Maize Sale with Commercial Buyers, 2009/10 Marketing Season

Covariates	----------2009/10 Marketing Season ----------		
	Km distance to Commercial maize buyers	Km distance to assembly traders	Km distance to millers, breweries and other commercial buyers
	(A)	(B)	(C)
Male headed household (=1)	1.179	1.925*	-1.357
	(1.500)	(1.076)	(12.750)
Age of household head (years)	-0.073*	-0.062*	-0.154
	(0.039)	(0.035)	(0.284)
Education of household head (reference no education)			
Primary (1-7 years)	-0.896	-0.236	-47.248
	(2.419)	(1.702)	(39.139)
Secondary (8-12 years)	-0.151	0.616	-56.417
	(2.654)	(2.070)	(39.648)
Post-Secondary (> 12 years)	1.017	5.293	-86.635**
	(3.857)	(3.515)	(41.588)
Number of maize buyers coming into village	-0.045	-0.057**	-0.062
	(0.028)	(0.023)	(0.426)
Km to nearest District Town	0.087**	0.045	0.687***
	(0.037)	(0.032)	(0.227)
Km to nearest FRA Buying point	0.147	0.185**	0.251
	(0.090)	(0.092)	(0.372)
Area planted to maize (Ha)	2.388***	0.993	5.923
	(0.884)	(0.737)	(3.642)
Quantity of maize harvested (Mt)	40.234***	25.213**	-2.458
	(11.153)	(10.893)	(35.127)
Seasonal quarterly dummies (ref. May, June July)			
August, September and October(=1)	-1.833	0.287	-29.028**
	(1.454)	(1.274)	(12.442)
November, December and January (=1)	4.996*	6.211**	32.419
	(2.840)	(2.599)	(28.924)
February, March and April(=1)	2.235	2.793**	-16.921
	(1.503)	(1.208)	(10.987)
Province (reference Lusaka)			
Central	6.563**	5.520**	29.066
	(2.908)	(2.481)	(18.148)
Copperbelt	2.310	0.649	31.650
	(3.072)	(2.030)	(19.183)
Eastern	0.161	2.508	77.116**
	(2.294)	(1.997)	(35.697)
Luapula	-0.955	0.458	1.397
	(2.330)	(2.074)	(21.966)
Northern	0.975	3.182	-1.788
	(2.511)	(2.341)	(15.166)
Northwestern	-1.290	1.206	80.736***
	(2.335)	(2.121)	(23.395)
Southern	8.806***	12.564***	5.965
	(3.401)	(3.293)	(15.551)
Western	-2.444	-0.301	-31.719*
	(2.472)	(2.306)	(18.993)
Constant	-2.079	-4.159	55.031
	(3.923)	(3.359)	(42.297)
Observations	2,699	2,438	261
R-squared	0.139	0.109	0.338
N_psu	1018	978	178
N_pop	248170	229602	18568

Source: MACO/CSO Crop Forecast Survey, 2009-2010 Marketing Season.
Notes: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

5. CONCLUSIONS AND POLICY IMPLICATIONS

While it is widely viewed that smallholder farmers in remote areas are isolated from markets and face severe constraints in marketing their food grains, to date there has been very little empirical investigation to back up these perceptions. This study is motivated by the need to overcome this paucity of empirical evidence and provide policy makers with an up-to-date assessment of smallholder farmers' market access conditions for maize, the primary food grain in Zambia.

This study uses official Crop Forecast Survey data of the Government of Zambia's Central Statistical Office to examine the distance traveled by smallholder farmers to the point of maize sale and the number of traders buying maize directly in farmers' villages. The 2009/10 Crop Forecast data is a nationally representative sample of over 14,000 small- and medium-scale farm households. Analysis is also drawn from nationally representative Supplemental Surveys to the Post Harvest Survey, also conducted by the Central Statistical Office in earlier years to examine changes over time in famers' market access conditions.

The study highlights five salient findings. First, over 50% of smallholder farmers are within 3 km of a feeder road that is accessible by vehicular transport. This in itself does not ensure good access to markets but allows for clear interpretation of the other main findings. There is a high degree of correlation between the distance traveled to the point of maize sale and the distance to the nearest place where vehicular transport can be accessed. Proximity to feeder roads hence appears to be an important determinant of traders' willingness and ability to enter into otherwise remote areas to provide markets for smallholder farmers' surplus production.

The second main finding is that despite the poor condition of many feeder roads in Zambia, most smallholder farmers either sell their maize directly on their farms or travel very short distances to sell their maize to private buyers. Over 60% of the farmers selling maize to assembly traders sold their maize right on their farms. Another 20% traveled up 3 km or less for their major maize sales transaction. Roughly 10% of farmers, typically those with larger quantities of maize to sell, chose to travel long distances of 30 km or more to sell their maize to larger buyers such as millers and brewers and hence the long distances that they traveled represents a deliberate marketing strategy on their part to bypass assembly traders. Farmers choosing to employ this strategy tended to be located in the same areas as other farmers selling on their farms to assembly traders. Therefore the long distances traveled by about 10% of the smallholder population to sell maize is generally not reflective of severe market access problems, but more indicative of a deliberate marketing strategy. An apparent exception to this conclusion is farmers in some areas of Southern Province, where even those farmers selling to assembly traders faced somewhat longer distances travelled.

A third major finding concerns the degree of competition in village-level maize assembly markets. Farmers who sold maize in the 2010 Crop Forecast Survey indicated that the mean number of traders buying maize directly in their villages during the 2009/10 season was 9.0. The number of assembly traders was statistically significantly higher in areas of surplus maize production and lower in the less productive areas where only a small number of households were surplus maize producers. These findings indicate a reasonable degree of competition in village-level maize buying in most areas of rural Zambia, and that the transport and market failure problems commonly attributed to smallholder conditions in Zambia are much less of an issue than commonly thought. There are some exceptions however. In about 15% of the areas covered by the Crop Forecast Survey, the number of assembly traders was below 5, but these tended by be maize deficit areas where very little surplus production was generated. Further research is required to obtain a more

comprehensive understanding of why some areas of Zambia have few maize traders operating there, but the results of this study can unquestionably rule out distance from the district town and remoteness as a major cause.

The fourth main finding is that the distance traveled from the farm to the point of maize sale was statistically unrelated to the farmers' distance to district town. Hence, distance to the district town appears to be a misleading indicator of farmers' access to private traders and markets. In fact, the distance to the nearest district town was an insignificant variable in models of the price received by farmers selling to private maize traders, the distance traveled by farmers who sell their maize to private traders, as well as in models of the number of traders operating in farmer respondents' villages. These findings indicate that farmers' market access conditions for maize are roughly the same regardless of farmers' degree of remoteness as defined by distance to the nearest district town. As mentioned above, there is a much higher correlation between the distance traveled to the point of maize sale and the distance to the nearest place where vehicular transport can be accessed as well as the percentage of surplus maize producing households in the area.

The fifth major finding is that farmers selling their maize to the Food Reserve Agency (FRA) are more likely to be located close to a district town. Over 57% of all smallholder households selling to FRA were located within 9 km of a district town. The probability that the FRA buys maize from a farmer diminishes as the household's location becomes further away from the district towns. This finding contrasts markedly with the commonly held contention that the FRA's role is crucial in providing market access to farmers in the remote areas where the private sector will not go. In fact, the vast majority of maize sales by farmers in remote areas (over 30 km from the district town) are by assembly traders. Ironically, these traders are often derogatorily branded as 'briefcase buyers' but it appears that they provide a valuable service to farmers in remote areas. Clearly, if these traders were not operating in the remote areas, a large proportion of smallholder farmers in Zambia would face much more serious problems in marketing their maize than they currently do.

Regarding the modeling of market access conditions by researchers, the findings of this study question the use of conventional market access measures such as the distance or travel time from the farm to the nearest district town. Such conceptualizations of market access do not take into consideration the broader range of factors that determine the degree to which traders operate in rural areas and the degree of competition among them.

Turning to policy implications, the findings of this study seriously question the notion that state operations in remote rural areas are always necessary to provide smallholder farmers with viable access to strategic food markets. Certainly smallholder farmers continue to suffer from a variety of constraints to smooth marketing of their products. Access to buyers and transport appear to not be the major constraints for at least most of them. Other research has highlighted the ubiquitous problem of under-weighing or under-grading of farmers' grain by traders. Serious efforts to encourage market development and to ameliorate market failure are likely to require an increased commitment to investment in public goods, e.g., more widespread use of grades and weight measures, strategic investment in road, rail and port infrastructure, research and development of crop varieties and agricultural extension systems to raise smallholders' productivity to enable them to produce a surplus in the first place (Jayne et al 2010). The Zambian government may wish to consider prioritizing agricultural investment in these productivity and market-enhancing public goods which currently receive a very small proportion of overall government spending on agriculture (Govereh et al. 2006, Chapoto 2011). The future of the small-scale farming sector's ability to prosper from maize production and marketing will depend on strengthening the performance of the marketing

system serving small-scale farmers, and on integrating the informal marketing system with the more developed “formal” marketing channels that are rapidly expanding in the region. Meeting this market development challenge is crucial not only for small-scale farmers’ as sellers, but also as purchasers of food.

APPENDICES

Table A1. Number and Percent of Households Selling Maize by Province and Buyer Type

Province		Number of households selling maize to private buyers (weighted)	Number and percent of households selling to private buyers by type					
			Private assembly traders		Millers and Breweries		Other households	
Central	2009/10	60,268	49,430	82.0	7,233	12.0	3,605	6.0
	2010/11	54,480	43,485	79.8	2,680	4.9	8,315	15.3
Copperbelt	2009/10	29,748	21,435	72.1	3,256	10.9	5,057	17.0
	2010/11	28,168	17,548	62.3	2,447	8.7	8,173	29.0
Eastern	2009/10	53,619	49,946	93.2	597	1.1	3,075	5.7
	2010/11	36,017	23,745	65.9	1,219	3.4	11,054	30.7
Luapula	2009/10	20,620	15,153	73.5	641	3.1	4,826	23.4
	2010/11	31,192	17,394	55.8	425	1.4	13,373	42.9
Lusaka	2009/10	7,607	4,314	56.7	1,915	25.2	1,377	18.1
	2010/11	8,447	3,139	37.2	733	8.7	4,574	54.2
Northern	2009/10	46,256	37,905	81.9	1,808	3.9	6,542	14.1
	2010/11	40,151	29,554	73.6	1,003	2.5	9,594	23.9
Northwestern	2009/10	30,533	26,151	85.6	19	0.1	4,364	14.3
	2010/11	22,470	16,502	73.4	522	2.3	5,446	24.2
Southern	2009/10	41,161	29,134	70.8	3,114	7.6	8,913	21.7
	2010/11	52,669	28,710	54.5	4,777	9.1	19,182	36.4
Western	2009/10	15,061	10,537	70.0	955	6.3	3,569	23.7
	2010/11	17,091	11,060	64.7	742	4.3	5,289	30.9
National	2009/10	304,872	244,005	80.0	19,539	6.4	41,328	13.6
	2010/11	290,684	191,138	65.8	14,546	5.0	84,999	29.2

Source: MACO/CSO Crop Forecast Survey 2009-2010 and 2010/11 Marketing Season.

Table A2. Distribution of Distance to the Location of the Largest Maize Sale Transaction to Assembly Traders

Marketing Year	Province	Number of households	%	Distance to nearest Assembly traders					
				Mean	Pctile 10	Pctile 25	Pctile 50	Pctile 75	Pctile 90
				----------Kilometers----------					
2007/2008	Central	49589	(23.2)	16.43	.00	.00	.00	6.00	34.00
	Copperbelt	21407	(10.0)	4.60	.00	.00	.00	1.00	22.00
	Eastern	20343	(9.5)	7.74	.00	.00	.00	.50	10.00
	Luapula	16974	(7.9)	4.98	.00	.00	.00	2.00	10.00
	Lusaka	3638	(1.7)	2.36	.00	.00	.00	.00	4.00
	Northern	39856	(18.7)	5.58	.00	.00	.00	2.00	8.00
	Nwestern	27406	(12.8)	9.64	.00	.00	.00	3.50	15.00
	Southern	18667	(8.7)	14.41	.00	.00	1.00	12.00	60.00
	Western	15626	(7.3)	22.41	.00	.00	.00	10.00	100.00
	National	**213506**	**(100.0)**	**10.72**	**.00**	**.00**	**.00**	**4.00**	**25.00**
2009/2010	Central	49623	(20.3)	10.46	.00	.00	1.00	4.00	25.00
	Copperbelt	21435	(8.8)	3.57	.00	.00	.00	.00	7.00
	Eastern	50013	(20.5)	5.37	.00	.00	.00	2.00	15.00
	Luapula	15153	(6.2)	28.15	.00	.00	.00	.00	2.00
	Lusaka	4314	(1.8)	3.09	.00	.00	.00	.00	2.00
	Northern	37905	(15.5)	5.42	.00	.00	.00	1.00	5.00
	Nwestern	26151	(10.7)	3.26	.00	.00	.00	.00	2.00
	Southern	29152	(11.9)	19.68	.00	.20	4.00	35.00	52.00
	Western	10537	(4.3)	3.08	.00	.00	.50	1.60	4.00
	National	**244283**	**(100.0)**	**9.02**	**.00**	**.00**	**.00**	**2.00**	**24.00**
2010/2011	Central	43485	(22.8)	11.02	.00	.00	1.00	6.00	25.00
	Copperbelt	17548	(9.2)	6.97	.00	.00	.30	5.00	20.00
	Eastern	23745	(12.4)	6.70	.00	.00	.00	3.00	30.00
	Luapula	17394	(9.1)	2.31	.00	.00	.00	1.00	3.00
	Lusaka	3139	(1.6)	1.88	.00	.00	.00	.00	3.00
	Northern	29554	(15.5)	3.90	.00	.00	.00	2.00	13.00
	Nwestern	16502	(8.6)	3.35	.00	.00	.00	1.00	6.00
	Southern	28710	(15.0)	10.65	.00	.00	1.00	7.00	40.00
	Western	11060	(5.8)	3.03	.00	.00	.00	1.00	5.00
	National	**191138**	**(100.0)**	**6.88**	**.00**	**.00**	**.00**	**3.00**	**20.00**

Source: CSO/FSRP Supplemental Surveys 2004 and 2008; MACO/CSO Crop Forecast Surveys 2010 and 2011.

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