

Full Length Research Paper

Market participation of smallholder maize farmers in the upper west region of Ghana

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Received 24 January, 2014; Accepted 26 June, 2014

This study investigated farmer characteristics, private assets, public assets and transaction cost variables influencing the probability and intensity of participating in the market by smallholder maize farmers in the Upper West Region of Ghana. The Household Commercialisation Index was used to estimate the level of market participation and the Double Hurdle Model was used to estimate the factors influencing both market participation and intensity of participation. The results indicated that about twenty-four percent of maize is sold in the region within a production year which implies low commercialisation index. Specific farmer characteristics, private assets, public assets and transaction cost variables significantly influenced the probability and intensity of market participation behaviour in the region. The study concludes that maize is produced as a staple for household consumption. The study recommends that government through the Ministry of Food and Agriculture should institute productivity enhancing measures to increase the productivity of maize as well as establish rural finance schemes to address the credit needs of smallholders.

Key words: Household commercialisation index, double hurdle model, market participation, maize, smallholder farmers, upper west region, Ghana.

INTRODUCTION

Ghana has a largely agrarian economy. Area under cultivation in 2010 stood at 7,846,551 ha representing 57.6% of the total agriculture land area. Agriculture is however dominated by smallholder farmers who are predominantly rural dwellers, with about 90% of farm holdings less than 2 ha in size.

The implication of this dominance of smallholders is that no meaningful policy to enhance the development of the agricultural sector can overlook these farmers. As a result, many authors (such as Siziba et al., 2011;

Chamberlin et al., 2007), policy documents (such as

GPRS II, FASDEP II, CAADP) and institutions (such as MoFA, 2007 and the World Bank, 2007) have emphasised the reorientation of policies towards access to markets by smallholder farmers as a means of improving their livelihoods and development. In line with this, the Government of Ghana recognised that strategies to improve agricultural performance should include investments that improve and enhance market access. Siziba et al. (2011) noted that a leap that African agriculture needs to make to reduce poverty and hunger is to transform from the low productivity semi-subsistence

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farming to high level commercial production. Therefore, any pathway that can lift large numbers of the rural poor out of poverty will require some form of transformation of smallholder agriculture into a more commercialized production system (Olwande and Mathenge, 2012).

Northern Ghana, which includes the Northern, Upper West and Upper East regions, is poorly endowed with natural resources and the income per capita of its population falls well below the national average. The Upper West region is among the poorest and least developed regions in Ghana having the least average annual per capita income of GH¢130 as against the national average of GH¢400 (GSS, 2008). The Ghana Poverty Reduction Strategies I & II, indicate that nine out of ten people in the region are poor and almost 90% of its population depends on farming in rural areas.

In the Upper West Region, maize is one of the major crops grown and is of high commercial value. Maize accounts for 50-60% of the total cereal production in Ghana and represents the second largest crop commodity in the country after cocoa. Maize is grown by over three-quarters of farmers nationally with two-thirds being grown in the Upper East and Upper West Regions. The implication is that increased production of maize in the Upper West Region presents opportunities to promote smallholder income growth and hence reductions in poverty levels and also enhance achievement of food security.

Despite this growing emphasis on market participation, agricultural commercialisation is low (IFAD-IFPRI, 2011). They indicated that the national average of marketed surplus ratio which defines the level of commercialisation is 33%, which is observed as low. While there are significant differences of market commercialisation across regions, the Upper West Region has one of the least average marketed surplus ratio of 18% only better than the Upper East Region which has 15%.

Maize which has potentials for increasing incomes is still widely produced as staple crop. Why is maize not making transition from staple to commercial crop in view of the potentials it presents? And why is the level of commercialization of smallholder farmers in the Upper West Region so low? The study specifically addresses the following questions. What is the level of market participation by smallholder maize farmers? What factors influence the intensity of market participation by smallholder maize farmers? Based on these questions, the study addresses these objectives:

1. To estimate and analyse the level of market participation by smallholder maize farmers.
2. To estimate and discuss the magnitude and effects of factors which determine the probability and intensity of smallholder maize farmers' participation in the market.

Literature review

The concept of market participation has been defined and

interpreted in various ways. Based on the work of Barrett (2008), two basic interpretations can be inferred: households can participate in the market either as sellers or buyers. Therefore market participation has a demand side; households participating as buyers, and a supply side; households participating as sellers. Both the decision to enter the market as a seller or a buyer is motivated by the theory of optimisation where the household seeks to maximise utility subject to the cash budget and available non-tradable resources. In empirical studies, the supply side of market participation is emphasised as studies tend to focus on that side of the equation. Based on the supply side, market participation is often conceived in terms of sales as a fraction of total output and can be generally referred to as commercialisation of agriculture (Makhura et al., 2001; Omiti et al., 2009).

Empirical evidence of smallholder farmers' participation in the market has been extensively considered for variety of agricultural products in agrarian economies especially Africa. Literature has focused primarily on understanding the role of transactions costs and market failure in smallholder decision making. With respect to the transaction cost variables affecting market participation, Goetz (1992) observed that in small or less developed markets it is costly to identify trading opportunities while poor market access due to lack of transport, distance, and/or barriers such as ethnicity or language increase a household's cost of observing market prices to make transaction decisions, thus reducing the household's leisure time in sub-Saharan Africa. In general, many evidences found strong positive associations between market participation and low levels of transactions costs especially transport costs and information costs (Alene et al., 2008; Ouma et al., 2010).

Empirical evidence of household characteristics/private asset variables and market participation has generally been found to exhibit positive relationship with market participation. For example, Siziba et al. (2011) observed that off-farm income, ownership of radio and number of livestock owned were highly significant private asset variables positively associated with high volume of cereal grain sales among smallholder farmers in sub-Saharan Africa. Socioeconomic characteristics such as age, education, farm size, ownership of some assets and output were observed to have positive effect on market participation of various agricultural commodities (Olwande and Mathenge, 2012; Omiti et al., 2009; Randela et al., 2008).

Public assets variables have also been found to have positive relationship with market participation especially with respect to access to credit and insurance (Cadot et al., 2006; Stephens and Barrett, 2009) and input use and access to extension services (Alene et al., 2008). For example, Olwande and Mathenge (2012) and Omiti et al. (2009) observed price to positively affect market participation. Siziba et al. (2011) observed that extension training and participation in research have positive

effect on market participation.

MATERIALS AND METHODS

Study area and data collection

The Upper West region has eleven political/administrative districts. The study focused on four purposively selected agricultural districts: Jirapa-Lambussie, Nadowli, Wa West and Sissala East because of their highest share in the production of maize in the 2011 production season.

The data for the study was completely primary data gathered through a household survey by the use of a semi-structured questionnaire aided by a face to face interview of smallholder maize farmers in the 2011 production season. The semi-structured questionnaire was designed to collect a range of data on amounts of maize production and the proportion sold, household characteristics such as age, gender, marital status, farm experience of the household head, household size, etc.; private assets variables such as farm size, off-farm income, ownership of a mobile phone, etc.; public assets variables such as access to credit, extension contact, etc.; transaction cost variables such as access to market information, point of sale of output, etc. A multi-stage sampling procedure was adopted to draw a sample size of 200 maize farmers. The multi-stage procedure was a three-stage, clustered, purposive and random sampling approach. The three stages involved the selection of districts, the selection of enumeration areas earmarked by MoFA and associated communities and the selection of maize farmers.

Analytical framework

This study is theoretically underpinned by the Barrett's stylized household's non-separable market participation behaviour model which is premised on utility maximisation. The basic assumption of the Barrett's model is that a farm household faces a decision to maximise utility either as a net buyer, net seller or autarkic represented in the reduced form as a function of the exogenous variables (A, G, W, P, Z) capturing private asset stock, public asset stock, household-specific characteristics, commodity price and transaction costs respectively. Boughton et al. (2007) shows that each of the choice variables (being a net buyer, net seller and autarkic) can be represented in reduced form as a function of the exogenous variables. This implies that participating in the market as a seller can be a stand-alone model reflecting a fundamental relationship between market participation of households as sellers and some variables which serve as covariates as:

$$\text{Market participation (as sellers)} = f \left(\begin{array}{l} \text{private asset stock (A), public asset stock (G),} \\ \text{household characteristics (W),} \\ \text{commodity price (P) and transaction cost (Z)} \end{array} \right) \quad (1)$$

Following from equation 1 and other studies (Omiti et al., 2009; Randela et al., 2008; Boughton et al., 2007), the specific theoretical relationship is represented as:

$$\text{Market participation (as sellers)} = f \left(\begin{array}{l} \text{AGE, GEN, EDUC, MARST, HHSIZE, FEXP, MFBO, FRMSIZE, HHINC,} \\ \text{OFINC, OUTPUT, TEL, ACCRE, EXTCON, PRICE, MKTINFO, POS} \end{array} \right) \quad (2)$$

In empirical studies however, econometric models applied to market participation in general typically adopt a two-step analytical approach. The reason for the application of two step analytical approach is that market participation is seen to embody two

decision processes: the unobservable decision to participate and the observed degree or extent of participation.

The Cragg's double hurdle model (DHM) and the Heckman sample selection model are the widely used models in the two step approach. The Heckman model is designed for incidental truncation, where the zeros are unobserved values. However, in this study, a zero value in the data would reflect farmers' optimal choice rather than a missing value. It would be erroneous to equate these missing observations to zero. Therefore, the DHM is used in this study. It estimates a probit model in the first stage and a truncated regression model in the second stage.

The truncated Barrett's stylized non-separable household market participation behaviour model as summarised in equation 1 does not explicitly capture the two step approach of market participation as indicated in empirical studies. This study adds to the Barrett's theoretical model by creating the empirical dimensions of the unobservable decision to participate and the observed degree or extent of participation as follows.

$$\begin{aligned} \text{Market Participation model: PART} \\ = \alpha_0 + \alpha_1 \text{AGE} + \alpha_2 \text{GEN} + \alpha_3 \text{EDUC} + \alpha_4 \text{MARST} \\ + \alpha_5 \text{HHSIZE} + \alpha_6 \text{FEXP} + \alpha_7 \text{MFBO} \\ + \alpha_8 \text{FRMSIZE} + \alpha_9 \text{HHINC} + \alpha_{10} \text{OFINC} \\ + \alpha_{11} \text{OUTPUT} + \alpha_{12} \text{TEL} + \alpha_{13} \text{ACCRE} \\ + \alpha_{14} \text{EXTCON} + \alpha_{15} \text{MKTINFO} + \varepsilon \end{aligned} \quad (3)$$

$$\begin{aligned} \text{Intensity of Participation model: HCI} \\ = \beta_0 + \beta_1 \text{AGE} + \beta_2 \text{GEN} + \beta_3 \text{EDUC} + \beta_4 \text{MARST} + \beta_5 \text{HHSIZE} \\ + \beta_6 \text{FEXP} + \beta_7 \text{MFBO} + \beta_8 \text{FRMSIZE} + \beta_9 \text{HHINC} + \beta_{10} \text{OFINC} \\ + \beta_{11} \text{OUTPUT} + \beta_{12} \text{TEL} + \beta_{13} \text{ACCRE} + \beta_{14} \text{EXTCON} + \beta_{15} \text{PRICE} \\ + \beta_{16} \text{MKTINFO} + \beta_{17} \text{POS} \\ + \mu \end{aligned} \quad (4)$$

The description, measurement and expected signs of variables are displayed in Table 1. The estimation of the market participation models represented in equations 3 and 4 can be achieved by first estimating the level of participation. This achieves the first objective of the study. The Household Commercialisation Index (HCI) proposed by Govereh et al. (1999) and Strasberg et al. (1999) is used but modified to estimate the level of Maize Commercialisation Index (MCI) only and specified as:

$$\text{HCI}_{im} = \left[\frac{\text{Gross value of maize sale}_{ij}}{\text{Gross value of all maize production}_{ij}} \right] * 100 \quad (5)$$

where HCI_{im} is the i^{th} household commercialisation index for maize; the numerator is the total amount of maize sold by the i^{th} household in the j^{th} year ($j = 2011$ farming season) and the denominator is the total value of output of maize by the i^{th} household in the j^{th} year.

EMPIRICAL RESULTS AND DISCUSSION

Socio-economic characteristics of surveyed households

The age of surveyed household heads range from 21 to 88 years with a mean age of 47 years. This implies that farm households in the region can be described as relatively young and within the economically active population. About 86% of household heads is male while about 14% is female. This is consistent with the gender distribution in Ghana where 65.3% are male-headed and 34.7% are female-headed (GSS, 2012). The majority (84.5%) of household heads is married while 15.5% is

Table 1. Description, measurements and expected signs of variables in the participation and the intensity models.

Variable	Description	Measurement	Expected sign	Model*
<i>PART</i>	Decision to participate in the market or not	Dummy: 1 = farmer participates in market (sold maize); 0 = otherwise		PBT
<i>HCI</i>	Percentage of total output sold	Household Commercialisation Index		TRR
Farmer characteristics				
<i>AGE</i>	Age of the farmer	Number of years	+/-	PBT/TRR
<i>GEN</i>	Gender of the farmer	Dummy: 1 = if male; 0 = otherwise	+	PBT/TRR
<i>EDUC</i>	Education level of the household head	Number of years of schooling	+/-	PBT/TRR
<i>MARST</i>	Marital status of farmer	Dummy: 1 = if married; 0 = otherwise	+	PBT/TRR
<i>HHSIZE</i>	Household size of farmer	Number of people in the household	+/-	PBT/TRR
<i>FEXP</i>	Farmer experience in maize farming	Number of years in farming	+	PBT/TRR
<i>MFBO</i>	Membership of farmer to an FBO	Dummy: 1 = if member; 0 = otherwise	+	PBT/TRR
Private assets variables				
<i>FRMSIZE</i>	Total amount of land cultivated to maize in the 2011 production season	Hectares	+	PBT/TRR
<i>HHINC</i>	Total annual household income	Ghana Cedi (GH¢)	+	PBT/TRR
<i>OFINC</i>	Proportion of off-farm income in total annual household income	Ratio	+/-	PBT/TRR
<i>OUTPUT</i>	Total output of maize produced in the 2011 production season	Number of 50 kg bags	+	PBT/TRR
<i>TEL</i>	Farmer ownership of a mobile phone	Dummy: 1 = if yes; 0 = otherwise	+	PBT/TRR
Public Assets/Social capital variables				
<i>ACCRES</i>	Access to credit by farmer	Dummy: 1 = if farmer applied and received credit; 0 = otherwise	+	PBT/TRR
<i>EXTCON</i>	Farmer contact with extension officers	Dummy: 1 = if yes; 0 = otherwise	+	PBT/TRR
<i>PRICE</i>	Average price at which each 50 kg bag of maize is sold	Ghana Cedi (GH¢) per 50 kg bag	+	TRR
Transaction cost variables				
<i>MKTINFO</i>	Farmer access to market information	Dummy: 1 = if yes; 0 = Otherwise	+	PBT/TRR
<i>POS</i>	Point of sale of output	Dummy: 1 = market centre; 0 = farm-gate	-	TRR

*Model in which variable is applied: PBT is Probit model (Participation/hurdle 1), TRR is Truncated Regression model (intensity of participation/hurdle 2).

unmarried. Mean household size in the region is about 10 people and ranges from 2 to 32. The majority of households (69.5%) have no formal education. This is followed by heads with primary level of education (13.5%). The least are heads with university education (0.5%). The mean years of education shows that on average the highest level of education attained by a household head is primary education (approximately primary 3). Households have on the average 13 years of farming experience in maize farming. The minimum and maximum farming experience are 1 and 68 years respectively. The average annual household income is GH¢1,123.80 and ranges between 25 and GH¢6,900. Household income basically flows from sales of maize output, other on-farm activities, and non-farm activities.

About 16% of household heads engaged in non-farm income activities in the region in the 2011 farming season. Mean annual non-farm income is GH¢204.67.

The mean farm size cultivated to maize is 1.10 ha with a minimum of 0.40 and maximum of 2 ha. The mean output of maize is 11.02 bags with a minimum of 1 bag and a maximum of 89 bags. Households with access to credit represented only 22.5% of the sample. This means that access to credit is one of the major constraints faced by households. The majority (92%) of households were not members of any farmer organisation while 8% belonged to FBOs. Those who are members meet on average 2 times a month. Farmers who had access to market information represented the majority (63%). Market information basically constituted market prices

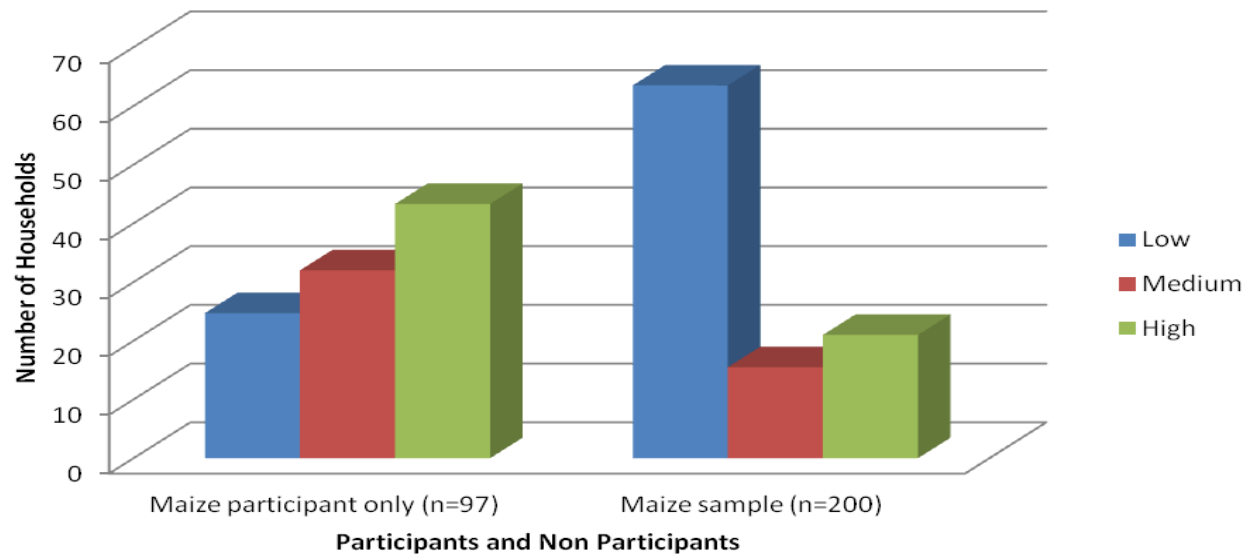


Figure 1. Characterisation of degree of participation by households. Source: Drawn from Household Survey Data (2012).

and where sharp market is. Access to information was from friends/relatives (16%), market women (28%) and radio (56%). Households receiving agriculture extension services constituted 41% of surveyed households while those without contact constituted 59%. This implies that extension contact in the region is very low.

About 48.5% of households participated in the maize market while 51.5% did not. This implies that about 49% of farmers in the region sold maize output from the 2011 farming season while about 52% did not. 55.7, 38.1 and 6.2% of maize sales were done at farm-gate, market centre and both farm-gate and market centre respectively. The average price received by maize farmers is GH¢68.55 per 50 kg bag distributing into GH¢67.03 per 50 kg bag at farm-gate and GH¢71.40 per 50 kg bag at the market centre.

Level of market participation by smallholder maize households

The level of market participation or commercialisation of smallholder maize households from the data gathered indicates that the average marketed surplus ratio is 23.77%. This implies that on average 24% of the output of maize is sold by sampled farmers in the Upper West region within a production season. The result shows a low commercialisation index and hence maize can be regarded as a staple crop cultivated for the purpose of household consumption. The estimate of the level of participation was used to characterise farmers according to low, medium and high commercial farmers. According to Abera (2009), households who sell at most 25% and below of their output are low commercial farmers, those who sell between 26 and 50% are medium commercial

farmers and above 50% are high commercial farmers. Following this categorisation, 63.5% are low commercial farmers, 15.5% are medium commercial farmers and 21% are identified as high commercial farmers. Figure 1 gives a pictorial view of the categorisation of households.

The figure shows that there are more high commercial farmers than medium and low commercial farmers for only farmers who sold maize. However, considering the whole sample of maize farmers (both those who sold and those who did not sell), there are more low commercial farmers than high and medium commercial farmers.

Determinants of market participation and intensity of participation of smallholder maize households

The user written command, '*craggit*' by Burke (2009) in Stata was used for the estimation of the magnitude and effects of factors that determine the probability and intensity of smallholder maize farmers' participation in the market. This command estimates the first and second hurdles of the DHM simultaneously. Diagnostic test for multicollinearity which is a common problem in any regression analysis was conducted based on variance inflation factor (VIF) to identify any potential misspecification problems that may exist in the estimated models. The test indicated that the largest VIFs in the probability model is 2.09 and that of the intensity model is 3.11. These values are well below the maximum value of 10 that is used as a rule of thumb to indicate the presence of multicollinearity. This implies that multicollinearity is not a problem in the estimated models. Heteroscedasticity is identified as a common problem with typical cross-section data. The established procedure for the correction of heteroscedasticity is to

Table 2. Estimates of determinants of market participation and intensity of participation.

Variable	Double hurdle estimates			
	Hurdle/Tier 1: Probability of participating in the market (Probit Regression)		Hurdle/Tier 2: Intensity of participating in the market (Truncated Normal Regression)	
	Coefficient	Robust standard error	Coefficient	Robust standard error
CONSTANT	1.4578**	0.7373	29.0423***	10.4511
AGE	-0.0408***	0.0100	-0.5130***	0.0991
GEN	-0.1662	0.3860	-10.4799**	4.6090
EDUC	-0.0751**	0.0357	0.2644	0.2719
MARST	-0.3491	0.3800	-3.0830	3.5305
HHSIZE	-0.1580***	0.0337	0.6033***	0.2052
FEXP	0.0010	0.0103	0.0991	0.0996
MFBO	1.2002***	0.4260	0.1742	3.7230
FRMSIZE	0.7742***	0.2835	0.6515	2.3759
HHINC	0.0005**	0.0002	0.0028***	0.0006
OFINC	3.4399***	1.0801	-10.6958**	4.4348
OUTPUT	0.0780**	0.0350	0.1824***	0.0692
TEL	0.0349	0.2819	-1.8071	2.6761
ACCRE	0.9644**	0.3765	8.2491***	3.1061
EXTCON	-0.0090	0.2844	-2.8364	2.4777
PRICE			0.4491***	0.0705
MKTINFO	0.5263*	0.2683	11.1541***	3.8656
POS			-9.1329***	2.5478

No. of observations = 200; Wald $\chi^2(15) = 88.83$; Prob > $\chi^2 = 0.0000$; Log pseudo likelihood = -417.9167; ***p < 0.01, **p < 0.05 and *p < 0.10. Source: Regression estimates from Household Survey Data (2012).

estimate the models using robust standard errors. Therefore, all the models are estimated using robust standard errors to correct for heteroscedasticity.

Determinants of market participation of smallholder households

The results of the determinants of the probability of participating in the market are displayed in Table 2. The Wald chi-square value of 88.83 is statistically significant at 1% indicating that the explanatory variables jointly explain the probability of participating in the maize market. The decision to participate in the maize market is significantly determined by age of the household head, number of years in school (educational status) of the household head, household size, membership in farmer based organisation, farm size, annual household income, proportion of off-farm income in total annual household income, output of maize, access to credit and market information.

Age is negatively associated with the probability of selling maize. This implies that older farmers are less likely to participate in the market as compared to younger ones. Older farmers might be more concerned about being food secured and would not want to take the risk of draining their maize banks as against the younger farmers who might want to enhance their quality of live

hence would engage in the market to achieve their objectives. Randela et al. (2008) observed that younger farmers are expected to be progressive, more receptive to new ideas and to better understand the benefits of agricultural commercialisation.

Number of years spent in school by the household head is negatively related to the probability of selling maize. That is, a higher level of education is associated with a reduction in the probability of participating in the maize market. This observation contradicts the expectation of Makhura et al. (2001), Enete and Igboke (2009) and Randela et al. (2008) who argued that education will endow the household with better production and managerial skills which could lead to increased participation in the market. The possible explanation for this is that farmers with a higher level of education engage in farming on a part time basis while they commit to their full time jobs. Since maize is a staple crop, more of the output is stored for household consumption. Households with larger sizes are less likely to sell their maize output. This confirms the finding of Siziba et al. (2011) that households with large family sizes fail to produce marketable surplus beyond their consumption needs. It also confirms the finding of Makhura et al. (2001) that households decide to sell when they cannot consume all they have produced and hence, the more members the household has, the more

likely that most of the produce will be consumed thereby decreasing the possibilities for selling.

Households who belong to farmer based organisations are more likely to sell maize. This is consistent with Olwande and Mathenge (2012) who argued that membership of a farmer to a farmer based organisation or group increases access to information important to production and marketing decisions while Matungul et al. (2001) observed that collective action as measured by belonging to farmers' organisations strengthens farmers' bargaining and lobbying power and facilitates obtaining institutional solutions to some problems and coordination. Farm size is positively related with the probability of selling maize. A larger farm size provides a greater opportunity for surplus production. Annual household income and the proportion of off-farm income in total annual household income are positively correlated with the probability of selling maize. Larger incomes and proportion of off-farm income enhance large scale production and input acquisition leading to larger marketable surpluses.

Output of maize is significantly associated with higher probability of participating in the market which is consistent with expectation since a higher output ensures marketable surplus. This finding underscores the importance of increased output by smallholders to enhance their chances of stepping out of poverty and improving their livelihood through increased income from increased participation in the market. Access to credit has a positive influence on the probability of selling maize. This result indicates that farmers with access to credit are able to produce enough marketable surpluses. One supporting argument is that access to credit gives the farm households the economic power to cultivate on large scale. Access to market information has a positive effect on the probability of selling maize. This confirms the finding of Siziba et al. (2011) who argued that access to information reduces risk perceptions. Another possible explanation for this result could be that farmers with access to market information might be easily persuaded to sell than those without such information.

Determinants of the intensity of market participation of smallholder maize households

The results for the determinants of the intensity of market participation are also displayed in Table 2. The intensity of participation in the maize market is significantly determined by age of the household head, gender of the household head, household size, annual household income, proportion of off-farm income in total annual household income, output of maize, access to credit, average price of maize output sold, access to market information and point of sale of maize output.

Age, conditioned on participating in the market, is negatively associated with the quantity of maize sales. Older farmers tend to sell less maize than the younger

ones. For an additional year of a farmer, the quantity of maize sold decreases by 0.51%. One possible explanation is that the older farmers are more concerned with food security and therefore livelihood as compared to younger farmers. Gender has a negative effect indicating that male headed households sell less maize than their female counterparts. Female farmers sell 10.48% more maize than male farmers. This finding is unconditional on the probability of participation in the maize market. This finding strengthens the debate in favour of making productive assets accessible to women since it is argued that they are equally productive and commercial. Household size is positively associated with the quantity of maize sold. While the probability of selling maize is significantly negatively associated with the household size, conditional on selling, the quantity sold is positively associated with the household size. An increase in the household size by 1 person increases sale of maize by 0.60%. This implies that though households with larger sizes are less likely to participate in the maize market as sellers, they sell more maize when they participate.

Conditioned on participation in the maize market, household income is positively correlated with the amount of maize sold. A GH¢1 increase in annual household income increases the quantity of maize sold by 0.003%. While the proportion of off-farm income in total annual household income is positively related to the probability of participating in the maize market, it is negatively related to the quantity of maize sold. This implies that conditioned on participation, households with higher proportion of off-farm income in total annual household income sell 10.70% less maize. This implies that maize market participants do not invest off-farm income in farm technology and other farm improvement activities and tends to trigger off-farm diversification. Output of maize is associated with more sales of maize conditioned on participation. For every extra 50 kg bag of maize produced, 0.18% would be sold. This confirms the finding of Reyes et al. (2012) that farmers who have greater production have more surpluses they could sell. Surplus production serves as incentive for a household to participate in market (Omiti et al., 2009; Barrett, 2008). Access to credit is positively associated with the intensity of participation in the maize market. This means that households with access to credit sell 8.25% more maize than households without access. Access to credit is conditional on the probability of participating in the maize market. This result is expected since access to credit provides the financial strength for households to engage in intensive farming leading to more marketable surplus. Average price of the output of maize is positively associated with the quantity of maize sold implying that households who were faced with higher prices sold 0.45% more maize than those who had relatively lower prices. This finding is consistent with expectation and reflects the selling behaviour (selling at their times and at different prices) of the farmers in the region. This finding

confirms the assertion from economic theory that output price is an incentive for farm households to supply more produce for sale. It also confirms the findings by Omiti et al. (2009) and Olwande and Mathenge (2012) that output price is an incentive for sellers to supply more maize in the market. Access to market information has a positive association with the quantity of maize sold conditioned on participation in the maize market. Households who had access to market information sold 11.15% more maize than those who did not have access. This confirms the finding of Siziba et al. (2011) and Omiti et al. (2009). Siziba et al. (2011) explains that this finding underscores the positive impact of public infrastructure and services in promoting market participation while Omiti et al. (2009) gathered that formal information sources enhance the intensity of market participation. The point of sale of output (which sort to capture the effect of transaction cost in marketing behaviour of farm households) negatively influences the quantity of maize sold. Households who sold maize travelling to market centres sold 9.13% less maize as compared to those who sold at farm-gate (in their houses). This finding confirms the findings of Omiti et al. (2009) and Martey et al. (2012). Distance to market is an indicator of travel time and cost. Once it is more costly and time consuming to travel to especially bigger market centres as compared to farm-gate sale, farmers are rational to choose to sell more at farm-gate even though big market centres in bigger and more developed communities offer higher prices. The average price of farm-gate sale of maize was GH¢67.03 per 50 kg bag while the market centre average was GH¢79.51 per 50 kg bag in the 2011 production season. Given that higher prices prevail in market centres and yet more output is sold at the farm-gate, it can be opined that transaction cost has a role to play in explaining why more output of maize is sold at the farm-gate. To explain further the role of transaction cost, 68.3% of maize households indicated that they sold at the farm-gate to avoid paying transportation fare or incurring other costs to get to market centres that offer higher prices. This implies that some households are not able to sell at market centres that offer higher prices as a result of transaction cost associated with reaching such markets.

CONCLUSIONS AND IMPLICATIONS

The analysis carried out showed that about twenty-four percent of maize output is sold by maize farm households in the Upper West region. In terms of characterising farm households, about 64, 16 and 21% of maize farm households are characterised as low, medium and high commercial households. Based on these evidences, a strong case can be made in favour of the fact that maize is a household consumption commodity mainly produced as a staple. It has not gained the status of a cash crop. Evidences with respect to few households having access to credit, production of maize on small land sizes, low

engagement to farmer based organisations are all reinforcing issues to low marketed surplus ratio in the region.

The study confirms that farmer characteristics, private and public asset characteristics and transaction cost variables are the determinants of the probability and intensity of market participation of smallholder farm households. Specific variables that affect both the probability and extent of participation are age of the household head, household size, annual household income, proportion of off-farm income in annual household income, output of maize, access to credit and access to market information. Literature on market participation concentrates on the role of transaction cost in the market participation behaviour of farm households. The role of transaction has been underscored by this study. Though distant and more developed markets offer better prices for maize, majority of households still find it convenient to sell at the farm gate to avoid incurring cost to reach such markets.

Based on the findings of this study, the following policy measures are presented. Productivity enhancing mechanisms such as making fertilizer and other agro-inputs both physically and financially available should be put in place by MoFA through the regional and district offices to increase production of maize in the region. The fertilizer subsidy programme should be strengthened by effectively targeting smallholders. This should be coupled with the delivery of effective and proactive extension service alongside effective monitoring and supervision to ensure that what is delivered to farmers is effectively implemented by them. MoFA and other stakeholders should establish rural agricultural finance scheme aimed at addressing the credit needs of smallholder farmers. The development of the informal credit market should also be considered. The role of credit in enhancing the large scale production cannot be overemphasized. The Statistics, Research and Information Directorate (SRID) of MoFA should create a department solely for providing agricultural market information to make market information delivery effective. Farmers should effectively support efforts to form and maintain effective groups by government and other stakeholders to take advantage of credit facilities offered by microfinance and other credit institutions available. Microfinance institutions are willing to offer credit to groups because of the characteristic of joint liability which minimises their risk. Credit acquired should be invested directly in farm activities instead of diversions. Such effective groups can also better influence market prices for their products through their collective bargaining power.

ACKNOWLEDGEMENTS

The authors are very grateful to the International Food Policy Research Institute (IFPRI), Ghana for providing funds for data collection and allowing for the use of the

data. Gratitude is also extended to Dr Paul Nkegbe and Mr Haruna Issahaku, Department of Economics and Entrepreneurship Studies, University for Development Studies, Wa Campus for their encouragement and support.

Conflict of Interest

The authors have not declared any conflict of interest.

Abbreviations: **CAADP**, Comprehensive Africa Agriculture Development Programme; **DHM**, Double Hurdle Model; **FBO**, Farmer Based Organisation; **FASDEP II**, Food and Agriculture Sector Development Policy II; **GPRS II**, Ghana Poverty Reduction Strategy II; **GSS**, Ghana Statistical Service; **HCI**, Household Commercialisation Index; **IFAD**, International Fund for Agricultural Development; **IFPRI**, International Food Policy Research Institute; **MoFA**, Ministry of Food and Agriculture.

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