Agris on-line Papers in Economics and Informatics

Volume VIII Number 3, 2016

Smallholder Maize Farmers' Food Consumption Expenditures in Ghana: The Mediating Role of Commercialization

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Abstract

This paper examines the effect of smallholder maize farmers' commercialization on their household food consumption expenditures in Ghana using data from the Ghana Living Standard Survey Round Five (GLSS5). The results indicate that the intensity of smallholder maize commercialization is generally low and that better output price, quantity of maize produced, farm size, type of market or point of sale, access to mobile phone network coverage, proportion of crops given to landlord, instant payment for maize sold, are inter alia key incentive variables that influence the intensity of maize commercialization. The study also revealed that intensity of maize commercialization positively influenced food consumption expenditures. Increases in the sale of maize results in increases in purchases of food items needed to address household food security needs. These findings demonstrate the urgent need to strengthen smallholder market integration initiatives, encourage market information delivery systems, and establish more retail outlets with improved market facilities in order to promote production and trade in high value cereals such as maize in Ghana.

Keywords

Commercialization, smallholder maize farmers, consumption, food expenditures, households.

Asante, S. B., Osei-Asare, Y. B. and Kuwornu, J. K. M(2016) "Smallholder maize farmers' food consumption expenditures in Ghana: The mediating role of commercialization", *AGRIS on-line Papers in Economics and Informatics*, Vol. 8, No. 3, pp. 13 - 27. ISSN 1804-1930, DOI 10.7160/aol.2016.080302.

Introduction

Agricultural commercialization refers to the process of increasing the proportion of agricultural production that is sold by farmers in markets (Pradhan et al., 2010). However, commercialization of agriculture can take different forms by either occurring on the input side with increased use of purchased inputs from the markets or the output side of production with increased market surplus (Leavy and Poulton, 2007). Smallholder commercialization also typically leads to an increased diversity of marketed commodities at national level and increased specialization at regional and farm levels (Pingali and Rosegrant, 1995; Timmer, 1997). The demand for modern technologies promotes the input side of production and facilitates the development and advancement of technological innovations. In turn, the use of modern technologies can result in higher productivity with lots of produce offered for sale in the markets.

The basis of smallholder commercialisation as a development strategy involves the participation in markets by farmers which provides increased incomes that are able to maximize the returns to land and labour through market opportunities, using earned income for household food consumption in ways that are efficient than subsistence production (Timmer, 1997). It is commonly argued that productivity growth in African agriculture will require a transformation out of the subsistence level, low-input use, and low-productivity.

Commercializing smallholder agriculture is an essential pathway towards economic growth and development for most developing countries relying on the agricultural sector (Von Braun 1994; Pingali and Rosegrant, 1995; Timmer, 1997). However, it is observed that smallholder farmers are often risk averse and are reluctant to venture into commercialization that presents financial risks with potential adverse effects on household food

security. Rogers (1995) notes that subsistence and semi-commercial farmers find it difficult to entirely shift to commercial agriculture. In view of the above, several examples abound to show that smallholder farmers are very slow in shifting to commercialization within farming systems and land tenure systems constraints that negatively impacts on commercial agriculture and food security (Wiggins et al., 2011). This explains why commercialization by farmers is not high enough to enable them benefit from increased income, savings and investment in productive assets (IFAD-IFPRI, 2011; Mahelet, 2007). Therefore, in the long-run, subsistence agriculture has been identified not to be a viable activity to ensure sustainable household welfare and food security (Pingali, 1997).

High variability in market prices of farm products and farm inputs cause significant risks to household income. Lack of efficient marketing institutions and rural infrastructure and access to credit prohibits smallholder farmers from assuming such risks. These factors influence commercialization by affecting conditions of commodity demand and supply, input and output prices, and the transaction costs faced by farmers, traders, and other members in the food marketing channels.

Due to lack of adequate storage facilities and pressing needs for cash to spend on other household items, households end up in many cases selling excess produce during the harvesting period, and mostly rely on market purchases during the months before harvest. According to Okoboi (2008), low income households must also be able to purchase available foods in the market. Farm households with inadequate access to productive resources such as land, inputs and capital, required for attaining physical efficiency in food production could be food insecure, i.e., resource poverty could lead to low productivity, food insufficiency, and lack of income to purchase the needed food items for the household. The pattern of consumption is also affected, as consumers are likely to consume more protein in addition to grains.

In developing countries such as Ghana, greater share of income of people is spent on food (Banerjee and Duflo, 2007). The welfare gains from market -oriented production arise from specialization in certain crops such as maize that builds on and creates comparative advantage, potential for large-scale production, and from dynamic technological, organizational and institutional change effects that arise through the flow of ideas due to interactions, training and experiments (Romer, 1994). According to Mhango (2010), household spending constitutes the largest source of spending in the Ghanaian economy. Changes in food intake patterns have been associated with a change towards crop production, which often results in diminished nutritional quality in diets. The development of the maize sector in Ghana is integrated with other high value agro enterprises in a manner to have positive effects on incomes, food security and poverty reduction. Maize is cultivated in most parts of Ghana with leading producers found in the transitional and forest zones. Maize production is highly characterized by smallholder farms with fewer large farms. The intensity of maize commercialization by the farmers would influence their ability to purchase other commodities required by the households. The specific research questions are; what is the intensity of maize commercialization in Ghana? What are the factors influencing the intensity of maize commercialization in Ghana? How has the intensity of maize commercialization affected food consumption expenditures of farm households in Ghana?

This current paper examined the mediating role of commercialization on smallholder maize farmers' food consumption expenditures. The objectives of the study were threefold:

i. Estimate the intensity of maize commercialization in Ghana.

ii. Determine the factors influencing the intensity of maize commercialization in Ghana.

iii. Estimate the effect of the intensity of maize commercialization on food consumption expenditures of maize farming households in Ghana.

Materials and methods

Study area and data

Ghana is one of the countries located in the West African sub-region and covers an area of 238,540 square kilometers with a tropical humid climate. The southern part of the country has a double rainfall pattern (May-June and September -October) whereas the north has a single rainy season (June-August). The dry season occurs from January to March. Agriculture in Ghana largely follows the country's ecological and climatic patterns across the ten regions (Western, Central, Greater Accra,

Volta, Eastern, Ashanti, Brong-Ahafo, Northern, Upper East, and Upper West).

The Ghana Living Standard Survey Round Five (GLSS5) developed by the Ghana Statistical Service (GSS) was the main data set used for this study. The GLSS5 involved national and regional representative household survey that was undertaken by Ghana Statistical Service (GSS) over a one year period from 2005 to 2006. The data was employed due to its extensive coverage. The GLSS5 is the fifth comprehensive household survey implemented by GSS since 1987; such surveys generally aim at providing data concerning household welfare. The average price of food items within the study period was obtained from the GSS since the survey did not capture the prices of food items. The survey covered household demographics, education, health, employment, migration and tourism, housing, agriculture, non-farm enterprises, consumption and expenditure, income, credit, assets and savings with a sample size of 8,687 households in 580 enumeration areas containing 37,128 household members. Out of the 8,687 households, 5,559 households owned and/or operated a farm or kept livestock or were engaged in fishing. From the 5,559 households engaged in agriculture, 1,670 households were involved in maize production and harvested within the period. The 1,670 maize producing households were further grouped into smallholder and large scale farmers based on the land size, from which 1,205 households who fall under smallholder farmers were used for the analysis of this study.

Intensity commercialization of maize

This study assesses the commercialization of smallholder production from the output side. This was achieved by employing the household commercialization index (HCI) to determine household specific intensity of commercialization (Von Braun, 1994; Strasberg et al., 1999, Martey et al., 2012). The index as specified in equation (1) measures the ratio of the value of crop sales by household to the value of all crops produced by the same household expressed as a percentage:

$$HCI = \frac{Value\ of\ crops\ sold}{Value\ of\ crops\ produced} \times 100\% \qquad (1)$$

The index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a subsistence oriented household and the closer the index is to 100, the higher the degree of commercialization. Since HCI depends on the output Y, and assuming that farmers consume a fixed amount (C) of crops produced, then:

$$HCI = \frac{Y - C}{Y} \times 100\% \qquad (2)$$

This assumption is realistic since farmers' consumption of a particular food crop cannot increase indefinitely with increasing production, for instance, if a farmer or a household consumes an amount equal to C, then any excess above C will be sold. The household commercialization index was calculated for maize. The calculated commercialization index was then used to categorize the farm households. Following Abera (2009) and for the purpose of the study, the degree of commercialization is grouped into four: zero (none of the output sold), low (1 to 25% of output sold), medium (26% to 50% of output sold) and high (> 50% of output sold). Consequently, a one way Analysis of Variance (ANOVA) test was performed to compare the index outcomes among households at varying degrees of commercialization.

Factors influencing the intensity of commercialization

The Tobit regression model was employed for this analysis since data generated about household commercialization index was in proportions. The dependent variable in this case has an upper limit of one in all cases and a lower limit of zero. The rationale for this is to match farmers' decision to fit the Tobit model which cannot take dependent variables greater than one or a negative and target policy interventions at farmer levels appropriately. According to Sindi (2008), it is assumed that both the decision to commercialize and the degree of commercialization are influenced by the same variables that increase the probability of commercialization and also increase the intensity of commercialization. The Tobit or censored normal regression model assumes that the observed dependent variables Y*i* for observations *i* =1,…, n must satisfy:

$$Y_i = \max(Y_i^*, 0) \qquad (3)$$

Where Y_i^* represents the latent variable generated by the classical linear regression model. The Tobit model used to estimate the factors that influence the intensity of commercialization is specified as follows:

$$Y^* = \beta_i X_i + e_i, \quad Y_i = \begin{cases} Y_i^* \text{ if } Y_i^* > 0 \\ 0 \text{ if } Y_i^* \le 0 \end{cases} \quad e_i = N(0, \sigma^2) \qquad (4)$$

Where X_i is a vector of exogenous explanatory variables, β_i represents the estimated maximum likelihood parameters; e_i represents the captured random influence on the relationship which is assumed to be normally distributed with mean zero and variance . Observation of zeros on the dependent variable could mean either a ''true'' 0 or censored data or y would always equal y and the model will be linear regression and not Tobit. The Tobit model does not correspond directly to changes brought about by changes in the independent parameters but rather the direction of the effect. The marginal effect of the changes in an explanatory variable on the intensity of maize commercialization is given as follows (Greene, 2003):

$$\frac{\partial E\left[Y_i / X_i\right]}{\partial X_i} = \beta\phi\left[\frac{\beta' X_i}{\sigma}\right] \quad (5)$$

From the above, the empirical Tobit model estimated for the factors likely to affect the intensity of commercialization for maize is given as:

$$\begin{aligned} Y_{maize} &= \beta_0 + \beta_1 GEN + \beta_2 AGEH + \beta_3 AGESQ + \beta_4 MARST \\ &+ \beta_5 HHSIZ + \beta_6 AVFOD + \beta_7 EDUH + \beta_8 OCCU + \beta_9 FMEXP \\ &+ \beta_{10} AFON + \beta_{11} LOC + \beta_{12} FMS + \beta_{13} LANT + \beta_{14} QTYP \\ &+ \beta_{15} QTYS + \beta_{16} SMKT + \beta_{17} SFGB + \beta_{18} SHSE + \beta_{19} TPAY \\ &+ \beta_{20} NFMI + \beta_{21} PCRL + \beta_{22} SAV + \beta_{23} TCIN + \beta_{24} UPM \\ &+ \beta_{25} RMIT + \beta_{26} FORZO + \beta_{27} SAZO + e \end{aligned} \quad (6)$$

Description of variables

The descriptions of variables in equation (6) are presented in Table 1.

Effect of the intensity of commercialization on food consumption expenditures

The food expenditure is the product of the food demand and the price of food as shown in equation (7). The food consumption expenditure (F_{cexp}) is a function of the price of food, all other prices, income, tastes and preferences. For cross-section data, it is reasonable to assume that all prices are stable within the time period under consideration (Meng, et al., 2012). In this respect, the expenditure on food is only determined by the consumer's income level (I), and tastes and preferences (T).

$$F_{c\exp} = P_f * F = P_f * f(P_f, P_m, I, T) = H(I, T \mid P_f P_m) \quad (7)$$

In empirical analysis, the interest is on real consumption across all farm households and the market prices which are used to aggregate the value of consumption of different goods in the consumption basket (Eskola, 2005). The total food consumption expenditure is a direct function of real quantities of goods consumed at their market prices with a chosen intensity of commercialization, i.e. the choice of optimal resource allocation into agricultural production, wage employment, and allocation of income into different markets and home produced goods (Eskola, 2005). The function is defined in equation (8) as:

$$F_{c\exp} = f(P_i^m, C_i, HCI_m) \quad (8)$$

Where F_{cexp} is the total food consumption expenditure by farm household, P_i^m denotes the market price of the good i (food items), C_i denotes the quantity of goods consumed by farm household, HCI_m denotes a measure of maize commercialization intensity by each household.

Following Baber and Shahnawaz (2010), Safdar, Ahmad and Sher (2012) and Meng, et al., (2012), the data was logarithmically transformed to examine the effect of the intensity of commercialization and other socio-economic factors on food consumption expenditures in Ghana. Baber and Shahnawaz (2010) indicated that the logarithmic function provides estimates that generate more realistic elasticities. The slope parameter is a direct measure of elasticity. Therefore, in estimating this functional form using the OLS, data for F_{cexp} and X were transformed into the logarithmic form. This is specified in equation (9) as:

$$InF_{c\exp} = \beta_0 + \beta_i InX_i + ... + \beta_n InX_n + e \quad (9)$$

Where F_{cexp} denotes the dependent variable (the total food consumption expenditure); X_i to X_n denote a vector of explanatory variables comprising the maize commercialization index (HCI_{maize}), farm size, demographic variables including the age, gender, family size, average price of food items (cereals and bread, meat, fish, oils and fats, fruits, vegetables, pulse and nuts, roots and tubers, others including dairy products) as shown in Tables 1 and 2; β_i denotes a vector of coefficients and e denotes the error term. The robust Huber/White estimator was used to obtain robust standard errors.

Variables	Description	Measurement	Expected sign
Maize comercialization index (Y_{maize})	Proportion of the value of maize sold to total maize produced	Ratio	
GEN	Gender of the household head	Dummy; 1 if male; 0 = otherwise	+/-
AGEH	Age of household head	Number of years	+/-
AGESQ	Age squared	Number of years	-
MARST	Marital status	Dummy; 1 if married; 0 = otherwise	+/-
HHSIZ	Household size	Number	-
AVFOD	Availability of food items	Dummy; 1 if No , 0 = otherwise	-
EDUH	Number of years of formal education	Number of years	+
OCCU	Main Occupation of respondent	Dummy; 1 if agriculture, 0 = otherwise	+
FMEXP	Number of years of Experience in Farming	Number of years	+
AFON	Access to mobile phone network	Dummy; 1 if yes, 0 = otherwise	+
LOC	Location of household	Dummy; 1 urban; 0 = otherwise	+
FMS	Size of the farm	Hectares	+
LANT	Status of land ownership	Dummy; 1 if owned; 0 = otherwise	+/-
QTYP	Total output of maize produced for the year	Kilogram	+
QTYS	Total output of maize produced used as seed	Kilogram	-
SMKT	Sale of maize by farmer in the market	Dummy; 1 if yes, 0 = otherwise	+
SFGB	Sale of maize to farm gate buyer	Dummy; 1 if yes, 0 = otherwise	+
SHSE	Sale of maize in the house of farmer	Dummy; 1 if yes, 0 = otherwise	+
TPAY	Time of payment if maize is sold	Dummy; 1 if instant payment, 0 = otherwise	+
NFMI	Proportion of non-farm annual income in total annual household income	Ratio	+/-
PCRL	Proportion of crop given to landlord	Percentage	-
SAV	Savings account or susu	Dummy; 1 if yes, 0 = otherwise	+
TCIN	Total Cost of input use	Ghana cedi (GHS)	-
UPM	Average price at which each unit of output is sold	Ghana cedi (GHS)	+
RMIT	Income from remittances	Ghana cedi (GHS)	+
FORZO	Forest zone	Dummy; 1 if Forest zone, 0 = otherwise	+/-
SAZO	Savannah zone	Dummy; 1 if Savannah zone, 0 = otherwise	+/-

Source: own processing

Table 1: Description of dependent and explanatory variables.

Variable	Description (GHS)	Food Item
Fexp	Average annual food expenditure	
Pcb	Average price of cereals and bread	Guinea corn/sorghum, Maize, Millet, Rice –Local, Rice –Imported, Bread –sugar bread, Biscuits, Flour (wheat), Maize ground/corn dough
Pmeat	Average price of meat	Corned beef, Pork, Beef, Goat meat, Mutton Bush meat/wild game, Chicken
Pfish	Average price of fish	Fish (fresh), Fish (dried), Fish (smoked), Fish (canned)
Poils	Average price oils and fats	Coconut oil, Groundnut oil, Palm kernel oil, Palm oil, Shea butter, Margarine /Butter
Pfruits	Average price of fruits	Coconut, Banana, Orange/tangerine ,Pineapple
Pveg	Average price of vegetables	Cocoyam leaves (kontomire), Garden eggs, Okro, Pepper (fresh or dried), Onions (large/small), Tomatoes(fresh), Tomato puree (canned)
Pnuts	Average price of pulse and nuts	Beans, Groundnuts, Palm nuts, Cola nuts
Prtube	Average price roots and tubers	Cassava and processed forms of cassava, Cocoyam, Plantain, Yam
Pothers	Average price of others	Sugar (cube, granulated), Ice cream, Salt, Ginger, Milk (powder), Tinned milk, eggs, cooked food

Source: GSS, 2012

Table 2: Description of prices of food items.

Following Blundell and Robin (1999), the "augmented regression approach" was used to control for endogeneity of maize commercialization intensity in the model. The following steps were followed:

a. the reduced form regression was performed in which HCImaize was regressed on the endogenous variables as specified in equation (10):

$$HCI_{maize} = \alpha_0 + \beta_2 lnP_{cb} + \beta_3 lnPmeat + \beta_4 lnPfish + \beta_5 lnPoils + \beta_6 lnPfruit + \beta_7 lnPveg + \beta_8 lnPnuts + \beta_9 lnPrtube + \beta_{10} lnPother + \beta_{11} Gen + \beta_{12} lnHsize + \beta_{13} lnFrmS + \beta_{14} Loc + \beta_{15} lnEdu + e \quad (10)$$

b. the residuals were predicted from Equation (10);

c. the main Equation (11) was regressed including the predicted residuals from equation (10) as explanatory variable;

d. F-test was used to test if the residuals were significantly different from zero.

The decision rule was that if the test shows significance then this implies endogeneity issues, hence the two stage least squares involving the use of an instrumental variable can be applied. The empirical equation with the dependent variable expressed in logarithmic form is specified as follows:

$$ln(Fexp) = \alpha_0 + \beta_1 HCI + \beta_2 lnPcb + \beta_3 lnPmeat + \beta_4 lnPfish + \beta_5 lnPoils + \beta_6 lnPfruit + \beta_7 lnPveg + \beta_8 lnPnuts + \beta_9 lnPrtube + \beta_{10} lnPother + \beta_{11} Gen + \beta_{12} lnHsize + \beta_{13} lnFrmS + \beta_{14} Loc + \beta_{15} lnEdu + e \quad (11)$$

According to the economic theory of demand, the income or wealth are important variables to explain the food demand. Hopper (2011) showed the close relationship between the income of the household and the quantities of milk, cream, cheese, eggs, meat, fish, and fresh fruits and vegetables purchased. Income was found to be one of the most prominent measures of food consumption behavior (Muhammad, et al., 2011). Hence the household maize commercialization intensity was instrumented using the value of crops sold (i.e. the income obtained from maize). The proportion of maize sold is therefore expected to be positively related to the average annual food consumption expenditures.

The socio-demographic characteristics of the consumers (i.e. age, gender, marital status, education, family size) are also expected to affect the food consumption expenditures. The age and education influences the frequency of food item consumed; and the total revenue and gender affect the product form consumed by the household (Jolly, et al., 2008).

The price of food items is expected to have a negative relationship with food consumption expenditure. Socio-cultural factors affect consumers' preference, eating habits, indigenous knowledge about the method of preparation, cooking time or convenience, nutritional and medicinal values and taste (Quaye, et al., 2009). The presence of children in the households is expected to have a positive relationship with expenditure (e.g. Han and Wahl, 1998).

Results and discussion

Socio-economic characteristics of smallholder farm households

The socio-demographic characteristics of sampled respondents are presented in Table 3.

The minimum age of a household head in the sample was 18 years whiles the maximum age of a household head was 99 years. The economically active population (19 to 60 years) represents 85.90 percent while 14.1 percent are supported by the economically active (less than or equal to 18 years and greater than 60 years). The survey reveals a dependency ratio of 0.14 as compared to 82 of the GLSS5 report (GSS, 2008). The mean age is 45 years which implies that the age distributions of the sample are in the active labour force.

The result of the survey also shows that males constitute 71.2 percent while females constitute 28.8 percent of the sampled population. This indicates a sex ratio of 40 females to every 100 males which is different from 94 males to every 100 females of the GLSS5. This implies the majority of males are found in the agricultural sector as compared to females.

The level of education of sampled heads of farm households in Ghana illustrates a majority (60.25%) having basic level of education. However, 30.29 percent of household heads had no formal education as compared to 31 percent of the GLSS5 survey results (GSS, 2008). This is a worrying situation due to the fact that, education serves as a means to gain extra employment activities especially in the non-farm sector (Minot et al., 2006). The mean years

of education is 6 years indicating that, on the average the educational level attained by a household head is primary or basic.

Variable	Frequency	Percentage
Gender		
• Female	347	28.80
• Male	858	71.20
Age		
• 18 – 30	221	18.34
• 31 – 40	337	27.97
• 41 – 50	287	23.82
• 51 – 60	191	15.85
• > 60	169	14.02
Level of Education		
• None	365	30.29
• Basic	726	60.25
• Secondary	71	5.89
• Tertiary	43	3.56
Marital Status		
• Married	706	58.59
• Single	61	5.06
• Otherwise	438	36.34
Household Size		
• 1 – 3	490	40.66
• 4 – 6	534	44.32
• 7 – 9	158	13.11
• > 9	23	1.91
Location		
• Rural	943	78.26
• Urban	262	21.74
Ecological Zone		
• Coastal	279	23.15
• Forest and transition	724	60.08
• Savannah	202	16.76
Main Occupation		
• Agriculture	822	68.22
• Otherwise	383	31.78
Land Tenure Status		
• Ownership with deed	143	11.87
• Otherwise	1062	88.13
Farm Size (ha)		
• < 0.5	471	39.09
• 0.5 – 1.0	454	37.68
• > 1.0	280	23.24

Note: *Total Number of respondents (N) = 1205
Source: Authors' calculations from GLSS5, 2013

Table 3: Summary of socio-demographic variables.

The mean household size is four implying that on the average 4 persons live in a household which is consistent with the findings of the GLSS5 survey. The minimum household size ranged from a minimum of 1 person to the maximum of 14 persons per household. Majority (40.66%) of household size ranged between 1 to 3 persons per household. In addition, 56.85 percent of sampled farm households were married whiles 5.06 percent constitutes sample households who were single and 36.34 percent were neither married nor single.

Majority (78.26%) of sampled households lived in rural areas whiles 21.4 percent lived in urban areas. The majority (60.08%) of respondents can be located in the forest and transition zone whiles 23.15 percent and 16.76 percent of sampled farm households can be located in the coastal and savanna ecological zones respectively. The majority (68.22%) of the households sampled engaged in farming as their major occupation and 31.78 percent had other sources as their major occupation although they had farms they work on. The results give an indication of the importance of farming and its related activities to households, producing varying crops such cocoa, rubber, coconut, Cassava, Plantain etc. and the rearing of animals for cash and food. The results further confirm the centrality of agriculture to households in the Ghanaian economy.

The majority of sampled farm households heads have landholdings between 0.6 to 1.2 hectares representing 46.89 percent. The mean land size is 1.2 hectares with 0.1 and 1.8 hectares being the minimum and maximum land holdings respectively. Knowledge of the various land sizes operated by smallholder farmers is important since, higher farm sizes serves as incentive to produce more for the market. About 12 percent of sampled farm households owned their farm lands with deed whiles 88 percent owned their farms without deed. This implies that most households are not outright owners but have access to land for their farming activities either through rent or sharecropping.

Intensity of maize commercialization in Ghana

Analysis of the intensity of maize commercialization in Ghana was measured as a ratio of the gross value of maize sold per household to the gross value of all maize produced. From Table 4, about 41 percent of respondents do not sell any portion of their maize produced, implying that these group of smallholder maize farmers do not commercialize their produce. Out of 711 respondents who commercialize their produce, about 89 percent of them sell more than 25 percent of maize produced. Smallholder farmers with low intensity of maize commercialization

Intensity of maize commercialization	Frequency	%	Mean household size	Mean farm size (ha)
Zero (0%)	494	41.00	4.41	0.68
Low (1-25%)	76	6.30	3.87	0.74
Medium (26-50%)	196	16.30	4.03	0.70
High (51-100%)	439	36.40	4.02	0.82

Source: Authors' calculations from GLSS5, 2013

Table 4: Intensity of maize commercialization by mean household size and farm size.

Source	SS	df	MS	F	P-value
Between groups	150.637659	3	50.212552	6399.91	0.0000
Within groups	9.42282476	1201	.007845816		
Total	160.060483	1204	.132940601		

Source: Bartlett's test for equal variances: chi2(3) = 4.9e+03 Prob>chi2 = 0.000

Table 5: Analysis of Variance.

(1 to 25%) and the medium intensity (26 to 50%) have about similar mean farm size of 0.74 and 0.70 hectares respectively. This finding is attributed to the fact that although farmers are cultivating larger land sizes their yield still remains low to commercialize at a higher intensity. Low yields are compounded in the long run by production shocks from the irregular rainfall pattern due to climate change, pest and disease attack, and constraints to adoption of technology are among the factors contributing to low yields among low commercialization intensity smallholder farmers. In addition, larger household size hinders smallholder farmers' ability to commercialize their harvested maize produce.

The ANOVA test presented in Table 5 revealed that there is a statistically extreme significant differences among the commercialization groupings (zero, low, medium and high) in terms of the mean commercialization index ($p<0.0001$). This implies that the intensity group of commercialization a farmer belongs to determines the amount of income earned.

Factors influencing the intensity of maize commercialization

Tobit regression was used to estimate the factors influencing the intensity of maize commercialization in Ghana. In cross-sectional data, heteroskedasticity is a common problem; hence the robust option in Stata 12 was selected to correct the problem.

Income of smallholder farmers was dropped out of the model due to correlation problems. Due to this problem, the farm income has been segregated into the following variables: Total output of maize produced for the year, and Average price at which each unit of output is sold as indicated Tables 1 and 6. The F-value was significant at 1 percent indicating that the explanatory variables included in the Tobit model jointly influence the intensity of maize commercialization (Table 6). Intensity of maize commercialization in Ghana is significantly determined by gender, age, age squared, availability of food at the time of purchase, access to mobile phone network coverage, farm size, quantity of maize produced, farmer being a market trader, sale to farm gate buyer, sale to consumers, time of payment, proportion of crops to landlord, unit price of maize and remittances.

Gender of household head is significantly associated with a decrease in the intensity of maize commercialization. Being a male headed household is likely to decrease the intensity of maize commercialization by 4.17 percent. This result is somewhat consistent with the fact women play a major role in most Ghanaian markets as compared to men. However, this is contrary to the findings of Cunningham et al., (2008) who found that men are likely to sell more grain early when prices are still high, while women prefer to store more output for household self-sufficiency.

Intensity of maize sales is likely to decrease by 0.75 percent for every additional year added to the age of the household head. However, a positive relationship exists between the age squared and the intensity of commercialization in Ghana. This implies that there is the likelihood of older household heads to have much experience in the aspect of commercialization, since they are likely to have more contacts with trading partners than younger and upcoming smallholder farmers who are yet to establish such contacts coming at a cost to them during their search.

Non availability of food at the time of purchase significantly influences the intensity of maize commercialization negatively. A unit change in the number of food items not available at the time of purchase by the farmer is likely to decrease the intensity of maize commercialization by 4.46 percent. This connotes that smallholder farmers tend to store their harvested produce for home consumption in times when there is no available food item required for the household at the time of purchase.

The telecommunication sector plays a major role in most businesses in Ghana of which the agricultural sector is not an exception (Aker, 2010). Access to mobile phone network is likely to influence the intensity of smallholder maize commercialization positively by 3.37 percent.

Variable	Estimated Results		
	Coefficients	Robust Std Error	Marginal Effect
Gender	-0.0566**	0.0273	-0.0417
Age	-0.0104**	0.004	-0.0075
Age squared	0.0001***	0.00004	0.0001
Marital Status	0.0077	0.0243	0.0056
Household size	-0.0012	0.0049	-0.0009
Availability of food	-0.0622*	0.0345	-0.0446
Years of education of household head	0.0040	0.0026	0.0029
Main Occupation	0.0316	0.0258	0.0027
Years of Experience in Farming	-0.0006	0.001	-0.0005
Access to mobile phone network	0.0471**	0.0223	0.0337
Location	0.0160	0.0262	0.0116
Farm Size	0.0950***	0.0249	0.0687
Land tenure	-0.0133	0.032	-0.0096
Quantity of Maize Produced	0.0001**	0.00003	0.0001
Quantity of Maize used as seed	-0.0016	0.0016	0.0001
Market Trader	0.9287***	0.0507	0.6364
Sale to farm gate buyer	0.9046***	0.0580	0.7098
Sale in the house	0.8466***	0.0599	0.6798
Time of Payment	0.1240***	0.0369	0.0897
Non-farm Income	-0.0151	0.0421	-0.0109
Proportion of Crops to landlord	-0.0023***	0.0007	-0.0016
Savings	0.0085	0.0261	0.0062
Expenditure on crop inputs	0.00002	0.00002	0.0001
Unit price of maize	0.0012***	0.0002	0.0008
Remittances	0.0001*	0.00003	0.00004
Forest zone	0.0344	0.0410	0.0248
Savannah zone	0.0367	0.0352	0.0270
Constant	-0.2988	0.1069	
Number of observations		1205	
F (27, 1178)		71.70	
Prob > F		0.0000	
Pseudo R2		0.7393	
Log Pseudo likelihood		-286.401	

Note: ***p < 0.01, **p < 0.05 and *p < 0.10

Source: Authors' calculation from GLSSS, 2013

Table 6: Tobit estimates of the factors influencing the intensity of maize commercialization in Ghana.

This is attributed to the fact that farmers will be able to contact input dealers, extension agents during periods of production and their buyers through the phone during periods when their maize is ready for the market. This finding is consistent with studies by Asingwire and Okello (2011) who investigated the telecommunication role and its effects on smallholder and market performance in Africa, their results revealed that ICT usage has positive benefits to farmers and market actors with users of such services receiving higher margins than their counterparts due to reduced marketing costs. The study also revealed that, using the Coastal zone as the base zone, the Savanna and the Forest zones had no effect on the intensity of maize commercialization in Ghana.

Farm size was significant at 1 percent significance level with a positive sign as expected. Farm size indicates the possibility to produce more for the household and the market. The intensity of maize commercialization increases by 6.87 percent for every additional hectare of land used for maize production. Quantity of maize produced (kg) was also identified to possibly influence the intensity of maize commercialization positively. This result confirms similar findings by Martey et al., (2012) in Ghana and findings by Olwande and Mathegene (2010) in Kenya suggesting that households with larger farm sizes are able to produce more marketable surplus and hence sell more in the market.

Numerous studies have examined the effect of marketing cost and access to markets on the intensity of smallholder commercialization (Sadoulet and de Janvry, 1995; Key et al., 2000; Pender and Alemu, 2007; Alene et al., 2008; Barrett, 2008). However, this study identified that the intensity of maize commercialization is likely to be influenced positively by the sale of maize by farmers in the market, to farm gate buyers and in the house. According to Kirsten et al., (2012), policy measures would provide opportunities for these farmers not only to improve market orientation but also increase market access of smallholder producers. This is a key issue as success and failure of smallholder commercialization has in many instances hinged on not only the ease and/or difficulties associated with producing for the market but also with accessing markets.

The proportion of maize harvested given to landlords significantly affects the intensity of maize commercialization negatively. A unit increase in the proportion of maize harvested given to landlords is likely to decrease the intensity of maize commercialization by 0.16 percent. Households without their own land normally are likely to engage in markets in order to fully meet their financial obligations at home and to their landlords (land owners).

An instant payment for the quantity of maize purchased is likely to increase the intensity of maize commercialization by 8.97 percent. Farmers will be assured of a reliable market if maize purchased is paid for instantly. In addition, income from remittances positively increases the intensity of maize commercialization. This implies that farmers' income received from remittances are used to increase the quantity of maize produced thereby intensifying the level of commercialization.

As expected the intensity of maize commercialization is positively related to increases in the price of maize. An additional increase in the price of maize will lead to a 0.08 percent in the quantity (kg) of maize sold. Households with good maize storage facilities store their produce in order to await higher prices. This finding is consistent with findings by Martey et al., 2012; Olwande and Mathegene 2010, Omiti et al., 2009, and Alene et al., 2008 that the output price is an incentive for producers and sellers to supply more to both domestic and international markets.

Effect of intensity of maize commercialization on food consumption expenditure

Using the two stage least squares (2SLS) instrumental variable approach, the result of the effects of the intensity of maize commercialization on food consumption expenditures is presented in Table 8. The result indicates that intensity of maize commercialization positively affects the food consumption expenditures in smallholder maize producing households in Ghana. This is important since an increase in household income leads to the households' ability to address its food security needs.

The intensity of maize commercialization significantly influenced food consumption expenditures in Ghana at 1 percent significance level. This implies that a unit increase in the proportion of maize commercialized is likely to increase food consumption expenditures by 43.8 percent, ceteris paribus. This means that as smallholder maize farmers commercialize more of their produce to earn more income, there is

the likelihood of an increase in the amount spent on other food items to meet household food needs. Other factors that were likely to affect the food consumption expenditures were also considered in the analysis. These variables include the average prices of food items as described in Table 2 and socio demographic variables (gender, household size, location and the years of education of respondent).

The share of food item category expenditure in total food expenditures in Ghana is shown in Table 7, with other food items having the highest proportion of 28.10 percent. The price of cereals and bread, price of fish and the price of pulses and nuts were identified to significantly influence food consumption expenditures. For instance, price elasticity for cereals and bread (3.78) indicates that an increase in the price of cereals and bread should cause a more than proportionate decrease in the quantity demanded. Hence, total expenditure decreases.

Similarly, the price elasticity for fish (1.99) indicates that it is fairly elastic implying that an increase in the price of fish ceteris paribus, will cause a more than proportionate decrease in fish demand. Hence total expenditure is likely to decrease. However, the price elasticity for pulses and nuts (0.91) is inelastic indicating that a rise in price causes a rise in total expenditure because demand decreases less than proportionately, ceteris paribus.

Food item category	Percentage
Cereals and bread	12.4
Meat	5.6
Fish	9.3
Oils and fat	6.4
Fruits	7.4
Vegetables	17.0
Pulse and nuts	3.6
Root and tubers	10.4
Other food items	28.1

Source: Authors' calculation from GLSSS, 2013

Table 7: Share of food item category expenditure in total food expenditures.

Furthermore, other explanatory variables such as farm size, household size, urban dwelling of the household (location) and the years of education respectively had positive relationship with the food consumption expenditure. Thus, larger farm sizes, is likely to enable farm households to raise more

Variable	Coefficient	Std. Err.	t	P > t
HCI	0.438***	0.137	3.21	0.001
Ln(Pcb)	3.780**	1.506	2.51	0.012
Ln(Pmeat)	1.961	1.327	1.48	0.140
Ln(Pfish)	1.985***	0.524	3.79	0.000
Ln(Poils)	1.058	1.347	0.79	0.432
Ln(Pfruit)	-0.175	0.466	-0.38	0.707
Ln(Pveg)	-2.663	1.870	-1.42	0.155
In(Pnuts)	0.909***	0.226	4.01	0.000
Ln(Prtube)	0.598	0.751	0.80	0.426
Ln(Pother)	-0.759	1.181	-0.64	0.520
Gender	0.036	0.036	1.01	0.314
Ln(Household size)	0.375***	0.024	15.43	0.000
Ln(Farm Size)	0.041*	0.024	1.73	0.083
Location	0.267***	0.037	7.13	0.000
Ln(Educ)	0.031*	0.016	1.91	0.056
Constant	5.470	0.126	43.36	0.000
Observations		1205		
Prob.>F		0.0000		
R^2		0.2134		
Adjusted R^2		0.2035		

Note: ***p < 0.01, **p < 0.05 and *p < 0.10

Source: Authors' calculations from GLSS5, 2013

Table 8: Effect of Intensity of Maize Commercialization on Food Consumption Expenditure in Ghana.

income to expand farm production, spend on food items to address household food security issues and also invest in the non-farm income sector. Larger household sizes are likely to increase the expenditure spent on food since there will be more people to feed. In addition, large household sizes promotes the division of labour into labour and time demanding investment in both farm and non-farm sector.

Conclusion

The intensity of smallholder maize commercialization in Ghana is generally low with about 59 percent venturing into commercialization and the remaining 41 percent of these farming households being purely subsistence farmers. For those practicing commercialization, about 6 percent attained low intensity commercialization; 16 percent (medium intensity); and only about 36 percent attained high intensity of commercialization. It was found that significant differences in farm income earnings existed among the three different commercialization intensity groups. The study also revealed that intensity of maize commercialization positively influenced food consumption expenditures. Increases in the sale of maize results in increases in purchases of food items needed to address households' food security needs.

The study provides the following policy recommendations to improve farm household food consumption expenditures in Ghana.

There is the urgent need to strengthen smallholder market integration initiatives, encourage market information delivery systems, and establish more retail outlets with improved market facilities in order to promote production and trade in high value cereals such as maize in Ghana.

It is recommended that the Ministry of Food and Agriculture, NGOs such as Techno-serve Ghana and other stakeholders should strengthen the business orientation of smallholder farmers through training towards commercialization.

Farm size significantly influences the intensity of maize commercialization. It is therefore recommended that the Ministry of Food and Agriculture (MoFA) through their extension agents should identify committed farmers and facilitate their acquisition of additional farm lands and other relevant purchased inputs for increased production and commercialization.

The unit price of maize produced significantly affects commercialization and food consumption expenditures. With the existence of the National Food Buffer Stock Company (NAFCO), realistic guaranteed minimum prices of maize should be set so that farmers can at least recover their cost of production. This would serve as an incentive for farmers to commercialize. Evidence has shown that investment in infrastructure has large net returns and also reduces transaction costs for farmers. In order to promote commercial agriculture, the Ministry of Roads and Transport and the Local Government Authorities in partnership with MoFA should invest in rural infrastructure such as markets and feeder roads. This could support the establishment and/or refurbishment of quality retail outlets in farming areas and to help farmers to target off-peak seasons to take advantage of high prices.

The use of mobile phones has been a major innovation for businesses, as adapted by Esoko to disseminate markets and price information of food commodities at different locations to farmers. It is recommended that telecommunication companies (MTN, Vodafone, Tigo, Expresso, Airtel and GLO) should enhance their network service coverage to enhance or promote the flow of market information to smallholder farmers in rural areas.

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