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Commercialization of smallholder agriculture in Ghana: A Tobit regression analysis

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The agricultural component of the Millennium Challenge Account (MCA) programme in Ghana, consistent with the country's Food and Agriculture Sector Development Policy (FASDEP) promotes the commercialization of smallholder farmers. This study analyzes the trends in maize and cassava production by farm households in Ghana and; estimates the levels of commercialization of these two crops. It also quantifies the magnitude and direction of factors influencing intensity of commercialization by the farm households using the Tobit regression analysis. Results indicate a higher annual growth rate of cassava production (16%) compared to maize production (6%). The extents of maize and cassava commercialization are 0.53 and 0.72 respectively; whilst total agricultural commercialization with respect to these two crops is 0.66. The study observes, inter alia, that output price, farm size, households with access to extension services, distance to market and market information determine the extent of commercialization. These results have implications for agricultural policy in Ghana.

Key words: Tobit regression, Ghana, commercialization, agriculture, smallholder farmers.

INTRODUCTION

Agricultural commercialization refers to the process of increasing the proportion of agricultural production that is sold by farmers (Pradhan et al., 2010). Commercialization of agriculture as a characteristic of agricultural change is more than whether or not a cash crop is present to a certain extent in a production system. It can take many different forms by either occurring on the output side of production with increased marketed surplus or occur on the input side with increased use of purchased inputs. Commercialization is the outcome of a simultaneous decision-making behavior of farm households in production and marketing (von Braun et al., 1994). Agriculture in Ghana is predominantly on a smallholder basis. About 90% of farm holdings are less than 2 ha in size, although there are some large farms and plantations for cash crops such as rubber, oil palm and coconut and to a lesser extent, rice, maize and pineapples (Chamberlin, 2007). The smallholder farms are dispersed, and this makes provision of support services expensive. Production is largely rain fed with less than 1% of the arable land irrigated; therefore production varies with the amount and distribution of rainfall. Maize and cassava are particularly important crops for the small farms, reflecting the importance of these crops to food security strategies under poor or variable market conditions. Smallholder commercialization in Ghana encompasses: sale of a marketable surplus of traditional crops; diversification into the production of new crops; introduction of new income generating and post-harvest activities such as processing of farm produce.

Agricultural production entails investment of resources, and farmers will have no incentive for making investments in areas where there is little opportunity for marketing their products, or if the returns accruing from the sales of agricultural products do not reflect the opportunity cost of investment. As a result, most farmers

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in areas with few marketing opportunities are engaged primarily in subsistence agriculture, which has constrained improvement in their quality of life. The Commercial Development for Farmer-Based Organization (CDFO) component of the Millennium Challenge Account (MCA) programme in Ghana seeks to encourage smallholder farmers to become market-oriented. Farmer-Based Organizations (FBO) in the Southern Horticultural Belt, Afram Basin and the Northern Zone are being trained and supported with credit to increase production and sales. The crops of interest in the programme are maize, pepper, pineapple, cassava, okro and papaya believed to be prime movers of commercialization. However, the success of the commercialization promotion will depend on a number of factors. The Food and Agriculture Sector Development Policy II (FASDEP II) of Ghana seeks to increase competitiveness and enhance integration of farmers into domestic and international markets. The aim is to enhance Ghana's comparative advantage and translate it into competitive advantage in producing the needed volumes and quality of commodities on a timely basis. Efforts at improving access to market information and intelligence, relevant market infrastructure and agricultural financing are some of the strategies adopted to enhance the competitiveness and integration of farmers into markets. This paper assesses the effectiveness of the drive for commercialization under the MCA programme.

The specific research questions addressed are: What is the trend in crop production in the MCA programme area? What is the level of crop specific and total agriculture commercialization in the study area? What factors influence intensity of commercialization of smallholder agriculture in the study area? The study objectives are therefore to:

i) Describe the trend in crop production by farm households.
ii) Estimate and analyze the level of farm household crop specific and total agricultural commercialization in the study area; and
iii) Quantify the magnitude and direction of effect of factors influencing the intensity of agricultural commercialization in the study area.

MATERIALS AND METHODS

Literature review

Commercialization of agriculture involves a transition from subsistence-oriented to increasingly market-oriented patterns of production and input use. Separation of household decision of production and consumption begins at the moment commercialization commences. Household decision-making of production and consumption is non-separable in subsistence farming while it is separable in market-oriented farming (Gebre-Ab, 2006). In situations where decisions are non-separable, the objective of the household is to maximize utility and where it is completely separable, the objective is profit maximization. The behaviour of households in-between the two situations aforementioned is guided by a mixture of two objectives directed at utility, on one side, and profit, on the other. The objective of utility maximization is dominant in the early phase of commercialization whiles that of profit maximization dominates in the subsequent phase. What to produce and how to allocate time between labour and leisure are decided upon differently in subsistence and commercialized farming. Pingali and Rosegrant (1995) classified farming system as subsistence, semi-commercial and commercial based on market orientation. The main purpose of subsistence system is to produce to maintain food household self sufficiency. The semi-commercial system is focused towards generation of marketable surplus and maintaining household food-security. In commercial system, profit maximization is the main motive of the entrepreneur. Production of cash crops in addition to staples or even exclusively is another form of commercialization. Similarly, commercialization also involves the widening and deepening of the household's market transactions relating to inputs and outputs.

Household transaction will initially have greater influence in the product market and subsequently, household's engagements in other markets will also increase in importance as the marketed output proportion becomes larger. However, integration of the household into the product and factor market is not simple and straight forward due to the endemic problems of missing markets and market failures in developing countries (Gebre-Ab, 2006). It requires creating new links and deepening existing relationships between the household, traders, microfinance institutions, and other farmers willing to supply labour and rent land. Reducing transaction cost would improve market participation. The transaction cost in smallholder agriculture arises essentially from lack of information, contract enforcement and coordination; thus, improvement in all these areas will improve market participation. Commercial reorientation of agricultural production occurs for the primary staple cereals as well as for higher-value crops. Commercialization of agricultural systems leads to greater market orientation of farm production; progressive substitution of non traded inputs for purchased inputs; and the gradual decline of integrated farming systems and their replacement by specialized enterprises for crop, livestock, poultry and aquaculture products (Pingali and Rosegrant, 1995). Generally, non-traded inputs like human and animal power is substituted by traded input like mechanical power and farmyard manure by chemical fertilizer. Thus, agricultural commercialization involves the gradual substitution of complex farming system by specialized enterprises for crop and livestock in which every farm decision depends on the market signal. The farm level determinants of increasing commercialization are the rising opportunity costs of family labor and increased market demand for food and other agricultural products. Family labor costs rise because of increasing off-farm employment opportunities, while positive shifts in market demand are triggered by urbanization and/or trade liberalization.

Commercialization is usually thought in large scale farming and economists usually tend to ignore the fact that the small farmers and poor farm households participate in the market either because they produce a little surplus or sell to earn cash income to meet other family necessities. The underlying premise is that markets allow households to increase their incomes by producing that which provides the highest returns to land and labour, and then use the cash to buy household consumption items, rather than be constrained to produce all the various goods that the household needs to consume (Timmer, 1997; Pingali, 1997). Desperation amongst some of the poor households is such that, they sell their crops even before it is being harvested. This is particularly the case when food is being sold and the households are forced to buy back food later in the year when the price is much higher. However,

Kostov and Lingard (2002) claim that subsistence agriculture could be an advantage under certain conditions, in the presence of risk. Von Braun et al. (1994) revealed that the subsistence production for home consumption is the best option for small farmers given all constraints. The poor generally lack land, capital and education to respond quickly to technological innovation and agricultural market opportunities (Jayne et al., 2003). Therefore, their land holding is the key determinant of commercialization as the land allows the farmers to increase production beyond subsistence needs and diversify into cash crop production.

At any given yield level, a household with lower land per capita has to devote a higher proportion of their land to food production if the household is to achieve a given level of self-sufficiency and hence there is less land available, if any at all, for production of higher value crops for market (Rahut et al., 2010).

Analytical methods

Study area and data collection

The study focused on twelve farming communities in Effutu Municipality in Ghana, based on the type of crop produced. Purposive and random sampling methods were used to sample 250 smallholder households. The purposive sampling procedure was used to group the respondents based on their commercialization level; from which simple random sampling procedure was used to select the farm households. Primary data from household level was used for the study whiles secondary data from Ministry of Food and Agriculture (MoFA) was also used to augment the primary data. The primary data was collected through a structured survey. This was in the form of 'structured questionnaires' administered to the identified households to capture data on the composition and characteristics of the household, household access to services and economic variables such as household income and off-farm income. The dominant crops of the households though are maize, cassava and yam with some vegetables produced on a small scale, data was obtained on cassava and maize only because they were the most dominant crops. Cassava and maize serve as source of income and household food requirements respectively.

The survey mostly relates to households belonging to MiDA assisted Farmer-Based Organizations (FBO), non-beneficiaries of MiDA and non-members of FBOs.

Level of household commercialization

This paper employs the household commercialization index (HCI) to determine household specific level of commercialization (Govereh et al., 1999; Strasberg et al., 1999). The index measures the ratio of the gross value of crop sales by household *i* in year *j* to the gross value of all crops produced by the same household *i* in the same year *j* expressed as a percentage:

$$HCI_i = \left[\frac{GrossValueofCropSales_{hhiyearj}}{GrossValueofallCropProduction_{hhiyearj}}\right] * 100 \quad (1)$$

The index measures the extent to which household crop production is oriented toward the market. A value of zero would signify a totally subsistence oriented household and the closer the index is to 100, the higher the degree of commercialization. The advantage of this approach is that commercialization is treated as a continuum thereby avoiding crude distinction between "commercialized" and "non-commercialized" households. The HCI_i effectively bring subsistence food production to the centre of discussions about commercialization.

Tobit model: The Tobit regression model is employed to quantify the magnitude and direction of the effects of the factors influencing commercialization of smallholder agriculture. Most studies have modeled agricultural commercialization as a two-step analytical approach involving the unobservable decision to commercialize and the observed degree or extent of commercialization (Vance and Geoghegan, 2004; Alene et al., 2008). The Tobit or censored normal regression model assumes that the observed dependent variables Y_j for observations j = 1,…, n satisfy:

$$Y_j = \max\left(Y_j^*, 0\right) \quad (2)$$

Where the $Y_j^{*}{}'s$ are latent variables generated by the classical linear regression model:

$$Y_j^* = \beta' X_j + U_j, Y_j = \begin{cases} Y_j^* if Y_j^* > 0 \\ 0 \quad if Y_j^* \leq 0 \end{cases} \quad (3)$$

Where X_j denotes vector of regressors, possibly including 1 for the intercept, and β' the corresponding vector of parameters. The model errors U_j are assumed to be independently normally distributed: $U_j \sim N(0, \sigma^2)$. An observation of 0's on the dependent variable could mean either a "true" 0 or censored data or Y_j would always equal Y_j^* and the true model would be linear regression and not Tobit.

Tobit model parameters do not directly correspond to changes in the dependent variable brought about by changes in independent variables. According to Greene (2003), the marginal effect on the intensity of market participation due to changes in the explanatory variable is given as follows:

$$\frac{\partial E\left[\frac{Y_j}{X_j}\right]}{\partial X_j} = \beta \emptyset \left[\frac{\beta' X_j}{\sigma}\right] \quad (4)$$

Following from the aforementioned discussion, 'the empirical model' for quantifying the factors which influence the intensity of maize market participation is specified as follows:

$$Y_i^* = \beta_0 + \beta_1 PRM + \beta_2 GEND + \beta_3 ASSOC + \beta_4 EXTACS + \beta_5 ADL + \beta_6 AGEHH + \beta_7 OFMI + \beta_8 EDUHSQ + \beta_9 QTYM + \beta_{10} LANSTA + \beta_{11} DISMKT + \beta_{12} FMEXP + \beta_{13} INFO + \beta_{14} CRDAV + \beta_{15} EDUHH + \beta_{14} FMSZ + \epsilon_i \quad (5)$$

Similarly, 'the empirical model' for quantifying the factors which influence the intensity of cassava market participation is specified as follows:

$$Y_i^* = \alpha_0 + \alpha_1 MAST + \alpha_2 AGEHH + \alpha_3 FMSZ + \alpha_. \alpha_7 OFMI + \alpha_8 FMEXP + \alpha_9 ADL + \alpha_{10} PRM + \alpha_{11} \quad (6)$$

Where Y_i^* is the percentage of output that is sold.

Table 1. Description of the explanatory variables used in the regression models.

Variables	Description	Measurement	Expected sign
Age (AGEHH)	Age of household head	Number of years	+/-
Marital status (MAST)	Marital status	D = 1 if married; 0 = otherwise	+
Age squared (AGESQ)	Age squared	Number of years	-
Gender (GEND)	Gender of the household head	D = 1 if male; 0 = otherwise	+/-
Education (EDUHH)	Number of years of formal education	Number of years	+
Education squared (EDUHSQ)	Education squared	Number of years	-
Adults in the household (ADL)	Number of adults in the household who assist on the farm	Number	+
Quantity of commodity (QTY)	Total output of crop produced for the year	Kilogram for maize and rope (12*12) or 91 kg for cassava	+
Farming experience (FMEXP)	Number of years experience in farming	Number of years	+
Farm size (FMSIZE)	Size of the farm	Hectares	+
Farm size squared (FMSZSQ)	Farm size squared	Hectares	-
Association (ASSOC)	Membership of Association	D = 1 if member; 0 = otherwise	+
Land tenure (LANSTA)	Status of land ownership	D = 1 if owned; 0 = otherwise	+/-
Land access (LANACES)	Access to more land	D = 1 if yes; 0 = otherwise	+
Extension access (EXTACS)	Household access to extension services	D =1if yes; 0 = otherwise	+
Credit access (CRDAV)	Household access to credit	D =1if yes; 0 = otherwise	+
Market information access (INFO)	Household access to market information	D =1if yes; 0 = otherwise	+
Vehicle access (VEH)	Household access to vehicle to convey produce to market	D =1if yes; 0 = otherwise	+
Market distance (DISMKT)	Distance between the residence of household head and the nearest market	Kilometers	-
Non-farm income (OFMI)	Proportion of non-farm annual income in total annual household income	Ratio	+/-
Unit price (PRC)	Average price at which each unit of output is normally sold	Ghana cedi (GHS)	+

The specific variables included in the model are described in Table 1. Gender of household head is expected to capture the differences in market orientation between males and females with males expected to have a higher propensity to participate in markets than females. The age of the household head could have a positive or negative effect on participating in market. It is a proxy measure of experience and availability of resources. It is possible that older and more experienced heads are able to take better production decisions and have greater contacts which allow trading opportunities to be discovered at lower cost than younger ones. Alternatively, it is possible that younger heads are more dynamic with regards to adoption of innovations both in terms of those that would enhance their productivity and enhance their marketing at a reduced cost (Enete and Igbokwe, 2009). Education is expected to exert a positive effect on commercialization. Enete and Igbokwe (2009), Southworth and Johnston (1967), Schultz (1945) and Ofori (1973) argued that education will endow the household with better production and managerial skills. Education enables an individual to make independent choices and to act on the basis of the decision, as well as increase the tendency to co-operate with other people and participate in group activities. It is also possible that education could increase the chances of the household head earning non-farm income. This could reduce the household dependency on agriculture and thus commercialization. Therefore, the direction of the effect is ambiguous. Farm size could be either smaller or larger than that which farmers would otherwise plant and harvest, stimulating increased levels of commercialization. According to Olwande (2010), farm size may have indirect positive impacts on market participation by enabling farmers to generate production surpluses, overcome credit market in the presence of vehicle thus reducing postharvest losses and stimulating higher levels of commercialization. Availability of credit and the associated cost of credit according to Sindi (2008) are crucial in the success of the agricultural industry. Credit could be used to purchase inputs (planting material, fertilizer and crop protection), pay wages, invest in machinery, or to smooth consumption. The availability of credit is expected to lead

to increased agricultural productivity and greater commercialization.

Household membership of association/group increases access to information important to production and marketing decisions (Olwande, 2010). Most farmer groups engage in group marketing as well as credit provision for their members. It is therefore expected that household membership of association/group will positively impact on market participation. The total number of adults in the household that assist on the farm serves as family labour supply for production activities and in such a situation impact positively on market participation. It is argued that there is continuous development with intensive agricultural systems, as household size increases the productivity of the land rises and exceeds subsistence requirements and this will lead to an increase in marketed surplus. However, the total number of adults may increase the household size thus demand greater food needs which reduces market participation. The directional effect is ambiguous. The household access to market information is associated with a higher level of market participation. Market information arrangements guarantee producers flow of insights on market requirements and opportunity sets that enable farmers to plan effectively on enterprise choices and efficient resource allocation. It also reduces the cost for searching for suitable prices.

EMPIRICAL RESULTS AND DISCUSSION

Socio-economic characteristics of farm households

70% of the household heads interviewed were males. Females become household heads in the absence of an adult male considered capable of being the household head (Abatania et al., 1999). This explains the large representation of male heads in the sample. Majority (29%) of the household heads falls within the age category 31-40 years whilst 6% are over sixty (60) years of age. The mean age of household head is 43 years. The farm households in Effutu municipality in Ghana can therefore be described as young and belong to the economically active group of the country. Younger household heads are more dynamic with regards to adoption of innovations (Polson and Spencer, 1992). Average household size is six. Large household sizes ensure adequate supply of family labour for maize and cassava production activities. Large families also enable household members to earn additional income from non-farm activities (Al-Hassan, 2008). The mean years of education shows that on average the highest level of education attained by a household head is primary school. Approximately, 82% of household heads are married. The mean landholding of a household head is 1.2 ha with 0.4 and 8.8 ha being the minimum and maximum landholdings respectively. Higher landholdings serve as an incentive to produce surplus for market. Most of the household heads interviewed do not own land but have access to land and practice mixed cropping.

Cassava and maize producing households have on the average 21 years of farming experience. Majority of the household heads belong to a farmer association and have access to market information through friends, relatives and sometimes the media (radio and television). However, majority of the farmers (66%) do not have access to extension services but have access to vehicles to convey their agricultural commodities to the market.

Access to credit is one of the major constraints faced by the household heads as the survey registered approximately 41% as having access to credit both from formal or informal sources. Average farm size planted to maize and cassava is 1 ha each whereas the maximum area cultivated is 2 ha each. The result could be attributed to the mixed cropping system of farming by most households. The mean value of maize and cassava produced are GHS 875.00 and 2029.00 respectively. Cassava is more drought tolerant than maize. Maize is normally cultivated for household consumption. A household head travels 18 km on the average to the market to sell maize and cassava. Distances traveled by a household head ranged from 4 to 29 km. Distance imposes a transaction cost to households and determines the volume of maize and cassava sold. The mean household income is GHS 1772.00 and the minimum and maximum household incomes are GHS 110.00 and 8600.00 respectively. Finally, the average off-farm income of a household is GHS 571.00. The growth rate of maize production increases over the study period with a statistically significant annual average growth rate of 6%. Areas under cultivation coupled with favourable weather conditions elucidate the positive growth rate of maize production. Also the growth rate of cassava production increases over the study period with a statistically significant annual average growth rate of 16%. The growth in cassava production is driven by area under cultivation, readily market and income generation.

Levels of crop specific and total agricultural commercialization

Analysis of household commercialization level indicates that proportion of maize and cassava jointly sold by majority of households in Effutu municipality ranged from 41 to 60%. The result depicts moderately commercialize households. However, cassava producing households recorded the highest proportion of cassava sold (Figure 1).

The proportion of maize sold by majority of maize producing households ranged from 41 to 60% whereas proportion of cassava sold by 90% of cassava producing households ranged from 81 to 100%. Maize yield per hectare is low compared to cassava yield per hectare. Households selling cassava are therefore described as highly commercialized households. High market demand for gari and suitable land serve as an incentive for most households to increase cassava production. The average production and sales of maize and cassava per household is presented are Table 2. The proportion of maize and cassava sold to total production of the two

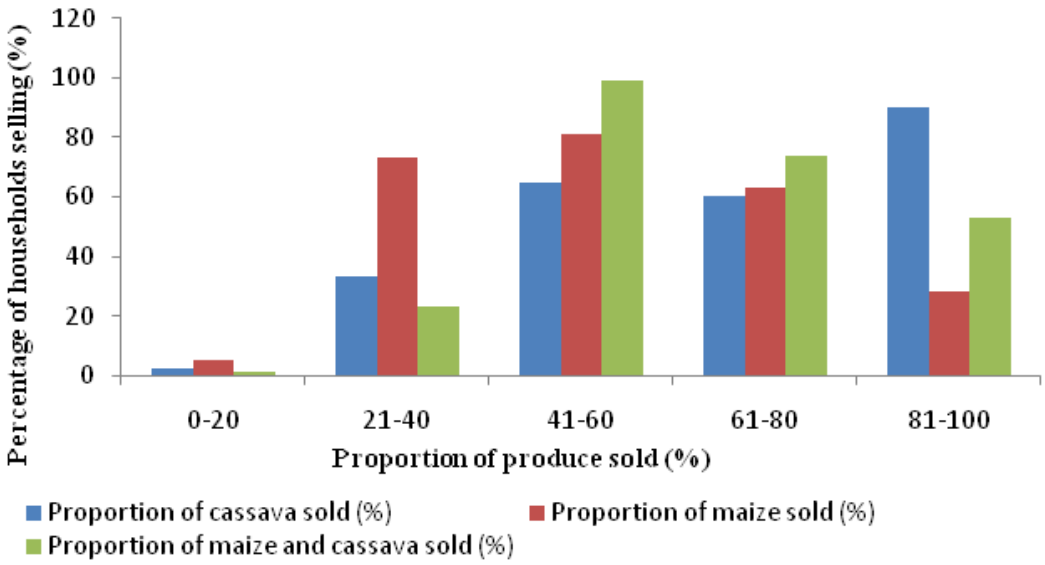

Figure 1. The percentage of maize and cassava sold from total production. Source: Authors' computation from Household Survey Data (2009).

Table 2. Share of crop output sold by household.

Crop type	Average production per household	Average sales per household	Share sold (%)
Maize	875	464	0.53
Cassava	2029	1451	0.72
Total agriculture	2904	1915	0.66

Table 3. Percentage of households engaged in market by farm size.

Farm size (hectares)	Percentage of farmers engaged in market		
	Maize	Cassava	Total agriculture
0 - 0.64	58.4	56.0	17.2
> 0.64	41.6	44.0	82.8

crops by a household in Effutu municipality is 0.66. Almost all the households produce maize and cassava. Proportion of cassava sold by cassava producing households exceeds proportion of maize sold by maize producing households by 36%. Markets offer households the opportunity to specialize according to comparative advantage and thereby enjoy welfare gains from trade. Most lands are put under cassava cultivation as it generates income for most households. Maize is mostly cultivated for household consumption but is sometimes sold to buy other commodities to supplement household food requirements. The percentage of maize and cassava sold by the house holds increases with farm size. However, for the individual crops, households reveal an increasing farm size with decreasing percentage of sales by households.

83% of house holds cultivate more than 0.64 ha of maize and cassava. A higher percentage of households with landholdings between 0 to 0.64 ha and more than 0.64 ha sell more cassava than maize (Table 3). Area under cassava cultivation is higher than the area under maize cultivation. Area under cassava cultivation contributes largely to the proportion of total crop sold by households. As farm size increases over a certain minimum, there is diminishing marginal returns which affect the volume of sale by percentage of households selling. It is therefore concluded that farm size influences the level of agricultural commercialization. The degree of maize and cassava commercialization increases with farm size (Table 4).

This is an indication that households with larger farm size are able to sell larger share of their production

Table 4. Degree of agricultural commercialization by farm size.

Farm size (hectares)	Percentage of crop sold		
	Maize	Cassava	Total
0 - 0.64	0.48	0.62	0.56
> 0.64	0.59	0.72	0.64

Table 5. Tobit regression estimates of determinants of maize commercialization intensity.

Variable	Coefficient	Robust Std. error	Marginal effect
Constant	0.034	0.089	
Gender	0.045	-0.050	0.022
Adults in the household	-0.007	0.006	-0.003
Age of household head	0.004***	0.001	0.002
Years of education of household head	0.064***	0.017	0.031
Years of education of household head squared	-0.006***	0.002	-0.003
Extension access	-0.054*	0.032	-0.026
Membership of association	0.013	0.046	0.006
Land status of household head	-0.087*	0.052	-0.042
Farm size	0.198***	0.039	0.097
Quantity of maize produced	-4.31E-06	3.4E-05	-2.1E-06
Unit price of maize	0.004**	0.002	0.002
Access to credit	0.035	0.032	0.017
Access to land	0.027	0.027	0.013
Distance to market	-0.002	0.003	-0.001
Off-farm income	-0.015*	0.008	-0.007
Access to market information	-0.018	0.032	-0.009
Number of observations		250	
F (16, 234)		4.830	
Prob > F		0.000	
Pseudo R^2		0.603	
Log Pseudo likelihood		-22.229	

compared to the households with smaller farm size. However, households with farm size between 0 to 0.64 ha and greater than 0.64 ha sell more cassava than maize.

This clearly supports the findings by Rahut et al. (2010) who established an increase in the degree of food crops commercialization with farm size. Due to the risk associated with maize production, most farmers commit a greater proportion of land to cassava production as a risk reducing strategy.

Tobit regression estimates of the determinants of maize and cassava commercialization

The stata 11 software was used to estimate the parameters and marginal effects of the determinants of the extent of agricultural commercialization by smallholder households. The Pseudo R-squared value indicates that 60% of the variation in the extent of maize commercialization is explained by the independent variables (Table 5), and 48% of variation in the extent of cassava commercialization is explained by the independent variables (Table 6). The extent of maize commercialization' by smallholder households is significantly determined by farm size, land status of household head, household access to extension services and market information, age of household head, number of years of education, off-farm income and unit price of maize (Table 5). The extent of cassava commercialization' on the other hand is significantly determined by marital status and age of household head, farm size, quantity of cassava produced, number of adults in the household, access to extension services and market information, distance from household's residence to the market, off-farm income, years of experience of household head in cassava farming and unit price of cassava per bag (Table 6). Age of household head is significantly associated with an

Table 6. Tobit regression estimates of the determinants of cassava commercialization intensity.

Variable	Coefficient	Robust Std. error	Marginal effect
Constant	1.127	0.256	
Marital status	-0.074*	0.043	-0.048
Age of household head	-0.032***	0.010	-0.021
Age of household head squared	3.47E-04***	1.12E-04	2.23E-04
Adults in the household	0.013*	0.007	0.008
Years of education of household head	0.004	0.004	0.003
Years of experience in farming	0.003*	0.001	0.002
Extension access	-0.064*	0.038	-0.041
Access to credit	-0.031	0.034	-0.020
Membership of association	0.068	0.046	0.044
Quantity of cassava produced	9.9E0-5***	3.24E-05	6.36E-06
Distance to market	-0.006*	0.003	-0.004
Off-farm income	0.020**	0.010	0.013
Farm size	0.154**	0.071	0.099
Unit price of cassava/bag	0.003*	0.002	0.002
Access to market information	-0.124**	0.052	-0.080
Number of observations		250	
F (15, 235)		6.38	
Prob > F		0.000	
Pseudo R^2		0.4809	
Log Pseudo likelihood		-30.663	

***p < 0.01, **p < 0.05 and *p < 0.10.

increase in the extent of maize commercialization. The extent of maize sales increases by 0.2% for every additional year added to the age of the household head. Age of the household head is used as a proxy for experience in farming. It is believed that older household heads have more contacts which allow trading partners to be discovered at lower cost relative to younger household heads (Table 5). However, age of household head is significantly associated with lower rates of cassava sales. Older household heads are less likely to increase the sales of cassava.

An additional year added to the age of household head, the extent of cassava commercialization decreases by 2%. This result contradicts the finding of Enete et al. (2009) that older households are more likely to increase the extent of cassava sales (Table 6). Farm size is significantly associated with a higher level of maize and cassava commercialization. Land size indicates the potential to produce surplus for the market. The extent of maize and cassava commercialization increases by 10% for every additional hectare of land put under maize cultivation (Tables 5 and 6). The result confirms the findings by Olwande et al. (2010) that households with larger farm sizes are able to produce marketable surplus and hence participate more in the market. Land ownership status of household significantly influences the extent of maize commercialization. For households that own land, the extent of selling maize is lower than households that do not own land by 4% (Table 5). Households that do not own land normally engage in market in order to meet their financial obligations to their land owners. Contrary to expectation, households with access to extension services are less likely to increase the sales of maize and cassava. The extent of maize commercialization by households with access to extension services is 3% lower than those without access to extension services (Table 5). Also, the extent of cassava sales by households with access to extension services is 4% lower than those without access to extension services (Table 6). The result may be attributed to lack of effective monitoring in ensuring effectiveness in utilization of improved technology passed on to the farmers. The contradiction could also be explained by complexity of teaching approach adopted by some extension agents. Households with higher off-farm income are less likely to increase the sale of maize. The extent of maize commercialization decreases by 0.7% for every additional Ghana cedi of off-farm income earned by a household (Table 5).

The result indicates that income earned from off-farm employment is not invested in farm technology and other farm improvement activities. However, off-farm income triggers off-farm diversification. This finding is consistent with the findings by Alene et al. (2008) and Omiti et al.

(2009). On the contrary, households with higher off-farm income are more likely to increase the sales of cassava. The extent of cassava commercialization increases by 1% for every additional Ghana cedi of off-farm income earned by a household (Table 6). The plausible reason to this result may be that cassava producing households invest their off-farm earnings in cassava production to boost production volume and sales. Education level of household is associated with a higher level of maize sales. Education is posited to influence a household's understanding of market dynamics and therefore improve decisions about the amount of output sold, inter alia (Makhura et al., 2001). The level of commercialization of maize increases by 3% for every additional year of education attained by a household head. However, commercialization of maize decreases beyond a certain level of education (Table 5). The result suggests the strong competing effect of diverting skills of household head to other off-farm employment opportunities. This could reduce household head dependency on agriculture and commercialization. The result is supported empirically by the fact that most of the study areas are accessible to major urban centres where employment is prevalent. Unit price of maize influences the tendency of households to supply more maize and cassava to the market. An additional increase in the price of maize leads to a 0.2% increase in the amount of maize and cassava sold (Tables 5 and 6). This finding confirms the assertion from economic theory that output price is an incentive for farm households to supply more produce for sale. This result confirms the findings by Olwande et al. (2010) and Omiti et al. (2009) that output price is an incentive for sellers to supply more maize in the market. This result is also consistent with the finding of Enete and Igbokwe (2009) that price of cassava influences the level of cassava market participation in Nigeria.

Number of years of household head experience in cassava production is significantly associated with a higher level of cassava sales. For each additional year of farming experience attained by a household head, the proportion of cassava output sold increases by 0.1% (Table 6). Experienced household heads are able to take better production decisions and have greater contacts which allow trading opportunities to be discovered at lower cost. Quantity of cassava produced is associated with a higher level of cassava sales. An additional bag of cassava produced leads to a 0.0006% increase in the level of commercialization of cassava (Table 6). According to Makhura et al. (2001), the decision to sell is preceded by a decision to consume. Households with higher value of crop produced sell higher proportion of their produce. Surplus production serves as incentive for a household to participate in market (Barrett, 2007; Rios et al., 2008; Omiti et al., 2009). Contrary to expectation, households with access to market information are less likely to increase the sales of cassava. Households that have access to market information have 8% less cassava sales than those without access to market information (Table 6). Market information arrangements guarantee producers flow of insights on market requirements and opportunity sets that enable farmers to plan effectively. However, this finding may be due to the lower cost incurred by household heads without access to market information as a result of already established contacts with trading partners who regularly buy cassava from them. The total number of adults in a household that assist the household head on the farm is significantly associated with a higher level of commercialization of cassava. An additional adult member of a household increases the extent of cassava sales by 0.8% (Table 6). Households with higher number of adults serve as a form of family labour for increasing output and sales. Distance from household head's residence to nearest market which is an indicator of travel time and cost to the market is significantly associated with a lower level of cassava sales. The extent of cassava sales decreases by 0.4% for each additional kilometer in the distance from household's residence to the nearest market (Table 6).

CONCLUSIONS AND IMPLICATIONS

Analysis of crop production trend in the Effutu Municipality in Ghana shows that the average annual growth rate of maize is 6% whilst that of cassava is 16% over the period 1992 to 2009. Area under maize and cassava cultivation coupled with favourable weather condition accounts for the growth rate. Descriptive analysis was used to assess the levels of crop specific as well as total crop commercialization. On the average, degree of total agricultural commercialization is 0.66 and the extent of maize and cassava commercialization is 0.53 and 0.72 respectively. Maize is normally grown to meet household food requirements whereas cassava generates income for households. Degree of maize and cassava commercialization and total crop commercialization increases with farm size. The Ayensu starch factory which formally provided market for the farmers coupled with high demand for gari accounted for the high production of cassava in the municipality. The extent of commercialization by farm size is more pronounced among cassava producing households. Farm size provides the opportunity to produce surplus production which is critical in improving market participation. The study findings confirmed assertions in the literature that off-farm income contributes more to marketed output if off-farm income is reinvested in farm technology. Consequently, farm outputs falls if non-farm income triggers off-farm diversification. Output price is an incentive for farm households to supply more output in the market. Assertion in literature that distance confines rural farmers to perpetual production of low-value and less perishable

commodities, particularly cereals was established. Household heads with higher level of education are more likely to increase the sales of maize. Education is believed to increase a household's understanding of market dynamics and therefore improve decisions about the amount of maize sold. Age of the household head is used as a proxy for experience in farming. It is believed that older household heads have more contacts which allow trading partners to be discovered at lower cost relative to younger household heads. On the other hand, younger household heads are more dynamic with regards to adoption of innovations both in terms of those that enhances productivity and marketing at reduced costs.

The following policy interventions are suggested. It is recommended that extension officials should strengthen the business orientation of farm households coupled with government support in terms of market infrastructure. There is therefore the need for the strengthening of the Food and Agriculture Sector Development Policy II (FASDEP II) and the Commercial Development of Farmer-Based Organization of the Millennium Challenge Account (MCA) Programme. It is also recommended that the Ayensu starch factory in the study area which formally provided a market for cassava produced in the municipality should be revamped. This will serve as an incentive to increase production level as well as the intensity of cassava commercialization. Farm size significantly influences the intensity of maize and cassava market participation. It is recommended that policy should improve the functioning of the land lease market and development of the land sales market and consolidation of fragmented farm structures. Policies should also promote the development of non-farm activities, as this would help in transfer of labour from farm to non-farm thereby increasing the availability of land for farming. Distance acts as a barrier to market entry by imposing transportation costs. There is the need to upgrade farm-to-market roads and support establishment of more and quality retail outlets in farming areas in order to lower transportation costs and encourage rural farm households to produce and trade in high-value commodities. The agricultural component of the Millennium Challenge Account (MCA) programme must be sustained. The study provides the following policy implications: First, government policy should aim at creating enabling environment for private firms in the agribusiness sector to train farmers coupled with investment in irrigation facilities. This incentive will enable farm households to target off-peak season production so as to take advantage of high price. Secondly, education of household head plays a significant role in the extent of maize sales. It is recommended that government policy should aim at enticing the elite into agriculture. The Youth in Agriculture Programme must also target young and dynamic graduates.

Thirdly, government policy should aim at periodic upgrading of the skills of extension agents on most effective way of technology package and delivery. Extension agents must also be well motivated to regularly visit and monitor the progress of farm households.

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