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Demographic and socio-economic characteristics of cassava farmers influencing output levels in the Savannah Zone of Northern Ghana

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The research studied the effects of demographic and socio-economic characteristics of cassava farmers on output levels in the Savannah Zone of Northern Ghana. One hundred and fifty cassava farmers were sampled randomly. The data were collected through a structured questionnaire from respondents. The farmers were drawn from three regions that fall under the Savannah Zone. Six districts were purposively selected from the regions. One hundred male cassava farmers and fifty female cassava farmers were considered for the study. An econometric model was specified to determine the relationship between the socio-economic characteristics and cassava output levels. The estimated linear regression model revealed that gender, education, experience, farm size and primary occupation of farmers were statistically significant. Other factors as marital status and land ownership of producers were found to be negative. The findings showed that producers whose primary occupations were not farming do not realise as much output as their counterparts who consider farming as their profession.

Key words: Demographic, socio-economic characteristics, smallholder farmer, cassava, savannah zone, Ghana.

INTRODUCTION

Cassava is regarded as the fastest transition crop globally and remains a staple food for some one billion people in 105 countries the world over, where a third of the caloric needs of the people are met (OECD-FAO, 2015). The relevance of the crop to Africa's age-old problem of food insecurity is not in doubt. The tropical root crop, cassava, could help protect the food and energy security of poor countries now threatened by volatile food prices (United Nations Food and Agriculture Organisation [FAO], 2008a). Cassava in Ghana is largely produced by smallholders on marginal and degraded lands of the humid tropics. Its production is influenced by several factors ranging from geographical to socio-economic. Production levels of the crop have been increasing on a yearly basis and constitute about 22% of Ghana's agricultural Gross Domestic Product [GDP]

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(FAO, 2013b). For sub-Saharan Africa (SSA), cassava is regarded as one of the most important crops due to its ability to withstand extreme weather conditions of the terrain and coupled with its less input demand.

Smallholder farmers remain one of the most important stakeholders in Ghana's agrarian economy. Even though the contribution of agriculture to Ghana's GDP continues to decline, about half of the population are still employed in the sector (FAO, 2015c). Cassava farmers in Ghana are mainly smallholder producers with fragmented land holdings who engage the land to feed their family and sell surplus produce for income. About 90% of the food basket of Ghana comes from these small-scale producers (MOFA, 2011). The operation is rarely held in commercial quantities. Nonetheless the smallholder sector plays a crucial role as far as livelihoods for the vast rural population is concerned. Already job creation and employments are considerable challenges for developing country governments and their private sector partners. According to World Bank about 75 million youth are unemployed worldwide and the International Labour Organisation (ILO) also forecast an increase in unemployment of about 1 million people in the developing world in the next two years (World Bank, 2015; ILO, 2016). Hence, the neglect of the smallholder farm sector, which holds a chunk of the population in the rural areas would only worsen their social and economic conditions resulting in rural-urban mass exodus.

Socio-economic factors continue to play crucial role in determining the levels of production undertaken and the sort of crops planted. The production levels are not the only areas affected but also the way business enterprises are managed which put the socio-economic characteristics of the farmers into focus (von Braun and Mirzabaev, 2015). Previous studies have concluded that if support is to be extended to crop producers in production locations, their basic characteristics are worth studying to fully understand their needs for need-driven assistance. For instance, Mwaniki (2006) stressed that, boosting agricultural production capacity of farmers requires that adequate information about the socio-economic characteristics of the farmers become part of the wider strategy to improve production. Many producers often missed out from supports due to their geographic and socio-economic characteristics and these influence their production output levels. The wealthy ones are easily noted as they have voices to be heard while the poor remain voiceless. Primary areas of interest identified in earlier studies consist of a mixture of some socio-economic and demographic factors.

Presently, this study focuses on the effects of socio-economic factors on output levels and other results of production. Evidence from empirical studies have shown an educational level of farmers to increase their output levels through increase knowledge of the production processes and easy understanding of research materials of new agronomic practices (Seyoum et al., 1998; Hassan and Ahmad, 2005; Kyei et al., 2011). Further, the magnitude of time and efforts needed to convince producers to undertake innovative and improved farming practices are reduced with literate farmers. Illiterate producers are sometimes trivial and unnecessarily focused on the personality of the extension personnel rather than the message (Onubogu et al., 2014). Of late, there is burgeoning concerns for farm size and output level relationship. Continuously, the empirical literature is flooded with arguments for and against farm sizes in productions. Many studies have concluded that the larger farm size is preferable to smaller farm size in terms of outputs obtainable from the production process (Hassan and Ahmad, 2005; ibid). However, findings of other investigators in the same area assert otherwise (Badunenko et al., 2006; Masterson, 2007). Their conclusive assertions lend credence that farms with smaller land sizes produce higher output than their larger size counterparts. There has not been a consensus on this, but quite strangely the approach adopted by researchers from both sides of the block raises more questions than it answers. Importantly, one thing that is driving the debate in a subtle manner is the productivity level of the land or the fertility level of the land under cultivation. That is to say how much is obtained from a parcel of land is a function of several factors rather than just the number of acreages engaged. Additionally, in making a case for either of them, there is always some unintended neglect of the influences of other factors of production in the production process which may lead to erroneous conclusions of one being preferable to the other (Masterson, 2007). Conventionally, age and experience are directly proportional in the smallholder farmer operations. The relationship between age of farmers and their potential output levels has engaged and continue to engage at least for some time. The argument surrounding age as far as efficiency, productivity and output potentials are concern gathered momentum and show no sign of ending anytime soon. Depending on the effects of other demographic and socio-economic factors on age, it can either enhance or reduce the output levels of farmers in production process. According to some studies age influences output levels positively because farming is an activity that the farmers perfect through practice over time (Abdul-kareem and Isgin, 2016; Ören and Alemdar, 2006; Erhabor and Emokaro, 2007; Siddighi-Balde et al., 2014). Other studies conclude otherwise as young farmers being more positioned to realised higher outputs than older farmers (Backman, 2009; Latruffe, 2010; Sibiko et al., 2011; Ramat et al., 2013; Samuel et al., 2014). They hold the view that older farmers may be reluctant to change and sometimes their unwillingness or inability to adopt technological innovations could affect their production abilities leading to low level of outputs realised.

The gender of farmers according to studies has some production implications. Many studies have concluded

that male farmers are likely to obtain higher outputs than their female counterparts from the employment of the same factors of production (Abdulai et al., 2013; Asante et al., 2013; Onumah et al., 2013). They contend that in some geographical localities, the culture of the people will likely exclude women in extension information dissemination because they are not considered as farmers like their male counterparts. Also, due to gender alignment issues, extension information content may not address the needs and conditions of women producers. Few researchers, however, assert that the women off-farm time could be used to gain more knowledge and information thereby increasing their knowledge of the production process (Latruffe, 2010; Onumah, 2013b).

Although, there are studies on socio-economic characteristics of other crop farmers in the Savannah Zone, there are a number of reasons this study is worthwhile; considering the relevance and importance of the crop to the Saharan region, basic socio-economic information on its producers would interest policymakers and provide a foundation for other studies involving the crop. The present study intends to model an econometric relationship between those specific characteristics of cassava farmers in the Savannah Zone of Northern Ghana and the corresponding output levels. The relationship between output levels and socio-economic factors is described to produce relevant policy information to agricultural stakeholders and researchers alike. Government has been continuously called upon to streamline policies for the development of the cassava; sufficient policy recommendation cannot be made to stakeholders if proper studies are not done.

MATERIALS AND METHODS

Research area

The study was carried out in the Savannah Zone of Northern Ghana which consists of the Guinea Savannah and the Sudan Savannah zones. The area covers the three northern regions (Northern Region, Upper West Region and Upper East Region) and the northern parts of both Brong-Ahafo and Volta Regions. The Northern Region is located within latitude 10° 39' 0" N and 8° 6' 30"N and longitude 2° 35' 30"W and 0° 27'30" E covering an area of 70, 383 km^2. The Volta region is located at 3° 45' latitude N and 8° 45' longitude N covering a total land area of 20572 km^2. The Brong Ahafo region is located within longitude 0° 15' E-3° W and Latitude 8° 45'N-7° 30'S covering a total land area of 39,557 km^2 (Adanu et al., 2013). Upper West and Upper East Regions were not considered for this study though they are part of the Northern Savannah Zone because cassava is rarely cultivated in those regions. The vegetation and climatic condition of this part of the country is characterised by short deciduous trees and shrubs with mono-modal rainfall pattern. Majority of the farmers are small-scale producers involved in mixed cropping and mixed farming systems to guarantee constant food supply in this risky climatic area.

The nature of production of the population and also the sizes of land under production qualify them as typical small-scale farmers. Other empirical studies refer to this group of producers as smallholder farmers. The categorization of small-scale farmers according FAO is in terms of the size of their lands under cultivation. Their primary aim of cultivation is for their own consumption and to sell off surplus for income. Many of the farmers in Brong Ahafo are settler farmers from Upper East and Upper West regions that rent land from owners under some form of agreements. The majority of the producers are engaged in agriculture as their primary source of livelihood even though it is not seen as an occupation by them. There is a belief among some farmers that agriculture is a cultural heritage bequeathed to them by their ancestors.

Data collection

A cross sectional data of one hundred and fifty (150) cassava farmers were sampled randomly in 2014 farming season through a farmer survey. The data were collected in six (6) districts of the regions using a simple random sampling methodology. One hundred (100) male cassava farmers and fifty (50) female cassava farmers were considered for the study. This was done because the numbers of male cassava farmers are more than female counterparts. Information on demographic, socio-economic characteristics of farmers that affect their output levels were obtained using focus group discussions and questionnaire administration.

Data analysis

An econometric model was specified for the study and regression technique used to obtain the estimates of the parameters of farmer specific socio-economic characteristics with their corresponding output levels. Stata 12 statistical software was adopted for the estimation of the parameters. Dummy variables were used to capture the subtle effects of some factors. A multiple linear regression model was estimated using Ordinary Least Square (OLS) technique. The theoretical regression model designed for study is stated as follows:

$$Y_i = \beta_0 + \sum_{j=1}^{K} \delta_j D_j + \sum_{i=1}^{N} \beta_i X_i + \varepsilon_i \quad (1)$$

where Y_i = Quantity of output, βs = A vector of unknown parameters of the variables to be estimated, X_i = A vector of variables influencing output levels, D_i = Dummy variables, δ_j = A vector of unknown parameters of the dummy variable, and ε_i = Error term $\varepsilon i \sim NID(0, \sigma_u^2)$.

RESULTS AND DISCUSSION

In Table 1, the average amount of cassava output realised is 7746.10 kg. The gender variable was modelled into a dummy to obtain the different output levels of male and female producers. The number of years stay in school defines the education variable in the study. The mean age of the farmers is 42. This reflects the fact that the active farming age group still cultivate the crop. Experience as seen in Table 1 refers to the number of years farmer has been farming. The average years of experience are 12. The income level of farmers depicts that of a typical smallholder farmer. Farm sizes are also smaller, averaging around 2.4 acres which is characteristic

Table 1. Descriptive statistics of producers (Field Survey, 2014).

Variable	Minimum	Maximum	Mean	Std. Dev.
Cassava output (kg)	600	31450	7746.10	6621.68
Gender (Dummy Variable male = 1 otherwise 0)	0	1	0.67	0.47
Marital status (Dummy variable married =1 otherwise 0)	0	1	0.81	0.40
Education (number of years)	0	16	6.24	5.26
Age (Number of years)	19	70	42.19	10.62
Experience (Number of years)	2	32	11.96	7.42
Land ownership (Dummy variables Owned = 1 otherwise 0)	0	1	0.80	0.40
Household size (Number)	2	25	8.25	4.04
Farm size (Acres)	0.5	12	2.45	1.80
Primary occupation (Dummy variable Farming = 1 otherwise 0)	0	1	0.53	0.50

Table 2. Estimates of the regression model (Field Survey, 2014).

Variable	Parameter	Coefficients	Std Error	t Stat	P-value
Gender	δ_1	1867.82*	960.92	1.94	0.05
Marital Status	δ_2	-754.41	1031.23	-0.73	0.47
Primary Occupation	δ_3	3064.28***	930.78	3.30	0.00
Land Ownership	δ_4	-539.82	971.13	-0.56	0.58
Intercept	β_0	-4015.60*	2083.34	-1.93	0.06
Education	β_1	218.86**	89.51	2.45	0.02
Age	β_2	67.26	45.44	1.48	0.14
Experience	β_3	162.59**	68.09	2.39	0.02
Household Size	β_4	42.48	97.10	0.44	0.66
Farm Size	β_5	1407.99***	227.46	6.19	0.00
R Square	R^2	0.55	-	-	-
Adjusted R Square	R^2(bar)	0.52	-	-	-
F Statistics	F	18.77	-	-	0.00

Significant at *, ** and *** significant at 10, 5 and 1%, respectively.

of smallholder farmers. The average household size for the study area according to the survey is 8.3. This figure is larger compare to that of the Northern Region of 6.1 (UNEP, 2014). About 80% of the farmers cultivate on their own land.

Empirical model

The empirical model adopted for the study is indicated as:

$$Y_i = \beta_0 + \sum_{j=1}^{4} \delta_j D_j + \sum_{i=1}^{5} \beta_i X_i + \varepsilon_i \quad (2)$$

where Y_i = Cassava output (kg), X_1 = Education, X_2 = Age (years), X_3 = Experience in farming (years), X_4 = Household size (number of persons), X_5 = Farm Size, D_1 = Gender (Male = 1 otherwise 0), D_2 = Marital Status (Married = 1 otherwise 0), D_3 = Primary Occupation (Farming = 1 otherwise 0), D_4 = Land Ownership (Land Owned = 1 otherwise 0), β_i = Coefficient of the input variable, δi = Parameter estimates of dummy variable, and ε_i = Error term $\varepsilon i \sim NID(0, \sigma_u^2)$.

The results of the estimates of parameters in the regression model are presented and discussed in Table 2.

The estimates of the regression analysis as shown in Table 2 indicate that gender, primary occupation, education, experience and farm size were statistically significant. These factors have been shown to be the most important factors influencing the output levels of cassava in the study area and are positively correlated with cassava output. The results also showed that producer-specific characteristics such as age, household size and farm size positively correlated with cassava output levels though some of their estimates were not statistically significant. The regression analysis reported an R-Square of 0.54.68 with a statistically significant F value of 18.77. Other factors as marital status, land ownership and primary occupation of producers were

found to be negatively correlated with output levels and statistically insignificant. The findings showed that producers whose primary occupations were not farming do not realise as much output as their counterparts who consider farming as their profession.

F test

H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$
H_1: At least one of them is different from zero

$$F_{(k-1,n-k)} = \frac{ESS/(k-1)}{RSS/(n-k)} \quad (3)$$

$$F_{(9,140)} = \frac{3572556876/9}{2960584223/140}$$

$$F = 18.77$$

$$F^{*}_{0.05\ (9,140)} = 1.94$$

The null hypothesis was rejected implying the existence of linear relationship between cassava output level and the farmer specific characteristics that influence it. Also, the significant value is an indication that the R^2 of the regression line reflects the true relationship.

Factors influencing output levels

Education of farmers

The estimate of the educational variable was positive and statistically significant at 1% implying educational level increase output of farmers. The finding is consistent with others in the empirical literature (Asadullah and Rahman, 2005; Msuya et al., 2008; Awunyo-Vito et al., 2013). This is apparently due to the fact that educated farmers are able to assimilate materials on improved methods of farming with ease. Even though the educational level of farmers increases outputs, yet surprisingly about 68.7% of the farmers had no formal education.

Experience of farmers

The number of year's engagement in the cultivation of cassava by a farmer is considered the experience. The majority of the producers experiences range from 1 to 20 years. The average year of experience among the farmers is 12 years. Like other business enterprises, experience is crucial to increase output levels in production. Longevity in the occupation exposes the producers to all the nuances in the production process and strengthening them significantly for proper decision making. The estimate was statistically different from zero at 1% significant level. The conclusion is in line with that of Danso-Abbeam et al. (2012). In a study on the technical efficiency in Ghana's cocoa industry, evidence from in the Bekwai district they concluded that farming experience does not only increase efficiency but also increase the quantity of output realised from the farm.

Farm size

Cassava farmers in the Savannah Zone of Northern Ghana are typical smallholder producers. The average number of acres of land used in the cultivation of cassava is 2.4 acres. Commercialisation of the sector is still an issue in Ghana. The concerns range from capital, markets to spoilage. The high water content level of the crop makes it perishable shortly after harvest. The crop is known to be marketed locally with high rate of spoilage. The parameter estimate for this factor is 930.57 and statistically significant at 1% level indicating that an acre increase in farm size leads to 930.57 kg increase in output of cassava. Farmers who have the monetory resources and able to increase their farm size have the tendency to increase their farm output *ceteris paribus*. The findings support that of Onu and Edon (2009), Martey et al. (2012) and Etwire et al. (2013). This means more output are realised with marginal increase in the quantity of land under production.

Primary occupation of farmers

The occupational status of producers of cassava is either primary farmers or they are engaged in farming as a secondary business opportunity. About 43.3% of the farmers are engaged in farming as their main occupation while the rest have other occupations and employ farming as secondary business enterprise. The estimate of this factor in the regression model is positive and statistically significant level of 5%. The finding is similar to the conclusion drawn by Abdulai and Huffman (1998). In their study on the examination of profit efficiency of rice farmers in Northern Ghana, they concluded that rice farmers who were engaged in farming as the main occupation realised more output than those who were not into fulltime farming businesses. The intuition behind this is partly to do with risk.

Farmers would likely do everything to realise more output with knowledge that their only source of livelihood is farming. The non-farm enterprises are supposed to diversify the income structure of the smallholder thereby strongly building them against shocks. The study however revealed that farmers with other businesses do not attach seriousness to the farming leading to low levels of outputs.

Gender and farm size

The interaction between gender and farm size produced a positive statistically significant estimate giving combined increase of 658.28 kg of cassava output. Meaning the gender of a farmer influences the size of land available for production. This is a reflection of a socio-cultural phenomenon that makes situations difficult for female farmers to acquire land for production.

The main challenge of this study was the measurement of output quantities. During the course of the survey, it was realised that the farmers had measurement issues. For this reason a conversion technique was adopted to convert all output quantities into kilograms.

Conclusions

The results of the findings permit us to draw some very important conclusions about the demographic and socioeconomic factors that influence output levels of cassava producers. The purpose of the study was to determine those factors and their level of influences on cassava output in the study areas. The study revealed that gender, education, farming experience, farm size and primary occupation of farmers are the statistically significant factors that affect the output of cassava in the Savannah Zone of Northern Ghana. The results as shown revealed that farmer' output levels were generally low and also they do not use fertilizer in cassava production. According to MOFA/SRID (2013), average output of cassava production is 19.71 mt/acre. However, the average output level realised in the production is 7746.1 kg/acre.

The results relating to farm size are particularly reinforcing the call made by other researchers for the commercialisation of agriculture. Farm size is positively related to production output levels. Again, farmers with higher level of education also produce commensurately higher outputs. This is consistent with empirical knowledge about agricultural production. The intuition is that farmers are able read educational materials and other documents; decipher information on improved agronomic practices. This inevitably increases their output levels. Despite the importance of education to cassava production, the majority of producers were found to be illiterates. It was also observed that the experience gained over a period of time by farmers is an invaluable asset in increasing production output levels.

RECOMMENDATIONS

The situations of the farmers depict typical smallholder farmers characterised with small land areas under cultivations. Efforts to proffer remedy for the present challenges of lower cassava output level facing cassava farmers require cautious planning taking into consideration their demographic and socio-economic situations. Another area that needs attention is the adoption of strategies to make use of experienced farmers. To this effect farmer field schools could be instituted to enable young farmers tapped into the experiences of their experienced counterparts through open field demonstrations. Farmers should also be provided with content related education through extension agents and other appropriate means.

It is recommended that government partners the private sector to promote large scale production or government and development partners make grants and loans for smallholder farmers to increase their farm size and efficiencies. High production potential exists in this industry which could be harnessed by commercialisation. Government should give incentives to farmers to retain the experience ones for increase production and reduce the tendencies of farmers picking up non-farm business enterprises that reduce their focus on the farm business.

Income from cassava production and post-harvest cassava processing represents around one fifth (22%) of Ghana GDP (SRID, 2013). There exist research programmes that strives to find workable solutions to pressing challenges of smallholder farmers. Farmer Participatory Researches should be instituted to include farmers in the search for solutions to their problems. There should be an urgent need to reconsider the current system and structure of agricultural research research for maximum farmer benefits. Ghana's agriculture is still natural and depends so much on rainfall. For the nation as a whole to develop and improve its agriculture potential, irrigation should be promoted. The Technical, Vocational, Education and Training (TVET) programme that is already in place should be redesigned to give much emphasis to agriculture. Small scale producers require tailor-made education to face the difficulties of agricultural production heads on. The Good Practice Centres (GPC) that have sprung across Ghana should be developed further to spur rural economic development through increased technical skills in the cassava value chain.

The cassava crop remains arguably the most promising for sub-Saharan Africans as far as food security is concerned. Cassava production industrialization in Ghana is just beginning to show potentials. However, the potential for starch markets for producers is great. Although the Presidential Special Initiative (PSI) on cassava was formulated, there exist no policy framework as the development of the crop matters. Ghana produces an average of 15 million metric tonnes yearly with about 9 million metric tones available for consumption (SRID, 2013). The surplus is often rot as Ghana is yet to take advantage of international trading in cassava. Trade is usually involves raw cassava at the local level, which is always in the bulk form. With frantic efforts Ghana small scale farmers could sell off their surplus to other

processing giants. Gradually cassava starch is replacing other known producers as maize and potatoes. This will trigger an increase in the amount of cassava that will be demanded by industries. Also, the supply chain of cassava offers a very significant opportunity for job creation among producers and locals. Cassava has got numerous uses that have the ability to spur rural community growth and agricultural transformation. The demand for cassava for the manufacturing of ethanol is growing giving farmers chance to increase production quantities. The local markets of cassava are often overlooked, leading wastage as very little is consumed.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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