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Examining the Socioeconomic Determinants of Rice Farmer's Choice of Land Tenure Systems in the Upper East Region of Ghana

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Abstact The study examined the socioeconomic determinants of rice farmer's choice of land tenure in the Upper East region of Ghana. The study employed 470 sample size extracted from Ghana Agricultural Production Survey. The study revealed that 76%, 21% and 3% of the rice farmers were land owners, rented title and share title respectively. Land owners obtained their farmlands through family, marriage, inheritance and gift. The study employed the multinomial probit model to examine the factors that influence the rice producer's choice of land tenure system. The multinomial probit estimates showed that socioeconomic characteristics such as marital status, age, household head, extension contact and credit access influenced the rice farmer's choice of land tenure system. We recommend that these socioeconomic characteristics of the rice producers should be critically considered when formulating any land policy in the Ghana.

Keywords: Ghana, land tenure, multinomial probit, rice farmers, socioeconomic

Introduction

About 69% of Ghana's land is used for agricultural purposes, with 18 % considered as arable land and 15% as permanent natural pasture (USAID, 2011). Ghana's land is governed by a pluralistic legal system in which customary and statutory systems overlap (Sarpong, 2006). Most of Ghana's land is held under customary tenure. The land is vested in chiefs, earth priests (who hold spiritual authority over land matters because of their role as the descendants of the first village settlers) or other customary authorities (USAID, 2011). Approximately, 80% of Ghanaian land is held under customary tenure system. The State officially owns 20% of all land. Three types of land are identified under the 1992 Republic Constitution of Ghana (Bugri, 2008). They include public lands

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controlled by the government; stool or skin lands managed by traditional authorities on behalf of communities and family or private lands controlled by individuals or family clans. Stool and family lands are called customary land. There are various tenurial arrangements under the customary land which include inherited title, customary freehold title, leasehold title and other lesser interests in the land (Bugri, 2008).

Land tenure confers entitlements and rights to land including other natural resources of the people who inhabit an area (Sarpong, 2006). Land tenure affects natural resources management globally, particularly in the developing countries like Ghana (Bugri, 2008). This has attracted a lot of attention in modern studies on sustainable natural resources management. Land resources and rights to them are essential to survival in developing countries. It has often been observed that in countries and societies where land tenure systems did not evolve properly to accommodate changes in agriculture, industry and services, the growth and development of such economies have stagnated (Ubink and Quan, 2008). Land resources have become a focus in addressing food production issues in Africa because most African agricultural production is land driven. Critics have attributed poor performance in the agricultural sector to insecure nature of communal land tenure systems in Ghana. For land tenure is thought to influence agricultural productivity through security or investment demand effect (Bugri, 2008). Land rights insecurity impedes investment in both rural and urban areas of West Africa particularly Ghana. This has therefore slowed economic growth in these areas (USAID, 2011). The issue of access to land in Ghana is critical due to its role in achieving sustainable rural development and increasing technological change (IFAD, 2008). It has been argued that farmers with secured tenure tend to invest in their lands which promote higher productivity (Kwabena-Twerefou, 2011). Thus, secure tenure increases incentives to undertake productivity-enhancing land-related investments (IFAD, 2008). Land tenure security results in higher levels of labour and management effort, which in turn encourages higher levels of investment in enhancing land fertility (IFAD, 2008).

Due to high demand for food commodities like rice, farmers with limited farmlands resort to various means to acquire enough farmland to tilt. However, the rice farmers' decision to choose a particular land tenure system is influenced by their socioeconomic characteristics. These socioeconomic factors have not been given much attention in most research in rice production. No study has attempted to investigate the socioeconomic factors that influence farmer's choice of land tenure in the rice industry in Ghana and the world as large. Most studies on rice focus on efficiency, productivity, and land tenure effect on land degradation (Seidu, 2008:2012; Donkoh and Awuni, 2011;

Kwabena-Twerefou *et al*., 2011). The present study attempts to contribute to knowledge by considering the factors that affect farmer's choice of land tenure systems in rice production in the Ghana. These factors will be relevant in formulating land policy towards secured land rights.

Materials and methods

Multivariate probit model

Land tenure system choice model concerns the decision made by farmer *i*, $i = 1, 2, ..., I$ of the alternative *j* in the set $w_i = (1, ..., j)$ which produces the highest utility level (V_{ij}). Thus, $V_{i1} \leq V_{ij}, \forall j \in w_i$ in this notation indicates the choice set is allowed to vary across individuals to account for their own specific land tenure system available. The land tenure choices 1, 2 and 3 denote owned, rented and sharecropped land respectively. Owned land is chosen as base category (option 0). The utilities of other land tenure systems (rented and sharecropped) are compared to that of the base category. The individual decision is based on the differences between utility derived from the other land tenure systems and the base category (owned land). This can be represented as $Y_{ij}^* = V_{ij} - V_{1j}$, where Y_{ij}^* denotes unobservable choice made. $Y_i = j$ if individual *i* makes choice *j*. If $Y_{ij}^* < 0$ for j = 1,…,J, then farmer *i* chooses the base category option (owned land) and $Y_i = 0$. Otherwise, farmer *i* makes choice which yields the highest value for Y_{ij}^* and $Y_{ij} = j$. Assuming that each farmer *i* faces the same *J* alternatives, a multinomial probit model formulation based on linear-in-parameters utilities may be written as follows:

$$V_{ij} = Z_{ij}\beta + \varepsilon_{ij}, \varepsilon_{ij} \sim N(0, \sum) \quad (1)$$

$$y_{ij} = \begin{cases} 1 & \text{if } V_{i1} \leq V_{ij} \text{ for } i = 1, 2, ..., I \ ; \ j = 1, ..., J \\ 0 & \text{otherwise} \end{cases} \quad (2)$$

The variable y_{ij} denotes the choice made by farmer *i*, V_{ij} is the unobservable utility of alternative *j* as perceived by individual *i*, Z_{ij} is a (1 x *K*) vector explanatory variables characterizing both alternative *j* and the individual *i*. β is a (*K* x 1) vector of fixed parameters and finally ε_{ij} is a normally distributed random error term of mean zero assumed to be correlated with the errors associated with the other alternatives *j* , $j = 1, ..., J$, $j \neq i$; and covariance

matrix of $\sum = Cov(\varepsilon_i) = \begin{pmatrix} \sigma_{11} & \sigma_{12} & \sigma_{13} \\ \sigma_{21} & \sigma_{22} & \sigma_{23} \\ \sigma_{31} & \sigma_{32} & \sigma_{33} \end{pmatrix}$, with $\sigma_{jj} > 0, \forall j$ (positive definiteness).

The predicated probability of choosing any of the land tenure choices can be represented with (3)-(5):

$$P(y_i = 1) = P(V_{i1} + \varepsilon_{i1} > V_{i2} + \varepsilon_{i2} \text{ and } V_{i1} + \varepsilon_{i1} > V_{i3} + \varepsilon_{i3}) \quad (3)$$

$$P(y_i = 2) = P(V_{i2} + \varepsilon_{i2} > V_{i1} + \varepsilon_{i1} \text{ and } V_{i2} + \varepsilon_{i2} > V_{i3} + \varepsilon_{i3}) \quad (4)$$

$$P(y_i = 3) = P(V_{i3} + \varepsilon_{i3} > V_{i1} + \varepsilon_{i1} \text{ and } V_{i3} + \varepsilon_{i3} > V_{i2} + \varepsilon_{i2}) \quad (5)$$

Assuming that the response categories are mutually exclusive and exhaustive, then $\sum_{j=1}^{J} P_{ij} = 1$. Thus, for each i , thus, the probabilities add up to one for each individual and we have only $J - 1$ parameters. This implies that (3) + (4) + (5) = 1 which is rewritten as :

$$P(y_i = 1) + P(y_i = 2) + P(y_i = 3) = 1 \quad (6)$$

In modeling discrete choice, the multivariate probit model (MNP) is often adopted as a way to avoid the well known limitations of the simpler multinomial Logit (MNL), viz., the independence from irrelevant alternatives. This property of the MNL follows from the assumption that the stochastic components of the utilities are independent and identically distributed as type 1 extreme value variates. The inadequacy of such assumption, for many cases, where it is realistic to assume that some alternatives are more similar to each other for the individual performing the choice, has been thoroughly noted in the literature (Burgette and Reiter, 2013). Although the MNP does not impose any restrictions on the covariance matrix of the stochastic components of the utilities, its elements are not identified (Burgette and Reiter, 2013). Indeed, due to the fact that in any random utility model the utility functions are only identified up to scale and location, all that is possible to identify are the parameters in the covariance matrix of the normalized utilities. These parameters are functions of the original elements of the covariance matrix and are unfit to be given an economic or behavioural interpretation. Again, if choices are large, number of such correlations can grow huge and multinomial probit has to estimate all these correlations. For this reason, multinomial probit is typically used only if the number of options is relatively small (Denis, 1999).

Specification of the multinomial probit model

Empirically, the multinomial probit regression model can be written as in indicated in (16):

$$L_{ij} = \alpha_{0ij} + \alpha_{1ij}G_{ij} + \alpha_{2ij}A_{ij} + \alpha_{3ij}A^2_{ij} + \alpha_{4ij}Hd_{ij} + \alpha_{5ij}Hs_{ij} + \alpha_{6ij}Ed_{ij} + \alpha_{7ij}Ka_{ij} + \alpha_{8ij}Fs + \alpha_{9ij}Ms_{ij} + \alpha_{10ij}Ca_{ij} + \alpha_{11ij}Ex_{ij} + \alpha_{12ij}Ir_{ij} + \alpha_{13ij}HC_{ij} + e_{ij} \quad (16)$$

where L_{ij} denotes land tenure (j = 1 denotes owned, 2 denotes rented and 3 sharecropped). G_{ij} equals 1 if farmer was a male and 0 otherwise, *A* denotes age of the farmers (years) and A^2 denotes age squared. *Hd* equals 1 if farmer was household head and 0 otherwise. *Hs* denotes household size. *Ed* denotes educational level (number of years of schooling). *Ka* equals 1 if farmers came from Kassena and 0 otherwise. *Fs* represents farming experience (number of years of farming). *Ex* equals 1 if farmer received extension service in 2011 and 0 otherwise. *Ms* equals 1 if farmer had married and 0 otherwise. *CA* equals 1 if farmer had access to credit facility in 2011 and 0 otherwise. *Ir* equals 1 if farmer had access to irrigation facility and *HC* denotes interaction between household head and credit access. α_{0ij} denotes the constant term and $\alpha_{1ij}, \alpha_{2ij}, ..., \alpha_{13ij}$ represent the coefficients of the explanatory variables in the model. e_{ij} denotes the disturbance term.

Sources of data and sampling procedure

The survey data was extracted from Ghana Agricultural Production Survey (GAPS) conducted by MoFA/IFPRI in 2011. The GAPS employed multistage sampling technique to select the respondents. The relevant data on rice farmers were extracted from the GAPS 2011 dataset. The dataset on rice farmers were extracted from the two districts from Upper East Region of Ghana. They include Bawku Municipal and Kassena Nankana East. Total sample size of 470 rice farmers was extracted from the dataset. This comprises 350 rice farmers from Kassena Nankana East and 120 from Bawku Municipal. The survey questionnaire (GAPS, 2011) and the dictionary of variables were employed. The survey questionnaire captured information on the socioeconomic characteristics of the respondents such as age, gender, household size, education, extension contact, credit access, land tenure, distance to nearest market and farm size.

Results and discussion

Descriptive results

The majority (51%) of the rice farmers were males (Table 1) while 49% were females. Fifty four percent were married and 46% were single (Table 1). Only 47% of the respondents could read and write (Table 1). This suggests that literacy rate in the Upper East region of Ghana is low. The results indicate that most of the rice farmers were young with mean age of 34 years. The minimum age was 17 with the maximum age of 90 years (Table 2). Most of these youth had spent average of 3 years in formal schooling (Table 2). The minimum years of schooling was 0, indicating that they had not received any formal education while maximum was 18 years suggesting tertiary level (Table 2). The low literacy rate can affect technology transfer since rice production involves a lot of technologies. The results also show that most of the farmers had engaged in the cultivation of rice for about 6.71 years with minimum and maximum of 1 and 42 years respectively. The average household size was 5 people with minimum and maximum of 1 and 14 respectively (Table 2). We observed that 62% had received no extension service with respect to their rice farming operations (Table 1). Only 38% had benefited from extension service (Table 1).

This result indicates that extension service delivery in the Upper East regions is low. One of the major problems that confront agricultural production is access to affordable finance. As demonstrated by the result in Table 1, only 3% of the rice farmers had accessed credit before but the majority (97%) did not have access to credit. The mean distance to the nearest market was 7.8km with minimum of 1km and maximum of 54km (Table 2). The results reveal that 91% of the rice farmers solely depended on rainfall for production while 9% had water sources for irrigation. These water sources include dam or pond, river and stream.

Table 1. Socioeconomic characteristics of the rice farmers

Variable		Frequency	% (%)
Gender	Male	240	51
	Female	230	49
Marital status	Single	254	54
	Married	216	46
Literacy	Yes	221	47
	No	249	63
Extension	Yes	179	38
	No	291	62
Credit	Yes	14	3
	No	456	97
	Owned title	357	76
Land tenure	Rented title	99	21
	Shared title	14	3
Land acquisition	Family	251	70
	Marriage	63	18
	Inheritance	16	4
	Gift	27	8
Transfer land rights by selling	Yes		

No	

Source: Survey Data (2011)

Table 2. Summary descriptive statistics of the socioeconomic characteristics of the rice farmers

Variables	Number of observation	Minimum	Maximum	Mean	Standard deviation
Age (Years)	470	17	90	33.59	17.077
Education (years of schooling)	470	0	18	2.59	4.31
Farming experience	470	1.00	42.00	6.71	8.03
Household size	470	1	14	5.41	2.89
Market distance	470	1	54	7.8	6.84

Source: Survey Data (2011)

The choice of land tenure systems opted by the rice farmers

The study identified three main land tenure systems operated by the rice farmers in the Kassena Nankana and Bawku districts. They include owned land title, rented title and sharecropping title. In the Upper East region, individuals do not own lands but the family heads. The chiefs oversee the distribution and sale of land. The *Tidanas*/*Tigatus* (chiefs of the land) are the original owners of the land. They transfer land to other family heads. We observed that 76% of the respondents farmed on their own farmlands. Twenty one percent rented the farmland and only 3% had engaged in sharecropping arrangement (Table 1). Additionally, the farmland owners acquired their lands through the family, marriage, inheritance and gift. Among these modes of land acquisition, majority (70.31%) owned their farmlands through the family. This confirms that most of the land belongs to family (particularly, the family head) (Table 1). Eighteen percent had their farmlands through marriage implying that their spouses transferred those farmlands to them. This is very common with the females. Four percent inherited the farmland from their family (Table 1).

This happens when a man dies in family and his properties including farm lands are inherited by the next of kin. Others (7.56%) acquired the farm land through gift (Table 1). Some people can give out acreage of farmland to someone to show appreciation to task done. Moreover, out of the 357 rice farmers who cultivated on their own land, 31% indicated that they could sell their farmlands while majority (69%) could not sell their lands (Table 4). Those who could not sell their land gave reasons for their inability to sell the land. The reasons include the following: the land they are cultivating belongs to family and did not personally own it. Others indicated that the land has been used as

collateral and therefore could not be sold. Lastly, some farmers stated that the land belongs to their spouse and they needed their consent before they could sell.

Empirical Results

Multinomial probit regression estimates of the determinants of the choice of land tenure

The multinomial probit regression model was used to examine the factors that influence rice farmer's choice of land tenure in the Kassena Nankana and Bawku Municipal of the Upper East Region of Ghana. Table 3 presents the maximum likelihood estimates of the multinomial probit regression model. Owned land was used as a base outcome for the multinomial probit analysis. Among the variables fitted in the models, only four variables significantly influence the probability that a farmer would rent a farm land. These include household head, Kassena Nankana, marital status, credit access and extension contact. Again, two variables significantly influence probability of choosing sharecropping land tenure system. They include age and household head.

The coefficient of marital status positively related to the probability of renting a farmland rather owning it. It was significant at 5% level which implies that married rice farmers are less likely to rent farmland in favour owning it. This is probably because, in northern part of Ghana, farmers can acquire land through marriage. Due to the dynamics of the land tenure system, where farmlands are distributed among the family members, married farmers are likely to receive inadequate farm size and therefore may like to increase farm size by renting. Another possible reason could be that married farmers might have a lot dependents and responsibilities. Hence, there is high demand for food commodities. Therefore, in order to meet their food demand, they need to rent extra farmland to produce enough food.

The coefficient of the variable age had a positive association with the likelihood of choosing sharecropping in favour land ownership. It was significant at 5%. This indicates that young rice farmers are more likely to engage in sharecropping because they wish to get more farmlands to cultivate. Young farmers usually have limited farmlands inherited from their parents. Implying that young farmers may decide to engage in sharecropping agreement because they are energetic and may want to cultivate sizeable farm, which they may not be able to get it from the family or would not have enough money to rent it. However, as they become older, they tend to withdraw from sharecropping and wish to have their own land. During this period, they

become weak and would not be able to work as they were young. Hence, their probability of engaging in sharecropping becomes smaller.

The variable household head was highly significant at 1% level and negatively influenced the probability of choosing renting land against owning it. This suggests that rice farmers who are household heads are less likely to rent farmland. Household heads are in charge of the affairs of the household as well as farmland. This also indicates that household heads are more likely to inherit land from their ancestors (particularly their parents) or the chief (*Tidana*). Similarly, household head was significant at 1% but negatively related the probability of engaging in sharecropping agreement. This demonstrates that household heads would prefer to own farmlands rather than involving in sharecropping. They are responsible for the distribution of farmlands among the household members. Therefore, acquiring farmland for rice cultivation would not be a problem for him.

The coefficient of Kassena Nankana was significant at 5% and positively influenced the likelihood of renting land in favour land ownership. This implies that farmers in Kassena Nankana district are more likely to rent farmland against owning it. The possible reason may be that rice production is quiet intensive and demand for suitable farmland for cultivation may be high. Therefore, getting land suitable for rice cultivation free of charge may be difficult but renting it may be easy.

Extension contact was significant at 10% and negative correlated with the probability of renting farms land. This indicates that those who benefited from extension contact would prefer to own their farmlands. Those who have access to extension service would benefit from land improvement technologies. These technologies may have long term effect in enhancing land productivity. This would also help them to continuously cultivate the field for rice production which may not be possible with renting. Credit access had positive effect on probability of renting land and significant at 10% level. When rice farmers have access to credit, they have enough funds to rent farmland suitable for rice cultivation.

Even though gender and farming experience were not significant, they positively influenced the probability of renting farmlands for rice cultivation. This suggests that these factors could increase farmers' probability to rent farmland in favour owning it. However, access to irrigation, education, and interaction between household head and credit access would reduce farmers' probability of renting farmlands, even though they were not significant. Moreover, gender, education, age, Kassena Nankana, farming experience, interaction between household head and credit access and access to irrigation influenced the likelihood of farmers engaging in sharecropping agreement,

whilst marital status, household size and extension contact would reduce farmers' probability of involving in sharecropping agreement.

Table 3. Multinomial probit estimate of the choice of land tenure arrangements

Variable	Rented	Sharecropped
Gender	0.285 (0.178)	0.366 (0.185)
Marital status	0.533 (0.059)*	-0.024 (0.942)
Education	-0.169 (0.76)	0.010 (0.713)
Age	-0.024 (0.487)	0.082 (0.082)*
Age squared	0.0002 (0.515)	-0.0008 (0.125)
Household head	-0.654 (0.017)**	-2.198 (0.000)***
Kassena Nankana	0.411 (0.050)**	-0.267 (0.278)
Farming experience	0.0028 (0.888)	0.0145 (0.497)
Household size	-0.127 (0.700)	-0.0363 (0.348)
Extension contact	-0.335 (0.090)*	-0.217 (0.399)
Credit access	0.692 (0.043)**	0.507 (0.196)
Household head x credit access	-0.699 (0.235)	0.628 (0.483)
Irrigation	-0.0548 (0.863)	0.0364 (0.927)
Constant	-0.907 (0.169)	-2.856 (0.001)**
Observation	470	
Log pseudo likelihood	-336.949	
Wald chi-square (20)	53.61	
Probability > chi-square	0.0011***	

Source: Author's computation (2013). Note that all values in parentheses are the probability values. *, **, *** denote 10%, 5% and 1% % significant level.

Conclusion and recommendation

The study examined the socioeconomic factors that influence rice farmer's choice of land tenure system in the Upper East of Ghana. The study focused on two districts in the region, namely, Kassena Nankana and Bawku. The study employed 470 sample size extracted from Ghana Agricultural Production Survey. The study revealed that 76%, 21% and 3% of the rice farmers were land owners, rented title and share title. Land owners obtained their farmlands through family, marriage, inheritance and gift. The study employed the multinomial probit model to examine the factors that influence the rice producer's choice of land tenure system. The multinomial probit estimates showed socioeconomic characteristics such as marital status, age, household head, extension contact, credit access and location specific variable – Kassena Nankana influenced the choice of land tenure system opted by rice

producers in Upper East region of Ghana. We recommend that these socioeconomic characteristics of the rice producers should be critically considered when formulating any land policy in the study area.

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