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Poverty and Risk Attitudes: The Case of Cassava Farmers in Awutu-senya District of the Central Region of Ghana

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Authors' contributions

Authors WG and SKND designed the study, performed the statistical analysis, wrote the protocol, and put together the write-up for the first draft of the manuscript. Author MW managed the data gathering process and most of the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Ghana's agriculture is characterized by low productivity, low farm incomes and low levels of technological adoption and use of inefficient production techniques. This poor state of Ghana's agriculture is related to farmers' attitudes towards risk in the adoption of new production techniques, as well as risk in the production and socioeconomic environment. Having realized that poverty is a major constraining factor in the farmer's production and socio-economic environment, the study therefore sought specifically to: measure the poverty situation among cassava farmers in the study area; analyze the risk attitudes of cassava farmers and determine the effect of poverty on risk attitudes of the farmers. The study area is Awutu Senya District. A random sampling technique was used for the selection of respondents. Data were generated using structured interviews and field visits. The collected data were analyzed using descriptive statistics, the Foster Greer Thorbecke poverty measures, Equal Certainty Equivalent Risk Model and regression analysis to determine the effects of poverty on the risk attitude of farmers. The result showed that 58% of farmers in the study area were poor and 31% measured the depth or extent of poverty as indicated by the FGT poverty measure. Furthermore, using the equal certainty equivalent risk model of assessing farmers' risk attitudes the study revealed that, as many

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as 82% of the farmers was risk averse. The result of regression analysis also suggested that age, household size, educational level, land size and degree of poverty were significant determinants of farmers' attitude towards risks. Poverty situation was found to be positively related farmers attitude towards risk. It is therefore, recommended that the government and private sector should initiate policy that strengthens existing programmes on alternative income generating activities within the broad framework of its poverty alleviation strategy to improve farmers' income. With improved income farmers should be able to improve on their risk management skill to mitigate the effect of perceived risky situation they find themselves.

Keywords: Risk attitudes; poverty; farmers; Ghana.

1. INTRODUCTION

The Agricultural sector in Ghana is dominated by small scale subsistence farmers and it contributes significantly to the country's economy. It employs 60 percent of the country's workforce and, contributes 35 percent to the Gross Domestic Product (GDP), and with real Agricultural GDP growth of 6.2 percent [1]. However, the growth of the sector has been constrained by low productivity stemming from the use of low –input/low output technologies, high post harvest losses and inappropriate or rudimentary processing/ value-adding technologies. Furthermore production is poorly linked to demand, and market information is not widely used by producers, a situation which according to TIPCEE, has hampered increased productivity in the sector [2].

Indeed the present poor state of Ghana's agriculture can also be traced to farmers' attitude towards risks management which essentially constrained their ability to adopt new production technologies, as well as manage the various kind of risk in the production and socioeconomic environment. Recognizing poverty as major constraining factor in the farmer's production and environment, there is the need to empirically study the relationship between poverty and farmer's attitude towards risk.

Presently, however there is paucity of information on this aspect of the research in Ghana and specifically in Awutu-Senya District. This is due to the fact that most studies in Ghana had focused on poverty, risk attitudes, and risk management in different dimensions and context but little or no attempt had been made to empirically investigate the relationship between poverty and risk attitude of farmers. It is with this background that this study has been conceived to empirically ascertain the relationship between the incidences of poverty among small-scale farmers and their attitudes towards risks in the district. This study has become particularly important in view of the Ghana Government efforts to develop the cassava crop into an important industrial crop under the presidential special initiative programme to feed the fledging starch industry in the study area. While the government and the private sector have initiated a number of crop improvement measures to boost the productivity of the crop in the district, they have not given adequate attention to the socioeconomic dynamics of the production environment of the farmer. Povertyand risk have been identified as key factors that can scuttle any desired outcome. Thusthe need for this study, to empirically ascertain the relationship between the incidence of poverty and risk in the district as a contribution to this effort. To facilitate the study the following research questions were formulated as a guide:

i. What is the poverty situation among cassava farmers in the study area?

ii. What is the risk attitude of cassava farmers in the study area?
iii. What is the relationship between farmer's poverty situation and their risk attitude?
iv. What are the socioeconomic factors other than poverty that influence cassava farmers' attitude towards risk?

2. OBJECTIVES OF THE STUDY

2.1 Broad Objective

The broad objective of the study is to empirically ascertain the relationship between the incidence of poverty and risk attitude alongside other socioeconomic characteristics of cassava farmers in the study area.

2.2 Specific Objectives

To address the broad objective of this study the following specific objectives were specified:

1. To determine the incidence of poverty among cassava farmers.
2. To analyze the risk attitudes of cassava farmers.
3. To examine the relationship between the incidence of poverty and risk attitude of farmers.
4. To ascertain socioeconomic factors other than poverty that affect cassava farmers' attitude towards risk.

3. THEORETICAL FRAMEWORK

There are different approaches for measuring attitudes toward risk [3,4]. For example, these approaches for measuring risk attitudes can be classified into direct and indirect approaches [5]. The proponents believed that the direct method, developed by von Neumann and Morgenstern, has serious flaws due to the fact that the subjects have different levels of tolerance or intolerance for gambling (the method used to reveal their preferences) and that the concepts of probability are by no means intuitively obvious, more so the method is a time consuming. For these reasons, they proposed and used an indirect approach in their study. In their model, risk was introduced into a model of economic decision making as a safety-first rule.

In another dimension, the methods of measuring risk behaviours have been classified to include: farm risk programming, sectoral risk programming and, expected utility and safety-first theory; and used theexpected utility and safety-first theory methods to measure the risk attitudes of subsistence farmers in northeast Brazil [6]. In another attempt to measure attitude towards risk, the author adopted the direct approach based on a modified version of von Neumann-Morgenstern method, or the Equally Likely Certainty Equivalent (ELCE) and the Ramsey or the Equally Likely but Risky Outcome (ELRO) and then used an interview schedule to elicit certainty equivalents and an experimental gambling approach to generate payoffs [7]. He observed that the interview method was subject to interviewer bias, thus his study showed that the interview results were totally inconsistent with the experimental measures of risk aversion. To overcome this difficulty several techniques for designing interviews were introduced to elicit the preference functions of farmers in their study [8].

Theincome variance approach was also used to analyze farmers' production decision behaviour under risk and as result categorized farmers' risk attitudes as follow [9]:

- **Risk-preferring/loving/taking**: a person is willing to take the risk of doing better than expected while being aware of the possibility of doing less-well than expected
- **Risk-neutral**: a risk neutral person is indifferent between certain and uncertain outcomes with the same expected value of income
- **Risk-averse**: a person is described as being risk averse if he prefers a situation in which a given income is certain to a situation yielding the same expected value for income but which involves uncertainty

The review of literature suggests that there is no single method that is universally accepted to quantify farmers' attitude towards risk. In this study however, the Equally Likely Certainty Equivalent with a Purely Hypothetical Risky prospect (ELCEPH) model was adopted but modified to study food crop farmers' attitudes toward risk. We followed ELCE-PH model[10] designed and used by Torkamani and Abdolahi. In our study the payoffs in the hypothetical lotteries presented to the farmers were in Ghana cedis with the highest possible win of GHc1000 and lowest possible win of GHc100. This was done instead of converting the original lottery values in Rials for corresponding values into Ghana cedis. The reason was that, in a real Ghanaian case scenario we gathered that a farmer into food production would possibly gain as high as GHc1000 in good times and as low as GHc100 in bad times for a typical production season. We found it appropriate to design the experiment by using possible values from the Ghanaian market than to just convert the values used in the original design from Rials into Ghana cedis. This would helped the farmers to relate the hypothetical lottery to what happens in the real market for good meaning of the lottery to elicit their responses.

The two other techniques that can be used in direct approach interview method are the Equally Likely Certainty Equivalent with a Hypothetical but Realistic Risky prospect (ECLE-R), and Probability of Winning Demanded (PWD).

4. CONCEPTUAL FRAMEWORK

The study is based on the assumption that farmers' attitude towards risk is linked to the incidence of poverty among farm-households and other socio-economic characteristics. Most importantly it is believed that these factors reinforce each other. For example, it has been argued that farm size, type of crop grown and adoption of modern techniques are closely interrelated [11]. According to them, the use of improved farming techniques can lead to increase production, while increased production may provide the additional resources needed to adopt improved farming methods. Similarly, they argued that the adoption of improved farming methods and types of crop grown typically influence each other. Meanwhile farm-households' response to risk and uncertain situation in their socio-economic environment may depend to large extent the level of poverty experienced by these households, since the incidence of poverty determines all the other clusters of disadvantages such as constrained access to resources among others [12], which otherwise would have enabled them to deal appropriately with the risk and uncertainty they face in their production and socio–economic environment. This phenomenon feeds into a dynamic that underscores these households attitude towards risk in the study area. Hence the need to empirically investigate the link between farmers' attitude towards risk and the incidence of poverty in the study area with the hope that the findings would inform policy prescription that

could adequately equip farmers to cope with risk and uncertainty in their socio-economic and production environment.

5. METHODOLOGY

5.1 Study Area

The district of Awutu-Senya is the study area and it is located within the coastal savannah ecological zone. The climate here is generally warm and relatively dry with an annual mean rainfall of between 600mm and 1200mm. The vegetation cover is mostly grassland interspersed with shrubs, thickets and trees such as parkia, silk cotton and coconut especially along the coast. Heavy black loamy soil are the soil type found in most part of the district especially at southern portion of the district; while the northern parts are made up of clayey loamy soil that supports the cultivation of cereals, legumes, vegetables and root crops mainly cassava. The cultivation of these crops is done mainly on small-scale and under rain fed conditions. The coastal areas of the district are dominated by artisanary fishing activities and some of the fishermen engage in part-time farming cultivating maize, cassava, groundnut and vegetables. In such kind of agro-ecological zone where there is high possibility of crop failure if no intensive crop growing maintenance practices are carried out, it would therefore not be surprising that most of the farmers in the study area would be risk averse in their attitudes towards production risk.

The choice of Awutu-Senya district as the focus of the study was informed by the fact that the district is the location of the only starch factory, and with the highest concentration of industrial cassava farmers in the country. This was Presidential Special Initiative as part of the government poverty alleviation and Agricultural Development strategy.

5.2 Sampling Technique and Sample Size

Snow ball sampling technique was used to identify a sample frame of 100 small-scale cassava farmers who had been in farming for not less than ten (10) continuous cropping seasons. The snowball sampling technique came in handy for this purpose because it was difficult to obtain list of cassava farmers from the district agricultural extension directorate. Moreover, the cassava farmers we were interested in were scattered over several communities in the district and not easy to locate. Using this technique some key informants who themselves were cassava farmers were identified and contacted for information that led to their colleagues who were also contacted to further identified more farmers. This process was repeated until 100 farmers were identified and used as sample frame. Thereafter, the simple random sampling technique using the lottery method was employed to select a sample size of 50 cassava farmers who were interviewed with a structured interview schedule to obtain primary data for the study. We had to sample 50 farmers from 100 because of limited budget and also time constraint. This however, did not affect appropriate statistical analysis that we undertook to get the results presented in the study. The data was then analyzed using the Statistical Package for Social Science (SPSS) statistical software.

5.3 Data Collection

5.3.1 Both primary and secondary data were used for this study

The primary data were obtained with structured interview schedule which was administered by Ministry of Food and Agriculture (MoFA) Extension Officers stationed in the communities

where the study was conducted in the districts. Information was collected from farmers on their socio-economic characteristics which were of interest to this study. Secondary data of interest were also obtained from MoFA annual reports, other reports from other relevant government agencies and literature. The information obtained from these secondary sources was used to supplement the cross-sectional data obtained from the interviews for subsequent analysis.

5.4 Data Analysis

The field data generated was analyzed using descriptive statistics, Foster-Greer-Thorbecke (FGT) poverty measure, Equal Certainty Equivalent Risk Model and the Logit Regression Model (LRM). All the data analysis was carried out using Statistical Package for Social Science (SPSS) statistical software version 15.0. All data was collected over a period of two months from March to April 2010

5.4.1 Measurement of poverty

We adopted the following model specified as a general formulation for computing poverty-incidence, depth and severity Forster et al. [13].

$$P_{\alpha} = \frac{1}{n}\sum_{i=1}^{q}\left(1-\frac{yi}{Z}\right)^{\alpha} \quad (1)$$

Where:

P - is the poverty index,
α - is a non-negative parameter that can take on different values (0, 1, and 2). The values 0, 1 and 2of α corresponds to P becoming respectively the head count ratio, the poverty gap and the squared poverty gap.
n - is total number of farmers;
q - is the number of poor farm households;
z - is the poverty line relevant to a given income unit. In our study the income unit used was amount earned in Ghana cedis; and the poverty line was defined as income of GH¢90 based on the Ghana Living Standard Survey [14].
yi - is the farm household per capita income.

In this study α = 0 and 1 will be considered and they are given as

$$P_0 = \frac{q}{n} \textbf{ (Head count index)} \quad (2)$$

$$P_1 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{Z-Yi}{Z}\right) \textbf{ (Poverty gap)} \quad (3)$$

to measure the index of poverty among the farm-households in this study. Additionally, its unique property which allows for the disaggregation of the population into specific subgroups, thus allowing for the analysis of a particular group's contribution out of the total

population was an added advantage for it adoption in this case. The poverty situation of the individual farmers involved in the study was also examined based on their annual income from a typical production period in relation to the national poverty line. The poverty line was chosen as GH¢90 based on the Ghana Living Standard Survey [14].

5.4.2 Assessment of attitude towards risk

Individual'sattitude towards risk can take the shape of utility function [15]. For instance, if the utility function has non-negative slope over a range of pay-offs it indicates that more pay-offs are preferred to less. While this is normally true in case of money it may not hold true in case of other things. As suggested as an example by some studies [16], many small scale farmers may enjoy farming for pleasure(a way of life for most rural farmers in sub-Saharan Africa) but the utility does not always increase with farm size- a large size may be too exhaustive.

In attempt to formalized this phenomenon mathematically, the utility function is presented as below [17]:

$$U^{(1)}(W) > 0$$

Where $U^{(1)}(W)$ is the *i-th* derivative of the utility (U) function for wealth (W) (income can be substituted for wealth here). So, if the first derivative of the utility function for wealth is positive (for all W) then it represents the situation where more is preferred to less. Similarly, risk aversion is indicated by a utility function that shows decreasing marginal utility as a level of the pay–off is increased while indifference (neutrality) to risk is represented by a linear utility function. More formally in terms of the second derivative:

1. $U^{(2)}(W) < 0$ suggests risk aversion CE<EMV
2. $U^{(2)}(W) = 0$ suggests risk indifference (i.e. neutrality) (CE=EMV), and
3. $U^{(2)}(W) > 0$ suggests risk preference (CE >EMV) where CE and ME are certainty equivalence and expected monetary value respectively.

We learnt that it is quite difficult to go from the shape of the utility function to some quantitative measure of risk aversion (or preference) [16]. So in an attempt to overcome such difficulty we used the direct approach of measuring attitude towards risk based on von Neumann-Morgenstern (N-M) model, the Equally Likely Certainty Equivalent with a Purely Hypothetical Risky prospect (ELCE-PH). The appeal of this model lies in the fact it has been designed to prevent the bias caused by probability preferences through the use of ethically neutral probabilities (i.e., P=(1-P)=0.5), thus the subject is confronted with two–state risky prospect having an equal probability of 0.5 for each state. Although this model has the strength of overcoming the criticism of bias due to probability preference, it has its own inherent weakness that is the subject is forced to make a choice between a certainty and lottery. To minimize this problem it has been suggested that questions may be presented as practical decision-making problems [8], hence this was the approach used by this study. Using this approach each farmer was asked to indicate the certain income that he or she would need to be indifferent between receiving certain amount for a typical growing season and a lottery with the highest possible win of GH¢1000.00 and the lowest of GH¢100.00 for same period, each with a probability of 0.5. The expected value of the lottery was GH¢550.00. So depending on whether the certain amount was greater than, equal to, or less

than the expected value of the risky prospect, each farmer in the sample could be classified as risk preferring, risk neutral or risk averse. The farmers were classified according to their choice into three groups as below:

- **Risk-preferring**: GH¢55 0.00 < certain amount
- **Risk-neutral**: GH¢55 0.00 = certain amount
- **Risk-averse**: GH¢55 0.00 > certain amount

5.4.3 Regression analysis

A logit regression model was estimated to establish the effect of income as a proxy measure of poverty situations, alongside other socioeconomic characteristics of farmer's attitude towards risk. In the study the dependent variable is a risk attitude dummy (1 = if farmer is risk averse, 0 = otherwise). The implicit equation is given as shown below:

$$\text{LOGIT: } \log [Pi/ (1- Pi)] = Z\beta + E$$

Where:

Z – represents the matrix of observations of the explanatory variables
β – represents the column vector of the coefficients; and
E – represents a vector of disturbances.
Pi – the dependent variable describes the probability that a particular condition occurs

Hence the test of the estimated beta (β) coefficients in the model equations were used to draw conclusions on how socio-economic variables that influence farmer-risk behaviour.

This equation is further expanded in the estimation as:

$$K = f (Ag, Se, Hhs, Edn, La, Acc, Fip, U)$$

$$K = \beta_o + \beta_1 Ag + \beta_2 Se + \beta_3 Hhs + \beta_4 Edn + \beta_5 Fs + \beta_6 Acc + \beta_7 Fip + e \quad (4)$$

Where:
K = **Log [P_{KA}/ (1- P_{KA})]** = risk attitude parameter
P_{KA} = probability that a farmer is risk-averse
Ag = Farmer's age (in years)
Se = Sex
Hhs = Household size
Edn = Educational level of the farmer (in years)
Fs = Farm size (in ha)
Acc = Access to microcredit
Fip = Farm household income below poverty line
U/e = random term

6. RESULTS AND DISCUSSION

6.1 Measuring Poverty Situation of Respondent

This discusses the first objective of the study by measuring poverty situation of farmers.

Table 1. Distribution of respondents by Poverty Groups

Poverty levels	Income (GH¢)	Frequency	Percent
Very poor	30 – 60	7	14
Poor	61 – 90	22	44
Non poor	91 – 200	21	42
Total	2,095	50	100

Source: Field Data, 2010 n = 50

Farmers were classified into three poverty levels on the basis of their annual income from a typical production period in relation to the poverty line, and the result is presented in Table 1. The poverty line was chosen as GH¢90 based on the Ghana Living Standard Survey [13] and the World Banks approach to measuring poverty. Those whose income fall between 1/3 and 2/3 of the poverty line (GH¢30-60) are termed "very poor", those whose income fall between 2/3 and the poverty line (GH¢ 61-90) are considered as "poor". Those whose income is greater than the poverty line are considered as "non-poor". A lower percentage (14%) of the respondent fell into the very poor class. However, the non poor constitute 42% of the farmers, implying that 58% are generally poor.

6.2 Result from the Analysis Using (FGT) Poverty Measure

$$P_0 = \frac{29}{50} = 0.58 \quad \ldots\ldots\ldots\ldots\ldots\ldots \text{(5) (Head Count Ratio computed)}$$

$$P1 = \frac{29}{50}\left(\frac{90-41.89}{90}\right) = 0.31 \ldots\ldots\ldots\ldots\ldots\ldots \text{(6) (The Poverty gap computed)}$$

The result from analysis using (FGT) poverty measure indicated headcount ratio of 0.58 and poverty gap of 0.31 (see equation 5 and 6 respectively). The head count ratio of 0.58 implies that about 58 per cent of the respondents in the area are poor. This is close to the current UND publication [18] that over 59.4% of food crop farmers live below the international income poverty line of US$1 dollar per day. The poverty gap, which is the mean distance of the income of poor households from the poverty line, was 31%. This gives approximately GHC 48.11 below the poverty line and shows the depth or extent or situation of poverty of cassava farmers in the study area. The mean per capita income of poor households is GHC 41.89.

6.3 Results of theAnalysis of Risk Attitude of Respondents

This section discusses the second objective of the study by analyzing the risk attitudes.

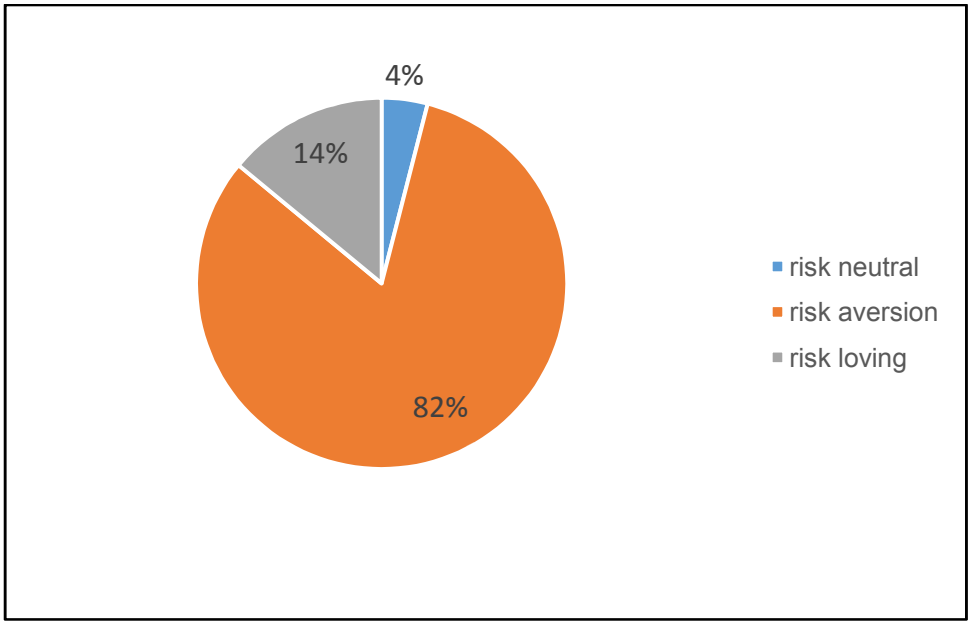

Fig. 1. Percentage Distribution of Farmers Based on their Attitudes Towards Production Risk

Source: Field Data, 2010 n = 50

The Equal certainty equivalent risk model also used as an econometric as well as an experimental model for assessing risk attitude among farmers in similar study [19] in same way it has been applied to assess the risk attitude among farmers in our study area. During the interview farmers were asked on individual basis, if they would accept an offer of GH¢ 500 and forgone producing to avoid the various risk of crop failure encountered during production. As could be indicated from the pie chart (see Fig. 1), only 14% said NO with the reason that they would not accept the money and forgo the production but rather will take the chance to produce with the view that the accrued profit after the sale of produce will be more than what is to be collected to forgo production, hence this category of cassava farmers were deemed to be risk takers. A few number of farmers were not ready to either accept or reject the offer and stop production and these were classified as being in category of risk neutral. Majority of the farmers (i.e. 82% of them) said YES to the question to accept the offer or forgo production with all its associated risk, thus were put in category of risk aversion. This confirmed an earlier observation in a study of cassava farmers in the north west of Brazil [7] which also made a similar conclusion, that majority of cassava farmers in his study area are risk averse.

Table 2. Distribution of risk attitude among poverty group of respondents

Risk Attitude	Poor	Non Poor	Total	Percent
Risk Aversion	27	14	41	82
Risk Neutrality	0	2	2	4
Risk Lovers	2	5	7	14
Total	29	21	50	100

Source: Field Data, 2010 n = 50

The result of the distribution of respondents by risk attitude class and poverty levels with a crosstab as entailed in Table 2, shows a distribution of risk attitude highly skewed towards risk aversion. It is worthy to note that 7 respondents out of 29 poor farmers shown in the table were found to be very poor all of whom were also risk averse. The observation noted in the distribution of risk attitudes among poverty groups in this study is consistent with the result obtained similar study of cassava farmers in North East Brazil [5] which also showed there were varying degrees of risk aversion among cassava farmers in his study area. The table shows that in all about 93% of the respondents of in the poor category showed risk aversion, while 7% of the same category of respondents indicated risk preference. A study of the distribution in the non-poor category of the respondents in the various classes of risk attitude showed that there were 67% of risk aversion, 24% of risk preference and 9% of risk neutral, which implied that there were all the categories of risk attitudes in non-poor cassava farmers in the study area. The crosstab could not easily explain the effect of poverty on risk attitudes of cassava farmers; hence the logit regression analysis was used to ascertain this effect as shown in Table 3.

Table 3. Effects of poverty and other relevant household characteristics on risk attitude

Independent Variable	Regression Coefficient	Standard Error	T –Value
AGE	-0.516*	0.082	-6.292
HOUSEHOLD SIZE	-0.005	0.023	-0.217
EDUC. LEVEL	- 0.011	0.008	-1.366
SEX	0.376*	0.062	6.064
LAND SIZE	- 0.096*	0.039	-2.495
POOR	0.143*	0.019	7.526
NON POOR	-0.251*	0.031	-8.096
INTERCEPT	0.055*	0.011	5.001
R^2	0.484		
ADJUSTED R^2	0.454		
F	26.124*		

Source: Field Data, 2010

The logistic regression analysis with summary result in (Table 3) attempts to link the effect of incidence of poverty and other socioeconomic characteristics to farmers' attitude towards risk.

The results suggest that the statistical parameter that indicate the goodness of fit of the model specified for the study are highly significant at alpha level of 0*.05.* From the table the adjusted R^2 value of 0.454 suggests that 45% of the variation to be observed in farmer's attitude towards risk was explained by the combined effects of all the independent variables in the model specified. The F-test statistic tested is statistically significant to suggest that the explanatory variables make significant effect in explaining whether a farmer in the study area has risk aversion attitude in production or otherwise. We therefore further examined the test of the individual variables beta coefficient to ascertain which of them makes unique and significant contribution in explaining farmer risk attitudes. With regards to the poverty variable in the regression model, we grouped farmers based on their income category compared to the national poverty line. That enabled us to be able to enter the different poverty categories into the model. We had to limit the categories to 'poor' and 'non-poor' by merging very poor and poor into one category as 'poor'. We acknowledge that the other way to handle the variable would be to make it a dummy variable (with D=1 if farmer was

classified as 'poor'; D=0 if farmer was classified as 'non-poor') but preferred using the categories as another option available to us

The regression results show that age, sex, and dummies for poor and non-poor have t-values greater than 2 (i.e. T-values range from 6.064 to 8.096) , which suggest that they all have significant effect in explaining farmers attitudes towards risk at 0.05 alpha level. Age was found to be inversely related to risk aversion attitude of farmers (i.e. β = - -0.516). This implies that the higher the age of the farmer, the less risk averse he will be. This supports the findings of earlier studies [7,20,21]. Binswanger asserted that older people having dealt much more in risky economic games at high stakes might be more willing to take risks at high levels than young people. According to Aye and Oji, age may also be indexing for the wealth status of the household and accumulation of social capital. It is believed that older farmers are more likely to have accumulated more wealth than younger farmers; and hence older farmers are more likely to have greater social capital and networks, which serve as some form of traditional insurance or fall-back strategies in the process of decision making.

The sex of respondent farmer entered the model as dummy with 1 = male and 0 = female. The result shows that sex is positively related to risk aversion attitude (i.e. β = 0.376). This observation underscore the fact that the gender of the respondents played very significant role in their response to risk; and suggests that female farmers in the study area are likely to be less risk averse than their male counterparts. Since adoption of technology in agricultural production have been found to relate to risk attitudes [22,23,24], gender mainstreaming becomes vital in directing policy formulation and implication to favour women especially in the case of resource allocation and control. This will be quite important because in a traditional Ghanaian society one's sex assigns the person to a particular cultural role in the community, and this to a large extent may determine one's access to available productive resources in the community.

For the variables indicating the poverty situation, the results show that poor and non-poor have positive and negative relationship respectively with farmer risk aversion attitudes (i.e. β = 7.526 and β = -8.096 respectively). Thus the lower a household's per capita income places the farmers in the category of being poor, the more risk averse they tend to be. In other words households whose incomes fell below the lower poverty line were more likely to be risk averse than the non-poor farmers. This confirmed the observations made by other researchers [25,26] that poorer farmers are more risk averse than wealthy ones and as such are more likely to avoid situations in which the probability of failure looms large. The results also agree with the conclusion reached by [27] which indicated that non-poor farm households were more likely to take risk and in turn appeared to be oblivious to risk in their decision- making process to the extent that they are sometimes considered to be risk neutral instead of risk takers.

Effects of household size and education of farmers contrary to what was found in some previous studies [5,7], were found in this study to be insignificant in explaining risk aversion attitudes of the farmers in the study. This stands to reason that the number of years in formal education, and the number of dependents in the farmer's household are not critical factors that influence farmers' decision behavior in this study. The study result declines that fact that in explaining smallholder farmers' behaviour toward resource use decision-making, amount of formal education one has had is very relevant determinant. Possibly farmers in the study might have been exposed to some kind of home-grown vocational education that could have also been considered in the specific context to help ascertain comprehensive effect of education on farmers' attitudes toward risk.

7. CONCLUSIONS AND RECOMMENDATIONS

- The result showed that more than half of farmers in the area were poor and the depth or extent of poverty was one out of three of the respondents, using (GLSS 2000) of GH¢ 90 as poverty line. Though majority of farmers in the study area were poor they get the largest portion of their income from farming activities and therefore any poverty alleviation strategies should be geared towards farming activities.
- Furthermore, the study revealed that (using the equal certainty equivalent risk model of assessing farmers risk attitudes) four out of five of the farmers were risk averse, few were risk lovers and very few were risk neutral. This show that majority of the farmers were risk averse.
- Result of multiple regressions also showed that sex, age and all degrees of poor and the non-poor were significant determinants of risk attitudes. Thus risk coefficients are shown to be significantly related to the above named set of important socio-economic and poverty variables that characterize cassava farmers' attitude towards risk. Thus the following recommendations are made under basis of these conclusions:
- Government through Millennium Development Authority (MIDA) and other initiatives should contribute in reducing poverty by implementing the objective of the Ghana poverty reduction programme (I and II) thus improve rural income by focusing on improving the quantity of produce and by increasing the farm gate price.
- That the government and private sector should initiate policy that strengthens existing programmes on alternative income generating activities within the broad framework of its poverty alleviation strategy to improve farmers' income.
- That the pro-poor policy initiatives by the government and private sector should be gender sensitive specifically tailored to the needs of those farmers who are culturally constrained to gaining access to productive resources by the virtue of their gender.
- That the Government in partnership with private insurance companies in the country should provide insurance products that are farmer friendly and caters for the peculiar needs of the agricultural sector in Ghana.
- That the major stakeholders associated with the PSI on cassava should be encouraged and supported by the government to institutionalize the idea of pre and post farming season stakeholders' forum to address issues of concern to all stakeholders associated with the PSI value chain on cassava. .
- That a value chain management committee with representation from all major actors in the chain be set up to manage the affairs of PSI value chain on cassava.

COMPETING INTERESTS

We declare that there was no competing interest in conducting this research

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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