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Determinants of Risk Status of Small Scale Farmers in Niger State, Nigeria

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Research Article

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ABSTRACT

Aims: To ascertain the risk status of farming households and whether the risk status is accentuated by some factors. The specific objective is to determine the relationship between their risk status and socio-economic characteristics and food security status in the study area.

Study Design: Cross-sectional study.

Place and Duration of Study: Department of Agricultural Economics and Extension Technology, Federal University of Technology, Minna, Nigeria, between March 2011 and February, 2012.

Methodology: The population for the study comprised farming households in Niger State. In order to obtain the sample for the study, two Local Government Areas (Suleja and Bosso) were randomly selected from where five farming communities were randomly selected and then ten farm families were randomly selected to give a total of 50 household from each Local Government Areas and 100 respondents for the study. The primary data covering background information, scale of production and yield, agricultural input use and access to credit, household food security and risk status were collected with structured questionnaire. Data analysis included the description of the socio-economic characteristics of the respondents using descriptive statistics and multinomial logistic regression used to confirm the determinants of risk status of the respondents.

Results: With an LRI of 0.3451, the estimates of the explanatory variables show that the set of significant explanatory variables and their sign vary across the groups. The model, through the explanatory variables included predicted correctly 46.17% of risk neutral respondents, only 0.31% of the risk seekers and 53.53% of risk-averse respondents. The overall prediction was 53.8%. In this particular study, sex, primary educational status, years of farming experience, marital status, household size, credit, membership of cooperative, land acquisition by inheritance and total investment capital are the factors found to have determined risk status at different levels of significance but with differing

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signs relative to the base outcome.

Conclusion: The model specified correctly predicted the probability of the risk status and has highlighted that there are more than just the observed socio-economic variables that explain the risk attitude of farmers, hence risk attitudes could only be explained by individual social, economic, cultural and psychological factors and it may be important to estimate individual risk preferences or identify factors that affect the individual's capacity to bear risk or consider their risk environment.

Keywords: Risk status; food security status; multinomial logit model; base outcome; commercially-oriented farming.

1. INTRODUCTION

Risk is believed to play an important role in the investment decisions of individual farmers (Isik and Khanna, 2003; Knight et al., 2003). Risk in production is a strong characteristic of agricultural production. Although risk is closely associated with agricultural production, it can be controlled, to some degree, by farmers through the use of modern inputs, such as chemical fertilizers and pesticides (Feber, 1980; Just and Zilberman, 1983). Risk in agricultural production can be exogenously-caused or endogenously-induced. While exogenous risk, which may arise from extreme weather conditions or threats of disease and pest outbreaks, is independent of farmers' production decisions, endogenous risk is incurred solely by such production decisions. In other words, while the pest outbreaks can be categorized as exogenously-caused, the change in risk from the use of pesticide to control for pest outbreaks is endogenously-induced by farmers' decisions (Knight et al. 2003; Rabin, 2000; Rabin and Thale, 2001).

Productions are dominated by large number of unorganized producers, many unskilled and therefore little are able to absorb new technologies. Most farmers are small-scale with little opportunity for diversification and insurance. Their attitudes to risk are nevertheless major determinants of rate of diffusion of new technologies among farmers and of the outcome of rural development program. Researchers have found that risks cause farmers to be less willing to undertake activities and investments that have higher expected outcomes, but carry with them risks of failure (Adebusuyi, 2004; Alderman, 2008). For example, it has been found that farm households use less fertilizer, improved seeds and other production inputs than they would have used if they simply maximized expected profits. It is also not uncommon to observe farm households in developing countries being reluctant to adopt new technologies even when those technologies provide higher returns to land and labor than traditional technologies. One aspect of this reluctance is reaction to risk. Hence, knowledge on how farmers make decisions as well as their attitudes towards risks is important in determining the strategies for agricultural development.

Agricultural risks are especially important if they result in income and consumption fluctuations. Fluctuations in consumption usually imply relatively high levels of transient poverty. High income risk may also be a cause of persistent poverty. This is likely when insurance and credit markets are absent or incomplete as it is the case for developing countries. The sources of risk vary in importance from one enterprise to another and from a group of farmers to another. Ezech and Olukosi (1991) identified irregularity in input availability, fluctuations in market prices, irregularity in water supply and variability in weather

conditions as major risk sources responsible for variation in farmers' income in dry season farming. Many factors including vagaries of nature, diseases, insect infestations, general economic and market conditions contribute to the price, yield or net return variability of agricultural producers. Meuwissen et al. (2001) found that price and production risks were perceived as important sources of risk. Salimonu and Falusi (2009) classified market failure, price fluctuation, drought, pest and diseases attack and erratic rainfall are the most important sources of risk facing by food crop farmers in Niger State, Nigeria. Results by Tru and Cheong (2009) show that, in general, price and production risks were perceived as the most important risk in Vietnamese catfish farming. Therefore, the main goal of this study is to ascertain the risk status of farming households and whether the risk status is accentuated by some factors. The specific objectives of this study are to describe the socio-economic characteristic of the farming households in the study area, and determine the relationship between their risk status and socio-economic characteristics and food security status in the study area.

Agricultural enterprises still constitute the most risky business in Nigeria (Nmadu and Peter, 2010). This is because the production environment as well as marketing prospects are fraught with imperfect knowledge and the vagaries of nature. The complex nature of weather and climate as well as other factors make agricultural enterprises more difficult to manage. Therefore this study is timely and will reveal the risk status of the respondents as well as the factors that accentuate them. The result will assist policy makers and stakeholders to understand the current situation and the needed policy support to cushion the effects of risk and thus encourage farmers to gradually move away from subsistence farming to more profit-oriented but higher-risk commercial farming. This will help to make the farm family food secure and make the nation self-sufficient in food production thus bringing about the needed transformation of the agricultural sector as a net exporter of agricultural produce.

2. METHODOLOGY

2.1 Location of Study and Sampling

The study was conducted in Niger State, Nigeria. The state has three agricultural Zones, each Zone with a marked climate pattern and a defined agricultural system. Zone I found in the southern part of the state comprises Agaie, Bida, Edati, Katcha, Gbako, Lapai, Lavun and Mokwa local government areas while Zone II comprises Rafi, Bosso, Shiroro, Chanchaga, Paikoro, Gurara, Tafa and Suleja local government areas and Zone III comprises Agwara, Borgu, Kontagora, Magama, Mariga, Mashegu, Rijau and Wushishi local government areas. In this study Zone II was randomly selected for the study.

Niger state is located in the middle belt zone of the country. It lies between latitude 8° and 11°20'N and longitudes 4°30' and 7°40'E and shares common boundaries with Kaduna State and FCT to north-east and south-east respectively; Zamfara State to the north, Kebbi State to the north-west, Kogi State to the south and Kwara State to the south-west, the Republic of Benin to the north-west. The state covers a land area of 76,363 square km (29,484 square miles), which is 10% of the total land area of Nigeria and about 85% of the land is arable. Minna with an estimated population of 304,113 is the capital city. Majority of the populace (85%) in the state are involved in agriculture while others constituting (15%) are involved in vocation such as white collar jobs, business, craft and arts. The state is made up of eleven ethnic groups viz. Nupe, Koro, Baraba, Kakanda, Gana Gana, Dibo, Kambari, Kamuku, Pangu, Dukawa, and Ingwai. Tribes from other States like Igbo, Yoruba, and numerous

others also settle in the State (Niger State Government, 2011). Niger state experiences distinct dry and wet seasons with annual rainfall varying from 1,100mm in the northern part of the state to 1,600mm in the southern parts. The maximum temperature usually not more than 94°F is recorded between March and June, while minimum is usually between December and January. Niger state support a variety of agro-allied industries, other resources are gold, clay, silica, kyanite, marbles, copper, iron, feldspar, lead, columbite, kaolin and tantalite.

The population for the study comprised farming households in the study area. In order to obtain the sample for the study, two Local Government Areas (Suleja and Bosso) were selected from where five farming communities were randomly selected, and then ten farm families were randomly selected to give a total of 50 household from each Local Government Area and 100 respondents for the study. The data for this study was from primary sources. A structured questionnaire was used for collecting the data in the study area between March and May, 2011. Other data collection methods that were used to gather the primary data were informal discussion and personal interview with household heads. The close-ended questionnaire consist of 5 main modules covering background information, scale of production and yield, agricultural input use and access to credit, household food security and risk status.

2.2 Method of Data Analysis

Data analysis included the description of the socio-economic characteristics of the respondents using descriptive statistics such as mean median, mode, standard deviation, frequency distribution in tables and percentages while the determinants of risk status of the respondents was estimated with the use of multinomial logistic regression.

Risk status is generally divided into three distinct categories: risk aversion, risk neutrality and risk seeking. A simple way of distinguishing among these three deferent attitudes is to measure the mathematical expected value that one is willing to forego in order to obtain greater certainty. If this expected value is strictly positive one is willing to pay a premium to avoid risk, this is the intuitive case of risk aversion. If the expected value is zero one is not willing to forgo any value to obtain greater certainty: this is the case of risk neutrality. If the expected value is strictly negative, one must receive the absolute expected value in order to accept greater certainty; this is the case of risk seeking. A more standard way of defining risk attitude is to consider a choice between an outcome received with certainty and a risky prospect with the same expected value. People who prefer the former are risk averse, while people who prefer the latter are risk seeking. Indifference defines risk neutrality. However, most small scale farmers in Nigeria are not exposed to the principles elucidated above, hence there is need to use a more pragmatic way of classifying the farmers into the different risk groups. Hence the farmers were provided with a set of ten questions which are both related to food security and their risk seeking behavior. Each farmer is expected to rank his response to the questions from five (5) indicating high acceptance to one (1) indication low acceptance (Appendix I). The mean response of each farmer was determined and was used to classify the risk nature of the farmer as follows: 1.00 - 2.49 Risk-averse, 2.5 Risk neutral and 2.51 - 5.00 Risk-seeking. Other means by which the farmers could be categorized to their risk status is their farm size. The philosophy behind this classification is that the level of risk a farmer is willing to take is directly related to the size of farms he possesses. It is also well established in literature that the size of farms a farmer possesses also tends to define his farming objectives which are subsistence farming, food security farming and profit-oriented farming. And in view of this a classification was proposed as presented on Table 1.

Table 1. Size classification of farmers and their risk-taking attitude

Farm Size (ha)	Income bracket (N = \$165)	Cropping system	Class	Objective	Risk – taking
0.1 - 0.5	5000 - 10,000	Intercropping	Subsistence	Food Security	Neutral
0.51 - 2-0	10,001 - 30,000	Intercropping	Small Scale	Food Security	Neutral
2.01 - 5.0	30,001 - 250,000	Mixed	Medium Scale	Mixed	Slight
5.01 - 20.0	250,001 - 1,000,000	Mono-cropping	Large Scale	Mixed	Intermediate
20.01 - 100.00	1,000,001 -25,000,000	Mono-cropping	Commercial Scale	Profit	High
100.01 -	25,000,001 - 500,000,000	Mono-cropping	Agribusiness Farm	Profit	Very High

Source: Nmadu J.N., Federal University of Technology, Minna, Nigeria, personal communication (2011).

This classification scheme serves two purposes as it gives the food security status of the farmers and their risk-taking nature which is subject to confirmation but could not be used as the mean farm size of the respondents was 1.67ha hence dealing with only a food secure and risk neutral farmers. Hence the earlier approach was adopted.

In order to categorize the farmers into the three main classes of security, each farmer was provided with a set of question related to how food-secure he is. Each farmer is expected to rank his response to the questions from five (5) indicating high acceptance to one (1) indication low acceptance (Appendix II). The mean response of each farmer was determined and then was used to classify how food-secure each of them is as follows: 1.0 – 2.49 Food-insecure, 2.50 neither food-secure nor insecure and 2.51 - 5.00 Food-secure.

2.3 Specification of the Multinomial Logistic Model

Behavioral response models involving more than two possible outcomes are either multinomial or multivariate. Multinomial models are appropriate when individuals can choose only one outcome from among the set of mutually exclusive, collectively exhaustive alternatives. Therefore, in order to determine the how the risk status of the farmer is affected by his food security status, the multinomial logistic regression model was used. The choice of this method is based on the fact that the risk behavior (dependent variable) is a categorical variable which can take three (3) levels (0, 1, and 2) as previously discussed (Pennings and Garcia, 2001; Ayinde et al., 2010). The probability that the *i*th farmer belongs to the *j*th risk behavior group reduces to:

$$P_{ij} = \frac{e^{S_j X_i}}{1 + \sum_{k=1}^j e^{S_k X_i}} \quad (1)$$

The generalized multinomial model is expressed as (Babcock et al., 1995):

$$P_{ij} = \frac{e^{S_j X_i}}{1 + \sum_{k=0}^j e^{S_k X_i}} \quad (2)$$

While the probability of being in the base outcome group or group 0 is

$$P_{i0} = \frac{1}{1 + \sum_{k=0}^3 e^{S_k X_i}} \quad (3)$$

Where *i* = 1, 2*n* variables; *k* = 0, 1,.. *j* groups; and S_j = a vector of parameters that relates X_i 's to the probability of being in group *j* where there are *j*+1 groups. The various independent variables included in the final model are X1 = Sex (1 if male, 0 otherwise), X2 = Age (years), X3 = Marital Status (1 if Married, 0 otherwise), X4 = Credit from formal and informal financial institutions (Naira), X5 = Educational status (1 if Primary level is attained, 0 otherwise), X6 = Educational status (1 if Secondary level is attained, 0 otherwise), X7 = Educational status (1 if Adult education level is attained, 0 otherwise), X8 = Educational status (1 if Tertiary education level is attained, 0 otherwise), X9 = Household size (number), X10 = Farming status (1 if full time farmer, 0 otherwise), X11 = Years of farming experience (years), X12 = Method of land acquisition (1 if by Inheritance, 0 otherwise), X13 = Farm size (ha), X14 = Farm income (Naira), X15 = Total investment capital (Naira), X16 = Total labor employed (man/days), X17 = Food security status (1 if Not food secure or insecure, 0

otherwise), X18 = Number of extension contacts, X19 = Membership of cooperative societies (1, if member, 0 otherwise).

To estimate the model the coefficients of the base outcome are normalized to zero (0). This is because the probabilities for all the choices must sum up to unity. Hence, for 3 choices only (3-1) distinct sets of parameters can be identified and estimated. The natural logarithms of the odd ratio of equations (1) and (2) give the estimating equation as

$$\ln \frac{P_{ij}}{P_{i0}} = S_i X_i \quad (4)$$

This denotes the relative probability of each of group 1 and 2 to the probability of the base outcome. The estimated coefficients for each choice therefore reflect the effects of Xi's on the likelihood of the farmers choosing that alternative relative to the base outcome. Stata Statistical/Data analysis 11.2 software (Stata, 2009) was used in estimating the model. The final estimates were selected based on the variables that gave the highest pseudo R². The coefficients of the base outcome were then recovered in line with Hill (1983) as

$$\beta_3 = -(\beta_1 + \beta_2) \quad (5)$$

Where β_3 = coefficient of the variable of the base outcome (risk aversion), β_1 = estimated coefficient of the risk neutral group, β_2 = estimated coefficient of the risk seeking group.

After the estimation, the partial derivatives or marginal effects and quasi-elasticities of the model were obtained from the software (Greene, 2003; Hill, 1983; Basant, 1997; Rahji and Fakayode, 2009; Maddala, 1990; Kimhi, 1994). Finally, McFadden's (1974) likelihood ratio index (LRI) also known as pseudo R², similar to the R² in a conventional regression, was computed as

$$LRI = 1 - \frac{\ln L}{\ln L_0} \quad (6)$$

Where, lnL = log-likelihood function
lnL₀ = log-likelihood computed with only the constant term.

3. RESULTS AND DISCUSSION

The description of the socio-economic characteristics of the respondents is presented on Table 2 while the summary of the variables in the multinomial logistic model is presented on Table 3. Table 4 contains the coefficient estimates of the variables that were finally included in the model while Tables 5 and 6 set out the marginal effects and quasi-elasticity of the variables in the model respectively.

The results on Table 2 show that the respondents are mainly male (92%) and majority are married (86%) who are in their active age (37 years). This is a big advantage as this has the potential to provide the needed labor on the farms since most of the farm operations by small scale farmers in Nigeria are still carried out manually using low technology. Only a very small fraction (8%) of the respondents acquired tertiary education, the majority had up to secondary education. This is a common trend in most Nigeria farming communities (Onu, 2011; Jemilehin, 2010; Nwafor, 2010) which tends to suggest that the Nigeria farmers have not appreciated the role of sound education in the management of the farm enterprises and may portends a very bad situation for the respondents as the capacity to adopt and absorb new and current production technologies may be limited (Zepeda, 1990).

Table 2. Socio-economic characteristics of the respondents

Socio-economic characteristics	Freq.	%
Sex		
Male	92	92.0
Female	8	8.0
Age (years)		
<21	21	21.0
21-30	34	34.0
31-40	24	24.0
41-50	21	21.0
Mean	37 years	
Marital status		
Unmarried	7	7.0
Married	86	86.0
Divorced	2	2.0
Widow(er)	3	3.0
Separated	2	2.0
Educational level		
Quaranic/No formal education	30	30
Primary education	13	13
Secondary education	43	43
Adult education	6	6
Tertiary education	8	8
Major occupation		
Farming	60	60
Civil servant	30	30
Trading	10	10
Household size		
1-5	20	20
6-10	31	31
11-15	35	35
16-20	14	14
Mean	3.39	
Farming status		
Full time	72	72.0
Part time	28	28.0
Farm size (ha)		
0.01-0.50	6	6
0.51-1.00	40	40
1.01-1.50	11	11
1.51-2.00	28	28
2.01-2.50	4	4
>2.50	11	11
Mean	1.67	

Table 2 continues.....

Years of experience		
1-5yrs	19	19
6-10yrs	33	33
11-15yrs	48	48
Mean		16.76
Method of acquiring Land		
Inheritance	74	74
Purchase	16	16
Lease	7	7
Gift	3	3
Food security status		
Food insecure	15	15
Not food secure or insecure	59	59
Food secure	26	26
Risk status		
Risk neutral	35	35
Risk averse	42	42
Risk seeking	23	23

Source: Field survey, 2011

Table 3. Summary of the variables postulated in the model

Variable	Type	Format	Mean	Std. Dev.	Min.	Max.
Risk status (categorical)	byte	%8.0g	1.88	0.7558526	1	3
Age (years)	byte	%8.0g	37.29	7.268717	22	63
Years of farming experience (years)	byte	%8.0g	16.76	10.15846	0	50
Years spent in formal education (years)	byte	%8.0g	4.95	4.955101	1	18
Marital status (categorical)	byte	%8.0g	2.07	0.623691	1	5
Educational status (categorical)	byte	%8.0g	2.49	1.210184	1	5
Method of acquiring land (categorical)	byte	%8.0g	1.39	0.75069	1	4
Others incomes (Naira)	long	%8.0g	105350	55856.12	35000	250000
Household size (numbers)	byte	%8.0g	3.39	2.339364	0	10
Extension contact (numbers)	byte	%8.0g	0.62	0.9927006	0	4
Membership of cooperative societies(categorical)	byte	%8.0g	0.44	0.4988877	0	1
Credit from formal and informal sources(Naira)	long	%8.0g	132720	66763.88	0	310000
Sex (Categorical)	byte	%8.0g	0.2	0.4020151	0	1
Farm size (ha)	float	%8.0g	1.666	0.960978	0.5	5
Farming status (categorical)	byte	%8.0g	0.72	0.4512609	0	1
Farm income (Naira)	long	%8.0g	695764	1410894	0	1.35E+07
Total investment capital (Naira)	long	%8.0g	77608	93733.37	1500	500000
Total labor employed (man/days)	int	%8.0g	876.48	907.7242	0	4681
Food security status (categorical)	byte	%8.0g	2.11	0.633971	1	3

Source: Data from field survey, 2011

Table 4. Coefficient estimates of the variables determining risk status

Variables	Risk neutral	Risk seeking	Base outcome= risk aversion
Sex	-1.767802* (.922208)	2.693245** (1.313773)	-0.92544
Age	-.0162933 (.0432271)	-.0215794 (.0663899)	0.037873
Marital Status	Married (.9392787)	2.43399 (1.59456)	-4.38888
	Reference group = Single, Divorced, Widow(er), Separated		
Credit from formal and informal financial institutions	-3.11e-07 (4.59e-06)	-.0000245*** (9.36e-06)	2.48E-05
Educational status	Primary (1.101261)	-4.054368* (2.390813)	2.033592
	Secondary (.7347191)	-.4613447 (1.027007)	1.266713
	Adult education (1.375863)	.9223035 (1.789255)	-2.71156
	Tertiary education (1.098793)	.7363616 (2.072594)	0.502781
	Reference group = Quranic/No formal education		
Household size	-.2574308* (.1407727)	-.1360988 (.1852601)	0.39353
Farming status	-.2840925 (.7205075)	-.6715034 (1.069386)	0.955596
Years of farming experience	-.0535255* (.0330757)	-.1617136*** (.0625793)	0.215239
Method of land acquisition	Inheritance (.7009062)	2.082232* (1.134454)	-1.8899
	Reference group = Gift, Purchase, Lease		
Farm size (ha)	-.4055816 (.3088415)	.1042537 (.486896)	0.301328
Farm income	2.63e-07 (5.80e-07)	7.55e-07 (6.21e-07)	-1E-06
Total investment capital	-2.86e-06 (3.30e-06)	7.55e-06* (4.28e-06)	-4.7E-06
Total labor employed	.0003078 (.0003216)	.0000578 (.0005787)	-0.00037
Food security status	Not food secure or insecure (.5679395)	-1.081395 (.9086149)	1.1214
	Reference group = Food insecure, Food secure		
Extension contact	.1517282 (.3492967)	-.0664104 (.4519949)	-0.08532
Membership of cooperative societies	.074686 (.6566092)	-3.089743*** (1.20895)	3.015057
Constant	1.428215 (2.062509)	3.005015 (2.971776)	-4.43323

LR $\chi^2(38) = 73.83^{***}$, Log likelihood = -70.065736, Pseudo R² = 0.3451

Predictions -Risk neutral 46.17% Risk seeking 0.31% Risk aversion 53.53% Total 53.83%

NB: Values in parenthesis are standard errors, ***P<0.01, **P<0.05, *P<0.10; Source: Data from field survey, 2011

Table 5. Marginal effects of the variables determining risk status

Variables		Risk neutral	Risk seeking	Base outcome= risk aversion
Sex		-0.4159401	0.3255614	0.0903787
Marital Status	Married	0.2198447	0.1366158	-0.3564605
Credit from formal and non-formal financial institutions		1.04E-06	-2.24E-06	1.20E-06
Educational status	Primary	0.5187489	-	-0.0570672
Household size		-0.0371323	0.4616817	0.0381999
Years of farming experience		-0.0018017	0.0010676	0.0142659
Method of land acquisition	Inheritance	-0.1246305	0.0124643	-0.0749685
Total investment capital		-8.14E-07	0.199599	-5.11E-09
Membership of cooperative societies		0.1496004	8.19E-07	0.137229
			0.2868294	

Source: Data from field survey, 2011

Table 6. Quasi-elasticity estimates of the variables determining risk status

Variables		Risk neutral	Risk seeking	Base outcome= risk aversion
Sex		-0.498308	0.3939015	-0.1447475
Marital Status	Married	0.5201608	0.9321902	-1.161042
Credit from formal and non-formal financial institutions		0.5609866	-2.655127	0.6022704
Educational status	Primary	0.1617902	-0.6279785	-0.1009106
Household size		-0.5004617	-0.0891462	0.3722288
Years of farming experience		-0.1180001	-1.931233	0.7790865
Method of land acquisition	Inheritance	-0.4879411	1.195233	-0.3456191
Total investment capital		-0.323172	0.4842788	-0.101337
Membership of cooperative societies		0.1731586	-1.21919	0.1402968

Source: Data from field survey, 2011

The respondents had good farming experience in terms of the years spent in farming but this might also account for the fact that many of the respondents did not acquire more than secondary education since it takes between 16 and 20 years to acquire primary, secondary and tertiary education in Nigeria. The average farm size of the respondents is still extremely low (1.67ha) and not different from the general trend in most farming communities in Nigeria (Nmadu and Peter, 2010).

The results on Table 4 show that the likelihood ratio (χ^2) is statistically significant at the 1% level meaning that the variables considered jointly exert a very significant influence on the risk status of the respondents. This is an indication that all or some of the slope coefficients are significantly different from zero. It therefore means that the model is capable of showing and explaining the determinants of risk status of the respondents. This indication is also

confirmed by the LRI of 0.3451 which is similar to the quantity obtained by Rahji and Fakayode (2009), Abadi Ghadim and Pannell, (1999) and Hill (1983) but quite higher than what Zepeda (1990) obtained. Zepeda (1990) had indicated that a ratio of 0.25 represent a good fit for multinomial Logit model. The model, through the explanatory variables included predicted correctly 46.17% of risk neutral respondents, only 0.31% of the risk seekers and 53.53% of risk-averse respondents. The overall prediction was 53.8% which makes the estimates obtained good enough for further analysis.

The results of the estimates of the explanatory variables in Table 4 show that the set of significant explanatory variables and their sign vary across the groups. The coefficient for sex, primary educational status and years of farming experience were significant for both groups relative to the base outcome but with different signs and levels of significance. While sex is negatively significant at 10% for the risk neutral group it is positively significant at the 5% level for the risk seeking group relative to the base outcome. Also, while primary educational status is significant at 10% level for both groups, it is negative for the risk neutral and positive for the risk seeking, years of farming experience is negatively related to risk status at the 10% level for the neutral and 1% level for the seeking groups. Finally, while marital status is positively significant at the 5% level and household size is negatively significant at the 10% level for the risk neutral, credit and membership of cooperative are negatively significant at the 1% level; and land acquisition by inheritance and total investment capital are positively significant at the 10% level for the risk seeking group respectively.

According to the results, probability of risk neutrality is reduced by the sex of the respondents while the probability of risk seeking is increased by sex relative to the risk aversion group. Majority of the respondents were males hence it appears that among the men, some are risk seeking and some tend to be neutral or averse which is the basic characteristics of the female gender. In addition, the probability of risk neutrality is increased by marital status. This tends to suggest that marriage encourages risk neutrality probably due to increased responsibility of having to take care of the wife (ves) and children. Taking risk involves mortgaging some assets either physical or social. In some primitive societies, even wives are taken as surety for loans or credit taken by households. This might even be the reason why the probability of risk seeking is reduced by credit taken.

Table 4 also indicated that the probability of risk neutrality is increased when the respondents have attained primary educational status. This is hardly surprising as only more educated farmers would have acquired the knowledge base that is necessary to understand the nature of risk and the various technologies available to fight it which will of course encourage risk seeking. This tends to confirm why the probability of risk seeking is reduced by primary educational status.

Household size tends to reduce the probability of risk neutrality in spite of the large family size. The result here seems to suggest that risk aversion is what is encouraged by household size tending to contradict the estimate of marital status. However, the possibility of larger households evading their responsibilities such as payment of taxes, levies, fees and even repayment of credit taken is higher and the indication for that is shown by Afolabi (2010) in line with this finding.

Years of farming experience reduces the probability of both risk neutrality and risk seeking respondents, quite contrary to expectation as it is expected that with growing experience in farming, the farmer is able to better understand the production technology and all associated

challenges thereby forming models of how to deal with such challenges intuitively. But with the socio-economic challenges surrounding the respondents, particularly the low level of education, experience alone seems inadequate to fight risk hence the farmer tends more towards aversion of risk factors.

Land acquisition by inheritance and total investment capital both increases the probability of risk seeking of the respondents in accordance with expectation. Since the land is not purchased, the respondent can afford to use it as surety or guarantee for any risky transaction. In the same vein, with capital accumulation and increase in farm assets, the farm enterprise attracts higher risk hence the farmer must indulge in certain risky enterprises. In such circumstances, risk seeking attitude is a natural course. Finally, membership of cooperative society reduces the probability of risk seeking behavior of the respondents quite contrary to expectation. It is thought that when farmers associate with members in similar social and economic status, the knowledge base for dealing with risks associated with agricultural production environment is enhanced thus boosting risk seeking abilities but the contrary has been the case. Perhaps this goes to show that the determinants of risk status of these respondents are as diverse as their differing socio-economic and other status.

The results of the marginal effects and quasi-elasticity (Tables 5 and 6) of the variables show that none of the variables is elastic with respect to risk neutrality while credit, years of farming experience and membership of cooperative are negatively elastic, method of land acquisition is positively elastic with respect to risk seeking character of the respondents; and marital status is negatively elastic with respect to risk aversion. Elasticity indicates that a one per cent change in the explanatory variable leads to more than one per cent change in the probability of risk status of the respondents.

4. CONCLUSION

The study categorized the respondents into three risks status and determined the factors that either increase or decrease the probability of the respondents being classified into those categories. The determinants were analyzed with the use of multinomial logit model and estimated using Stata 11.2 software. With an LRI of 0.3451 and total prediction of 53.8%, the model was adjudged good for further analysis. The estimates of the explanatory variables show that the set of significant explanatory variables and their sign vary across the groups indicating that the risk behavior of small scale farmers is not determined by the same set of factors. The factors that accentuate risk neutrality are not synonymous with the factors that determine risk seeking attitude or risk aversion. In some instances, where the same factors affect the risk status, the signs of the coefficient are not the same. In this particular study, sex, primary educational status, years of farming experience, marital status, household size, credit from formal and informal institutions, membership of cooperative, land acquisition by inheritance and total investment capital are the factors found to have determined risk status at different levels of significance but with differing signs relative to the base outcome. The results obtained show that there are more than just observed the socio-economic variables that explain the risk attitude of farmers, hence risk attitudes could only be explained by individual social, economic, cultural and psychological factors and it may be important to estimate individual risk preferences or identify factors that affect the individual's capacity to bear risk or consider their risk environment. It is therefore concluded that the model specified correctly predicted the probability of the risk status and has highlighted areas where policy support is needed. It is recommended that farmers should be adequately sensitized on the need to operate a more commercially-oriented farming enterprises rather the traditional

family-based subsistent ones. In this regard, there is need for farmers to operate a larger farm size that what is presently obtained which might imply that farmers are likely to encounter higher risk. The agricultural insurance industry in Nigeria should be adequately organized and empowered to handle the more risky farm enterprises that may attract higher risk if farmers transform from subsistent to commercial farming. Finally, it is recommended that small scale farmers should be sensitized on the benefits of being adequately educated to be able to handle commercial transactions more appropriately. There is also need to re-organize the adult and mass literacy as well as nomadic and distance learning programs such that continuous agricultural education would be provided for the farmers while on their farms and they would not need to leave their farms to distant locations in search of further education.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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APPENDICES

Appendix I. Method put in place for risk aversion by the farmers

Methods	I	II	III	IV	V
My enterprise is diversified					
My enterprise are well insured by NAIC					
I complement with my farm income with off farm income					
I have some of my assets in liquid(cash) form					
By my experience i engage in only less risky enterprise					
I secure credit to expand my farm enterprise					
I have an upland and fadama land					
I plant resistance Crop varieties in my Farm					
I obtain marketing Information before Sales of my farm Produce					
My farm organization is flexible enough to accommodate changes when they are necessary					

I=Strongly Agree II=Agree III=Indifferent IV=Disagree V=Strongly Disagree

Appendix II. Strategies put in place for food security by the families

Strategies	I	II	III	IV	V
Adequate storage facilities					
Sell part of produce					
Purchase more farm produce and store them					
Sell immediately after harvest					
Primary processing produce					
Sell produce when price is high					
Purchase grains immediately after harvest					

I=Strongly Agree II=Agree III=Indifferent IV=Disagree V=Strongly Disagree

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