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Poverty And Risk Attitude Of Farmers In North-Central, Nigeria

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Abstract: Poverty is a major limiting factor in farmers' production which influences their attitude towards risk. There is little empirical evidence on the connection between poverty and risk attitudes of farmers in north-central, Nigeria. So study was carried out t to examine linkage between poverty and farmers' risk attitude in Nasarawa state, Nigeria. Over all 120 respondents were interviewed through well structured research tool, randomly from ten villages (12 respondents per village) of Keffi Local Government Area of Nasarawa state using two-stage sampling procedure. Out of which 107 were useful for analysis. The data were analyzed using descriptive statistics, the Foster Greer Thorbecke poverty measures, safety first model of risk determination and Tobit regression analysis. At the poverty line of N2, 455.40 per capita per month, 43.93% of the respondents in the area were poor. Further, 58.9% of farmers in the area were risk averse. Household size, membership of organization, poverty status of farmers, housing index, primary school education and access to credit were significant determinants of farmers' attitude towards risk. Policy options geared towards ensuring physical, social and human capital development should be formulated to reduce poverty and enhance farmers' risk taking ability.

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1. Introduction

The bulk of agricultural production in Nigeria takes place in the rural areas and ironically, the level and incidence of poverty is very pronounced in these areas (NPC, 2004). In agricultural production, where farmers' crop yields and income are dependent on various exogenous factors such as weather conditions and price fluctuations, risk is ubiquitous in farming decisions (Menapace et al., 2012). The agricultural sector is exposed to a variety of risks which occur with high frequency. These include climate and weather risks, natural catastrophes, pest and diseases, which cause highly variable production outcomes. Production risks are exacerbated by price risks, credit risks, technological risks and institutional risks. Risk management in agriculture includes informal mechanism like avoidance of highly risky crops, diversification across crops and across income sources as well as formal mechanisms like agricultural insurance, minimum support price system and future markets.

However, people naturally differ in the way they take decisions involving risk and uncertainty and these differences are often described as differences in risk attitude. Understanding individual risk preferences is a prerequisite to understand economic behavior (Reynaud and Couture, 2012). If poor people are risk-averse to the extent that they are unwilling to invest in the acquisition of modern assets because that involves taking risks, they will remain poor (Mosley and Verschoor, 2003). Since poverty is a major constraining factor in the farmer's production and socioeconomic environment so there is a need to examine the effect of poverty on farmers' attitude towards risks.

There is dearth of information on the nexus between poverty and risk attitudes of farmers in Nasarawa state. This is because most empirical studies have focused either exclusively on poverty or risk attitudes of farmers without exploring the link between the two. Accordingly, the study was set out to answer the following research questions:

- What is the extent of poverty among farmers in the area?
- What are the attitudes of such famers towards risk?
- How do poverty and socio economic variables affect farmers' attitude towards risk?

The main objective of the study is to determine the linkage between poverty among attitudes towards

risks of farmers in Nasarawa State, Nigeria. The study had following specific objectives :

- to determine the extent of poverty among farmers in the study area
- to identify diverse risks affecting farmers and assess the attitudes of farmers towards risks

to determine the effects of poverty and socioeconomic status on risk attitudes of the farmers.

2. Material and Methods

2.1 Study area

Study was carried out in Nasarawa State that is comprised of approximately 27,117 square kilometers, with an estimated population of over 1.8 million (Nasarawa State Ministry of Information, 2005), being the last period population census was conducted in Nigeria . It is located on latitude 70 – 90^{O} N and longitude 70 - 100 ^{O} E. It lies within the Guinea Savannah region with a tropical climate and rainfall of 1311.75 millimeters annually. There are plain lands and hills measuring up to 300 meters above sea level at some points. Nasarawa State is predominantly an agrarian state, the major crops grown include yam, cassava, sesame, rice, and groundnut and cowpea. Agriculture is the main economic activity in Nassarawa State.

2.2 Data collection and Sampling Technique

Data for the study were obtained through well-structured questionnaire by appling two- stage sampling procedure and 120 respondents (12 from each village) from 10 villages (Shuwa, Jigwada,Keffi Shanu, Ginda, Campani, Tilla, Sabon Gari, Keffi, Yelwa Sabo and Gauta) were selected randomly from Keffi Local Government Area that had accommodation of large population of farmers. However, only 107 valid questionnaires were used for the analysis.

2.3 Method of Data Analysis

Descriptive statistics such as frequencies, percentages, mean and standard deviation were used to analyze the socio-economic characteristics of the farmers.

The Foster, Greer, and Thorbecke -FGT (1984) was used for poverty analysis. The model used to capture objective 1 is specified as:

$$p_{\alpha} = \frac{1}{n}\sum_{i=1}^{q}\left(1 - {yi}/{z}\right)^{\alpha} \qquad (1)$$

Where P is the poverty index, α is a non-negative parameter, which took the value 0 and 1 and 2 thus indicating the head count ratio, the poverty gap and the poverty severity respectively. Symbol n is total number of farmers; q is the number of poor farm households; z is the poverty line relevant to a given expenditure unit and yi is the farm household per capita expenditure. They are given as:

$$p_0 = \frac{q}{n} \qquad (2)$$

$$p_1 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{Z - y_i}{Z}\right)^1 \qquad (3)$$

$$p_1 = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{Z - y_i}{Z}\right)^2 \qquad (4)$$

2.3.2 Estimation of Risk Attitude Coefficient Using the Safety-First Model

The risk attitude coefficient was calculated using safety-first model derived as follows:

First, a Cobb-Douglas production function was estimated as:

$$Y = aX_1^{b1}X_2^{b2}X_3^{b3}X_4^{b4}X_5^{b5}e^{u} \qquad (5)$$

Where

Y = yield (grain equivalent/ha) {maize, rice and yam}
a = intercept of the equation
FERT = fertilizer (kg/ha)
PLM = planting material (grain equivalent/ha)
LAB = labour cost (₦)
CoC = cost of chemicals (₦)
CoE = cost of equipment (₦)
b's = partial regression coefficient
e = error term

The double log form of Cobb-Douglas function was used in the estimation based on evidenced from literature (Moscardi and de Janvry, 1997).

Fertilizer was selected among other inputs in estimating risk attitude coefficient due to its importance in increasing yield as proven based on agronomical point of view and also due to the uniformity in its use by different types of farmers in the study area. The elasticity of fertilizer which is the same as its coefficient together with the coefficient of variation of yield, product and factor prices was used to estimate a value of K for each farmer. Hence the marginal productivity of output using input of interest (X_1) i.e. fertilizer was derived as b_1Y/X_1.

$$\text{K (s)} = \frac{1}{\theta}\left(1 - \frac{PiXi}{Pfi\mu y}\right) \qquad (6)$$

Where

K(s) = risk parameter
θ = coefficient of variation of yield
Pi = factor price (fertilizer price/kg)
Xi = Input level (fertilizer kg/ha)
μy = mean yield
fi = elasticity of fertilizer input
P = price of output /kg

The coefficient of variation of yield, θ was calculated from summary statistics of yield from the study area.

$$\theta = \sigma y / \mu y \quad (7)$$

Where

σy = standard deviation
μy = mean yield

The input and product prices used were the prevailing market price during the time of the survey.

The farmers were classified into four (4) groups on the basis of the risk parameter k following the work of (Moscardi and de Janvry, 1977) A farmer is risk preferring if k<0, low risk averse if 0<k<0.4, intermediate risk averse if 0.4 ≤ k ≤ 1.2 and high risk averse if 1.2 <k <2.0

The censored Tobit regression model was used to determine effect of poverty on risk attitudes of farmers in the study area. It combines discrete and continuous variables.

The Tobit regression model is as specified below according to Tobin (1958); Salimonu and Falusi (2009).

$$Y^{*}i = \beta Xi + \varepsilon i \quad (8)$$

$$Y_i^* = 0, \text{ if } Y_i < 0 \quad (9)$$

$$Y_i^* = 1, \text{ if } 0 \leq Y_i \geq 1 \quad (10)$$

Where;

Y_i^* = the limited dependent variable, which represents the index farmers attitude towards risks.
x_i= vector of independent variable
B = vector of unknown parameters
ε_i = is a disturbance term
i= 1, 2 ... n (n is the number of possible observations)

The explanatory variables used as determinants of attitude of farmers towards risk are defined thus;

GDR = Gender of farmer (D=1 if male, otherwise D=0)
HHZ = Household size
AGE = Age of farmer in years
FME = Farming experience in years
MBO=Member of organization (D=1 if yes, otherwise D=0)
EXC = Extension contact (D=1 if yes, otherwise D=0)
POV=Poverty status of farmer (D=1 if poor, otherwise D=0)
HSI = Housing index
ASI = Asset index
FMS_0 = Farm size in hectares
PSE=Primary school education (D=1 if yes, otherwise D=0)
SSE=Secondary school education (D=1 if yes, otherwise D=0)
TTE = Tertiary education (D=1 if yes, otherwise D=0)
ACF=Access to credit facilities (D=1 if yes, otherwise D=0)
DER = Dependency ratio.

3. Results and discussion

3.1 Determinants Yield variability of Farming Households

Table 1 reveals summary statistics of the input and output quantities. Average yield realised at 1,706.643 grain equivalent/ha with each farmer using an average of 187.2944 grain equivalent/ha of planting materials. On average, respondents used 149.53 kg of fertilizer per hectare. Labour cost was ₦8, 6915.12 on average while the cost of chemicals and equipments stood at ₦7947.664 and ₦6553.346 respectively.

Table 2 shows the result of the estimate of yield from the production function. Planting materials, cost of equipments and cost of chemicals are significant at 1%, 10% and 10% respectively. Increase in planting materials positively influence output, so does cost of equipment. On the contrary, cost of chemicals negatively affects yield. Coefficient of yield variability is 0.840. These confirm the findings of (Aye and. Oji 2005) ; and (Abreha 2011).

Table 1 Descriptive statistics of production

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Yield (grain equivalent ha^{-1})	1706.643	966.0599	60	4100
Planting material (grain equivalent ha^{-1})	187.2944	201.3976	20	1100
Fertilizer (kg ha^{-1})	149.5327	149.3295	0	750
Labour (N)	86915.12	122207.6	6000	726400
Chemicals (N)	7947.664	7077.167	0	34000
Cost of equipment (N)	6553.346	7958.167	300	36800

NB. The output of the crops and planting materials considered in the study area were converted to grain equivalent to allow summation of different crops planted by the farmers.

Table 2 Production function estimates

Independent variables	Regression coefficients	Standard error	P > t	T – value
Planting materials	.5485	.1016	0.000***	5.40
Fertilizer	.00196	.01268	0.878	0.15
Labour cost	.0766	.1209	0.528	0.63
Cost of Chemicals	-.2121	.1312	0.109*	-1.62
Cost of equipments	.8947	.5211	0.089*	1.72
Constant	3.6793	.8750	0.000***	4.12
μy **=0.588**				
σy **= 0.494**				

***, ** and * are Significant at 1%, 5% and 10%. Number of observations = 107; F (5, 101) = 25.66; Prob > F = 0.0000; R-squared = 0.5596. Adj R-square = 0.5378; Root MSE = 0.43424.

Table 3. Summary statistics of poverty line and monthly per capita expenditure

Monthly mean per capita expenditure	N 3,664.78
Poverty line(2/3) monthly Mean per capita expenditure	N 2455.40
1/3 monthly Mean per capita expenditure	N 1221.60

Distribution of famers into poverty groups

Poverty Status	*Frequency*	*Percent*	*Cumulative*
Poor	47	43.93	43.93
Non Poor	60	56.07	100.00
Total	107	100.00	

Source: Field survey. 2013

3.2 Poverty Status of Farming Households

As shown on table 3, any household that is below 2/3 of ₦3, 664.78 is considered to be poor. However, 43.93% of farming households in Nasarawa state is considered to be poor. This however shows a reduction in poverty by 9% in the study area based on the findings of Ibrahim and Umar (2008), which indicates that poverty incidence in Nasarawa state was 53%.

3.3 Risk attitude and poverty status of farmers

Sources of Risks

The identified risks sources and types which affected most of the farmers include:

i. Natural risks: drought, flood, wind and storm, diseases and pests:
ii. Social risks: theft of produce, bush fire, invasion of farm by animals;
iii. Economic risks: producer price fluctuation, insufficient supply of seeds,
iv. Production risks: poor soil, lack of spraying equipment, lack of chemical,
v. Technical risks: scarcity of labor, insufficient credit facilities. The grouping was adopted from the research conducted by Olarinde et al (2011).

Attitude of Farmers towards risk

Table 4 profiles famers into risk categories. The categorization of famers into risk levels using the model designed by Moscardi and de Janvry(1977), was adopted, where farmers that fall in different groups, that is; $k<0$ are said to be risk preferring, $0<k<0.4$ are low risk averse, $0.4\leq k\leq 1.2$, intermediate risk averse and high risk averse if $1.2<k<2.0$.

Table 4: Distribution of famers based on their attitude towards risk

Risk factor	*Percentage*	*Cumulative*
Risk preferring	41.12	41.12
Low risk averse	4.67	45.79
Intermediate risk averse	28.97	74.77
High risk averse	25.24	100
Total	100	

Source: Field survey. 2013.

Table 5 Poverty index of farmers affected by diverse risks

Risk	P_0	P_1	P_2
Natural Risk	0.464	0.147	0.060
Economic Risk	0.440	0.138	0.055
Production Risk	0.460	0.147	0.060
Technical Risk	0.440	0.140	0.056
Social Risk	0.474	0.148	0.061

Source: Field survey. 2013.

Table 6: Distribution of farmers based on their risk attitude and poverty status

Risk factor	*Frequency*	*Percentage*
Risk preferring		
Poor	22	50.00
Non poor	22	50.00
	44	**100.00**
Risk averse		
Poor	25	39.68
Non poor	38	60.32
	63	**100.00**
TOTAL	**107**	

Source: Field survey. 2013.

3.3.1 Poverty index of farmers affected by risk

Table 5 summarizes the poverty indices of famers across diverse risks sources. It captured changes (increased or decrease) in poverty incidence and gap within risks sources for the year under review. As shown on table 4, farmers affected by social risks had the highest poverty incidence of 47.70% and poverty gap of 14.80%, while those exposed to economic risks had the least poverty incidence and poverty gap (44.0% and 13.8%) respectively.

Table 6 shows the distribution of respondents based on risk category and poverty status. A total of 50.0% risk preferring farmers are poor, while those that are risk averse have 39.7% as poor.

3.4 Determinants of Risk Aversion of Farmers

Table 7 shows the results of determinants of farmers' attitude towards risk using Tobit regression model. A total of fifteen variables were included in the model, out of which seven were significant. Primary school level of education was negatively related to risk aversion and significant at 1% as expected. This implies that the attainment of at least primary school exposes the farmer to enough knowledge hence decreases their level of risk aversion or increases the tendency of such farmers to take risk. The result agrees with that of Moscardi and de Janvry (1977) whose findings show that schooling had a positive impact on risk taking. Secondary school level of education was positively related to risk aversion and statistically significant at 5%, being contrary to a-priori expectations. This may be due to the expectation of secondary school leavers in getting white collar job, in place of farming. This is very common in the rural areas where educated youths see farming as a set back or an activity left for the poor, old and uneducated.

Poverty status of farmers is positively related to risk aversion, and it's statistically significant at 5%. It agrees with the findings of Aye and Oji (2005) which states that the lower a household's per capita income, (a measure of poverty) the more risk averse they will be. In other words households whose incomes fall below the poverty line are less willing to take risk than the non poor households.

Household size was statistically significant at 10% and negatively related to farmers' risk aversion. There are two opposing interpretations as to the nature of the relationship between household size and risk aversion. The larger the household size, the greater will be the total consumption needs of the farm family and thus, the less willingness to take risk. However, larger household size also augments the total labour supply of the farm thereby enhancing its income generating potentials and thus reducing farmers' risk aversion. The finding is consistent with that of Aye and Oji (2005).

Membership of organization was statistically significant at 10% and positively related to risk aversion. By implication, farmers that are members of groups such as cooperative societies are more risk averse. This is similar to findings by Aye and Oji (2005), which stated that unexpected sign observed may be attributed to the weakness of the cooperative systems and farmers' group in absorbing members' risk in agricultural production.

Access to credit was negatively related to risk aversion and statistically significant at 5%. It shows that farmers that have access to some form of credit facility to finance their farm activities or inputs are less risk averse. Since source of credit is another means of finance, it is expected to increase farmers' ability to purchase farm input and finance other farm activities with ease, which increases farm production and subsequently income via sales of output.

Table 7: Tobit Estimates of the Determinants of Attitudes towards Risk

Variables	Coefficients	Std. Error	P > | t |	Marginal effect
Gender	0.1100	0.2956	0.716	0.1100
Household size	-0.0887	0.0438	0.064*	-0.0887
Age of Farmers	-0.0005	0.0379	0.991	-0.0005
Farming experience	-0.0183	0.0375	0.633	-0.0183
Member of organization	0.3787	0.2314	0.126*	0.3786
Extension contact	0.2648	0.2918	0.381	0.2648
Poverty status of farmer	0.8949	0.3842	0.037**	0.8949
Housing index	-9.4375	3.8969	0.031**	-9.4375
Asset index	1.7386	1.2689	0.194	1.7386
Farm size in hectares	0.0539	0.0452	0.254	0.0539
Primary school education	-1.8382	0.5509	0.005***	-1.8382
Secondary school education	1.3610	0.5465	0.027**	1.3629
Tertiary school education	-0.0241	0.2497	0.925	-0.0240
Access to credit facilities	-0.4750	0.2484	0.078*	-0.4750
Dependency ratio	0.0725	0.5933	0.905	0.0724
Constant	7.7874	2.9145	0.019**	
Sigma	0.4113	0.0723		

Source: Field survey. 2013 *** Significant at 1% ** Significant at 5% *significant at 10%
Number of observations = 107 LR chi^2 (15) = 24.32 Prob > chi^2 = 0.0500 Pseudo R^2 = 0.4288.

This in turn lowers farmers' level of risk aversion. Housing index is also significant at 5% and inversely related to farmers risk aversion. In other words, farmers that are able to afford better housing condition tend to be less risk averse or more risk preferring. This is expected as farmers living in enabling environment are likely to be financially buoyant and have better welfare status which may decrease their level of risk aversion.

4. Conclusion

This section captures the summary of the major findings as obtained in the study. About 44% of the famers in the study area are poor with an average monthly expenditure of N2, 4555.40. Poverty line of 2, 455.40 shows 43.93% of the farmers fall in the poor category. Most of the poor farmers were female with 50.00%. Farmers in the study area exposed to diverse risk sources with economic and social risks having over 94% of the famers affected. Famers exposed to social risks in the years 2012 had the highest poverty incidence with 47.4% of the famers being poor. 58.88% of farmers in the study area were risk averse. Based on the findings of risks attitudes of farmers, it was observed that about 41.1% of farmers are risk referrer, while 58.9% are risk averse. Factors that have direct effects on farmers' risk aversion are membership organization, poverty status of farmers, and secondary school education, while those with adverse effect are household size, housing index, primary school education and access to credit facilities. The study however reveals that poverty is one of the major factors hindering farmers from taking risks.

5. Policy Recommendations

Based on the findings from the study area, the following policies were recommended:

- Seed and equipment are shown to be important inputs with a positive effect on yield, in lieu of this, timely supply of these inputs at subsidized prices to farmers should be intensified.
- Policy and programmes targeted towards poverty reduction, most especially those that are rural based should be intensified in order to ensure that farmers are moved out of poverty, which in turn will enhance their ability to take risk.

Competing Interests

Authors declare that they have no competing interests.

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