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Risk Attitude and Insurance: A Causal Analysis

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Abstract Decisions regarding insurance depend crucially on the extent to which individuals are willing to bear risk. Farmer's decision of whether or not to participate in insurance is likely to be influenced by comparison of expected net gain (or loss) with or without insurance. The attitudes of farmers to risk were assessed using Likert scale. The results show that farmers were aware of the benefits of agricultural insurance and were positively disposed to it. However, majority were against using insurance as a prerequisite for extension of credit lines. This study uses Safety First principle to investigate the impact of insurance on risk attitude of farmers.The result show the overall mean to be 2.47 implying that the farmers were intermediate risk takers. The risk attitude coefficient showed that 20.6 percent were low risk-averse, 40.2 percent intermediate risk-takers and 39.2 percent showed high risk-aversion. The influence of socio-economic factors revealed that age, education, experience and stock size were significant and positive determinants of risk attitude. Access to agricultural insurance impacted positively on the attitude of farmers to production risk. The Chow test confirmed differences in risk attitude between farmers with insurance and farmers without insurance.

Keywords Risk, Attitude, Insurance, Impact, Chow-Test

1. Introduction

Agro-business is risky compared to other businesses. Farmers, like most other people, also place greater weight on potential negative outcomes of risk and they are generally willing to sacrifice potential income to avoid either risk or uncertainty (Ghadim and Pannell 2003; Marra, et al. 2003; Dewan, 2011; Picazo-Tadeo and Wall 2011).Peasant farmers are naturally keen to avoid taking risk which might threaten their livelihoods. This behaviour influences the levels and types of inputs they use and the aggregate levels of output produced. The vicious circle of poverty takes many forms but one key element in many versions of the spiral, in many environments is risk aversion. If poor people are risk-averse to the extent that they are unwilling to invest in the acquisition of modern inputs because that involves risks, they will remain poor (Mosley and Verschoor, 2003). Agricultural production is subject to risk and the attitudes of producers toward risk will influence input choices insofar as these affect production risk (Picazo-Tadeo and Wall 2011). The characteristic time-lag in agricultural production activities inhibits accurate prediction of expected output and their prices, thus increasing the concern of risks and uncertainty. In other enterprises, economics of scale may be achieved without much distortion. In agriculture, however, linear extrapolation cannot be used to predict eventual outcome.

Agricultural insurance is seen as one of the best strategies to address farm risks and encourage farmers to embrace modern production practices with greater potential for better and quality yields (Wenner, 2005). In Nigeria, the Government introduced agricultural insurance programme with the tripartite aim of broadening farmers' access to farm resources, positively changing farmers' attitude to risk in their choice of resource use and to achieve increased food supplies in the market(Olubiyo, et al. 2009). Different factors can be identified that influence farmers' behaviour especially making decisions that relate to farm production, vis-à-vis choice of enterprise, its combination, the type and level of resources used in a given farming season.

A large number of poultry farmers in Nigeria produce under conditions that are exposed to the vagaries of nature and limited infrastructure like storage facilities and power (Onuorah, 2008). The importance of the poultry industry in Nigeria has been demonstrated by the number of researches conducted. The risky nature of the enterprise was worsoned by the outbreak of HPAI in 2006. Studies have evaluated behaviour or attitude to risk and responses of poultry farmers to risk and agricultural insurance (Aye and Oji, 2007; Ajemtomobi and Binuomole, 2006; Olubiyo et al 2009; Ajieh,2010). But to the best of our knowledge none has tried to quantitatively isolate the impact of insurance the risk attitude of farmers. Therefore, the study is an effort to quantitatively isolate the impact of insurance on the risk attitude using a sample of poultry farmers.

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2. Methodology

2.1. Study Area

Abia State is one of the 36 states of the Federation of Nigeria. The State comprises of three agricultural zones namely, Aba, Umuahia and Ohafia split into seventeen Local Government Areas. The State is located between longitude $7^0$10' and $8^0$0' East and latitude 4^0 40' and 6^0 4^1 North of the equator. Abia State occupies a land area of about 5834 square kilometer which is approximately 5.8% of the total land area of Nigeria and is rank 32nd out of the 36 States in terms of land area (Abia Mirrow 2006). It has a population of about 2,833,999 persons according to NPC (2006) and is rank 15th in population size in Nigeria. Its population density is about 2 persons per square kilometer of land, though this density has been increased by ecological degradation.

2.2. Sampling Techniques

The study adopted systematic sampling procedure to select respondents. The Resident Extension officers within the localities assisted in drawing the sampling frame from which the selections were made. To ensure wide coverage and ensure that farmers within the same homogenous and contiguous area where selected, the study adopted the Agricultural Development programme (ADP) delineation of communities into blocks and circles. These ensured they operate under similar environmental factors and have related characteristics to an extent. In all a total of 97 smallholder poultry farmers were enlisted for the study.

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2.4. Data Analysis

Data analysis involved the use of inferential statistics such as means, tables, frequencies and measures of deviation. Econometric techniques adopted involved the estimation of equations based on the ordinary least squares techniques.

2.4.1. Assessment of Attitude to Insurance

Likert-type of scale was used in the analysis of farmers' attitude to agricultural insurance. The scale falls under the criterion-group instrument whereby items are collected and analyzed against a criterion. In this the farmers' attitude are determined by requesting them to respond to some attitudinal statements. Each statement has weights attached to it or scores attached to it. Weights and scores are usually assigned so that high scores indicate favourable attitudes. The responses were weighted on a 5-point likert- type scale of strongly disagree = 1; disagree = 2; undecided = 3; agree = 4 and strongly agree = 5. The mean of the weighted value was taken as a cut-off point, such that statements with values above the mean are regarded as implying a positive attitude while mean scores below the weighted value were regarded as unfavourable, implying a negative attitude.

2.4.2. Estimation of Risk Attitude

The Safety-First Principle of determining risk attitude coefficient, proposed by Kataoka (1963), modified by Moscardi and de Janvry (1977), used in Nzenwa (2005); Ajetomobi and Binuomote, (2006) and Olaniyi et al, (2007). This principle assumes that the individual's objective is to minimize the probability of experiencing variability (a shortfall) in output or income below a certain initial level, (specified levels of disaster). The method involves the use of ordinary least squares (OLS) techniques. In this case, the generalized power function is estimated because of its wide use in production function analysis and the yield of consistent estimates. The implicit function is stated below:

$$Y = aX_1^{b1}, X_2^{b2}, X_3^{b3}, X_4^{b4}, X_5^{b5}, e) \quad (1)$$

Where:

Y = average market weight of birds in Naira (Nigerian currency);

a = intercept of the equation;

X1 = average cost of feed per annum in Naira;

X2 = average cost of stock (birds) in Naira;

X3 = average labour cost in naira (both family and hired);

X4 = average cost of drugs, veterinary services and chemicals in Naira;

X5 = capital input in naira (depreciated values of farm equipment, interest on borrowed capital, rent on land and premium cost);

b's = partial regression coefficients, and

e = error term.

The risk aversion coefficient for each producer is obtained from equation 2. The cost of stock from the result of the production function analysis was used in the computation of the risk parameter. The risk parameter (K) is computed as:

$$K = \frac{1}{\gamma} \left\{ PiXi \middle| Pf1\mu y \right\} \quad (2)$$

$$\text{The coefficient of variation of output } \gamma = {}^{Sy}/_{\mu y} \quad (3)$$

Where:

γ = coefficient of variation of output (market weight)

Sy = the standard deviation of output

μy = the mean of output

Xi = average quantity of the most significant input for each respondent.

Pi = input price

P = market price of output

$f1$ = the elasticity of production of input.

The risk-aversion coefficients can be expressed as a function of input prices, marginal products, output risk, and marginal output risk, all of which are either observable or estimable. These risk-aversion coefficients can then be used as the dependent variable in regression to check the influence of insurance and other socioeconomic variables on risk attitudes.

$$K = f\ (V_1, V_2, V_3, V_4, V_5, V_6, V_2, e) \quad (4)$$

Where:

K = Risk attitude coefficient

V1 = Age of farmers

V2 = Household size

V3 = Educational status

V4 = Farming experience

V5 = Size of stock

V6 = Volume of credit

V7 = Non- farm income

V8 = Dummy for insurance (1= insured farmers, 0 otherwise)

e = Error term

To isolate the impact of insurance, the above model was estimated for: (i) for farmers with insurance policy (ii) farmers without insurance and (iii) pooled data without an intercept dummy and (iv)for pooled data with an intercept dummy, 1 for insured farmers and 0 otherwise.

Test for the effect of insurance, homogeneity of slope and difference in intercept of the farmers.

Test for the effect of insurance, the F-statistics is given by Onyenweaku (1997) as follows

$$F^* = \frac{\left[\Sigma e_3^2 - \left(\Sigma e_1^2 + \Sigma e_2^2\right)\right] \ / \ \left[k_3 - k_1 - k_2\right]}{\left(\Sigma e_1^2 + \Sigma e_2^2\right) \ / \ \left(k_1 + k_2\right)} \quad (5)$$

Where Σe_1^2 and K_1 are the error sum of square and degree of freedom respectively for insured farmers, Σe_2^2 and K_2 are the error sum of square and degree of freedom respectively for uninsured farmers, Σe_3^2 and K_3 are the error sum of square and degree of freedom respectively for pooled data.

If the calculated F (f cal) exceeds the tabulated F (f tab), it means insurance had impact on the risk attitude of the farmers with insurance.

Test for Homogeneity of scope: The F- statistics is calculated as:

$$F^* = \frac{\left[\Sigma e_4^2 - \left(\Sigma e_1^2 + \Sigma e_2^2\right)\right] \ / \ \left[k_4 - k_1 - k_2\right]}{\left(\Sigma e_1^2 + \Sigma e_2^2\right) \ / \ \left(k_1 + k_2\right)} \quad (6)$$

where Σe_4^2 and K_4 are the error sum of square and degree of freedom respectively for pooled data with a dummy variable, other variables are as defined earlier.

If the calculated F (f cal) exceeds the tabulated F (f tab), it means that insurance bought about a structural change or shift in risk attitudes parameter.

Test for Differences in intercepts: The F- statistics is calculated as follows;

$$F^* = \frac{[\Sigma e_3^2 - \Sigma e_4^2][k_3 - k_4]}{\Sigma e_4^2 \ / \ k_4} \quad (7)$$

If the calculated F (f cal) exceeds the tabulated F (f tab), it means that the risk attitude of farmers with insurance differ from that without insurance.

3. Results and Discussion

3.1. Attitude towards Insurance

Farmers responses with respect to insurance were evaluated on the five-point Likert scale and the results are presented in table 1.

Table 1. Respondents Attitude towards Insurance

Statements	Frequency SA	A	U	D	SD	Attitude score	Mean
Insurance is beneficial to farmers	50	43	4	-	-	434	4.47
Insurance reduces farmers' worries and stress.	41	48	-2	1	5	410	4.23
Insurance cushions the affect of losses and damages	40	35	8	-	-	364	3.75
Insurance promotes using new technology and making greater investment in agriculture.	40	39	-	16	2	390	4.02
Recovering farmers is government liability.	55	40	-	-	-	435	4.48
Insurance should be mandatory to all farmers.	10	15	8	35	12	216	2.23
Insurance serves as an assurance to banks to grant loan to farmers.	12	22	15	20	25	273	2.80
Government is using insurance to collect money from farmers (indemnity).	20	10	20	28	10	316	3.26
Overall mean score N	3.66 97						

Note: SA= strongly agree, A=agree U= undecided D=disagree SD= strongly disagree.

The result of the analysis revealed that respondents agreed to the following statements: insurance is beneficial to farmers, insurance reduces farmers' worries and stress, insurance cushions the affect of losses and damages and insurance promotes using new technology and making greater investment in agriculture. Others are recovering farmers is government liability liability and Government is using insurance to collect money from farmers (indemnity) with a mean score of 3.00 and above, showing that the respondents have a positive attitude towards insurance. They recognized the fact that agricultural insurance is beneficial and it can help reduce farmers' worries and stress over uncertainties and risk associated with poultry enterprise. It implies that respondents had a favourable attitude towards

insurance as confirmed by the overall mean score of 3.66. However, respondents displayed their disagreement with making insurance a requisite for credit assessment from formal financial institutions. The farmers believe that taking insurance policy should be optional and should not be tied to acquisition of credit Most farmers are appreciative of the risky nature of the enterprise and one appropriate way to overcome such risk and uncertainty is through insurance.

3.2. Determination of Risk Attitude Coefficient

The Safety – First Principle was used in the determination of the risk attitude parameter of poultry farmers in the study area. This principle assumes that the individual's objective is to minimize the probability of experiencing variability (a shortfall) in output or income below a certain initial level, (specified levels of disaster). Assuming that the first principle holds, the degree of risk aversion manifested by an individual farmer is derived from an observed behavior because given a production technology and the risk associated with production and market condition. The observed level of factor use reveals the underlying degree of risk aversion. This method involves first, the estimation of the production function in which the direct relationship between input vector (X) and output (Y) is established. Then the most significant input variable from the estimated function is determined by considering the R^2-values, signs and magnitudes of significant variables, coefficients of significant variables, including conformation of variables to *a priori* expectations. From our results, the cost of stock with a coefficient of 0.168 appeared as the most significant input of the production process in the study area. The estimated function is shown in table 2

Table 2. Estimates of Cobb-Douglas production function.

Variables	Parameter estimates	t-ratios
Feed (X_1)	-0.144**	-2.307
Cost of stock (X_2)	0.168***	4.653
Labour (X_3)	0.157*	1.936
Drugs and Chemicals (X_4)	0.025	0.873
Capital input (X_5)	0.118**	3.566
Intercept	3.158***	8.404
R^2	0.406	
R-Adjusted	0.373	
F-value	12.444***	

Note: ***, **, * represent significant at 1%, 5% and10% level of probability respectively.

The elasticity of cost of stock (X_2), together with the coefficient of variation of output γ, the average price of product per kilogram and factor price per kilogram for year 2010 was used in determining the risk attitude coefficient (K), for each farmer. Thus K- value is unique and specific for each farmer. The computed risk attitude coefficient (K) was used to classify the respondents into three risk aversion groups as shown in the table 3.

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Table 3. Distribution of risk attitudes coefficient (K).

Risk averse group	Frequency	Percentage	Mean risk attitude coefficient.
Low intermediate high	20 39 38	20.6 40.2 39.2	1.25 2.13 4.02
Total Overall mean of risk attitude coefficient	97 2.47	100	7.41

The analysis revealed that 20.6 percent of the respondents are in low risk averse group 40.2 percent are in intermediate risk averse group while39.2 percent are in high risk averse group contradicting Nzenwa, (2005) finding that over 70 percent of farmers are high risk averse. The overall mean risk attitude coefficient of 2.47 implies that on the average poultry farmers are mainly in intermediate risk averse group.

3.3. Influence of Socioeconomics factors on Risk Attitude

Estimation using the Safety-first principle permits us to obtain consistent estimates of the risk-aversion coefficients for each producer. This enables us to ascertain the influence of farmer socio-economic characteristics on risk attitude. While our main objective is to isolate the impact of agricultural insurance on the risk attitude of farmers, it is equally important to examine the effect of other factors that the farmer is exposed to in the production process. Therefore our analysis included seven other variables considered important in ascertaining the risk attitude of the farmer. The results of the four models estimated are presented in table 4

All the models had a relatively high explanatory power showing that most of the socio-economic variables that influence the risk attitude of the farmers had been captured by the models. The model for farmers without insurance had the lowest explanatory power (54 percent) while the pooled data with intercept dummy had high explanatory power of 82 percent when considering the R2 adjusted value. The models estimated were true reflection of the equations as all the models had F-values that were highly significant (99 percent). It is assumed ceteri paribus that older farmers tend to be less prone to take risks than younger ones.While some studies have found that risk aversion increases with age (e.g., Dillon and Scandizzo, 1978; Gómez-Limón et al., 2003), others have not found a significant effect for this variable (e.g., Abdulkadri et al., 2003; Moscardi and de Janvry, 1977). However, this study confirmed a priori expectation that older farmers are more risk-averse as the age variable in all the models except for pooled data had positive statistical coefficients. The positive coefficient implies increasing

risk-aversion as the farmer gets older.

Table 4. Influence of Socio-economic characteristics on Risk Attitude

Variables	Farmers with insurance	Farmers without insurance	Pooled data	Pooled data with dummy
Intercept	7571.79*	126.3	3.753***	0.225
	(1.65)	(0.928)	(35.873)	(0.505)
Age (V_1)	3386.40***	0.3028**	-0.017	0.006*
	(5.99)	(2.702)	(-0.278)	(2.084)
Household size(V_1)	-0.84***	0.031	0.103*	-0.011
	(-5.10)	(0.764)	(1.807)	(-1.268)
Education(V_1)	874.80*	-0.225	0.049	0.071***
	(1.97)	(-0.672)	(0.770)	(5.894)
Experience(V_1)	994.60	0.337**	0.113*	0.035*
	(1.64)	(2.479)	(1.874)	(2.018)
Stock Size(V_1)	1643.58**	0.137	0.864***	0.009***
	(2.02)	(1.400)	(15.490)	(6.025)
Credit(V_1)	-56.29	-20.231***	(-0.004)	-5.181E-7*
	(-0.19)	(-2,234)	(-0.600)	(2.442)
Non- farm Income(V_1)	-57.85	-157.45	0.054	-2.239E-5*
	(-0.23)	(-1.123)	(0.960)	(-1.733)
Dummy				-0.289***
				(-3.686)
R^2	0.678	0.573	0.746	0.852
R^2 Adjusted	0.651	0.536	0.727	0.819
F- value	30.11***	33.18***	38.21***	183.277***

Note: *, ** and *** = Significant at 10, 5 and 1 % respectively. ( ) = t – ratios.

Two opposing interpretations can be given to the relationship between risk taking and family size, on one hand, the larger the size of the family, the higher the subsistence consumption needs and given a fixed amount of land, the lower the willingness of the farmers, to assume risks. On the other hand, family size might affect the labour capacity of the peasant household in

which case a larger family size implies greater capacity to assume risks. The result of this study supports the first interpretation in the model of farmers with insurance. The coefficient of household size was negative and significantly related to level of aversion . While the model with pooled data supports the second assertion of increasing risk-aversion and is in tandem with the findings of Ajetomobi and Binuomote (2006).

Higher levels of education have generally been associated positively with risk taking. The results in Table 4 contradict this finding. The years of schooling of the respondent had a negative and significant effect on risk attitude of the farmers. Education increased risk aversion in the model for farmers with insurance and the model with pooled data with dummy and was not significant in the other two. Similar results of non-significance of education were found by Gómez-Limón et al. (2003) and Picazo-Tadeo and Wall (2011). Intuitively, it is expected that experienced farmers will be more risk-taking than less-experienced farmers but the result of the study is to the contrary. Here, experience increased risk aversion in all the models except in the model of farmers without insurance were it was not significant but increased risk preference.

Stock size has a direct relationship in all the implying that risk aversion increases with large stock size. Natural risk associated with the poultry enterprise is spontaneous and can be highly devastating, so farmers are normally apprehensive of the risk of this nature. Using stock size as a proxy for assets shows that farmers who have more assets are more risk averse because of their level of investment (Ajetomobi and Binuomote 2006). Moreover, larger stock size will imply larger scale of farming operation and higher demands for credit to maintain the larger scale of production. In addition, it was only in the model of farmers without insurance that stock size is not significant. This can be explained by the low average stock size of 68 birds when compared to the average stock size of 220 for farmers with insurance.

Volume of credit has an inverse relationship with risk attitude and was significant of farmers without insurance and the pooled data with dummy. The enterprise is capital intensive and therefore necessitates the need for additional finances and at the appropriate time. Farmers therefore patronize informal sources despite the high interest rate. Farmers reported that they are constrained to use institutional sources because it is tied with insurance and the bureaucracy of administrative procedures. Insurance has a negative and significant relationship to risk attitude at one percent. Insurance as a means of transferring risk reduces farmers risk attitudes because participants' farmers are sure of indemnity in cases of mishap making the farmer more risk taking and less risk averse.

Non-farm income is also negative and significant at one percent. This confirms with a priori expectation that non-farm income supplements the farmers to meet annual farm income and subsistence needs hence if it decreases, risk attitude will increase because subsistence need may be at risk. Having off-farm income was found to reduce risk aversion, a result also found by Ayinde (2008) and Picazo-Tadeo and Wall (2011).

3.4. Isolating the Impact of Agricultural Insurance on Risk Attitude

The Chow test examines the equality of parameters between two subgroups (Hardy, 1993). The null hypothesis is that the parameters are equal, meaning that all the independent variables have uniform effects for both subgroups. Here, insurance is postulated to have no influence on risk attitude of farmers. The results of the statistical tests for structural shift in the risk attitude function and differences in structural parameters were presented in Table 5. The calculated chow's F statistic for effect of insurance on

risk attitude was significant at 1 percent. The result confirms that there is significant difference between the risk attitude of farmers with insurance and those without insurance. Hence, we reject the null hypothesis of no difference.

Table 5. Tests for difference in Risk Attitude

Farmer Classification	Error sum of squares	Degrees of freedom	Calculated F
Tests for Risk Attitude			
Farmers with insurance	1314.317	29	
Farmers without insurance	2041.012	52	
Pooled data	408.658	89	9.84***
Tests for homogeneity of slope			
Farmers with insurance	1314.317	29	
Farmers without insurance	2041.012	52	
Pooled data with dummy	1607.071	88	6.50***
Test for differences in intercept			
Pooled data	408.658	89	
Pooled data with dummy	1607.071	88	8.23***

Note: *** = significant at 1 percent

The result of the test for homogeneity of slopes for farmers with insurance and farmers without insurance shows that the calculated Chow's F statistic is statistically significant at 1 percent. The result confirms heterogeneity of slopes or that insurance resulted in differences in risk attitude between farmers with agricultural insurance and those without insurance. This implies that the slopes of the production functions are heterogenous. Heterogeneity of slopes indicates that the production functions are factor-biased.The calculated chow's F statistic for the test for differences in intercept is significant at 1 percent. This result confirmed heterogeneity of intercepts for the farmers with insurance and farmers without insurance. This confirms the result of the pooled data with dummy variable representing farmers with insurance and without insurance and the negative coefficient of the insurance dummy can be interpreted that farmers without insurance are show more risk preference when compared to farmers without insurance.

4. Conclusions

This study investigated the the impact of agricultural insurance on risk attitude among farmers.The respondent farmers consisted of farmers participating in agricultural insurance and others without insurance. Structured questionnaires were used in data collection and data analysed using inferential statistics. First the attitude to risk of farmers were assessed using likert scale, The results show that farmers were aware of the benefits of agricultural insurance and were positively disposed to it. However, majority were against using insurance as a prerequisite for extension of credit lines. The Safety-first principle adopted in estimating the risk attitude coefficient of farmers show the overall mean to be 2.47 implying that the farmers were intermediate risk takers. However, on the basis of the analysis 20.6 percent of the respondents were classified as low risk-averse, 40.2 percent intermediate risk-takers and 39.2 percent showed high risk-aversion. The influence of socio-economic factors revealed that age, education, experience and stock size were significant and positive determinants of risk attitude. In other words these factors increased farmers' risk-aversion. On the other hand, household size, stock size and non farm income were significant and negative, increasing farmers risk preference. Availability of insurance increased farmers' disposition to risk. The Chow test confirmed differences in risk attitude between farmers with insurance and farmers without insurance.

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