Assessment of Crop Farmers' Willingness To Take (WTT) Agricultural Insurance Scheme in Kogi State, Nigeria: Application of Turnbull Estimator

Evaluación de la disposición de los agricultores de cultivos a tomar un plan de seguro agrícola en el estado de Kogi, Nigeria: aplicación del estimador de Turnbull

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Resumen

El estudio utilizó el estimador de Turnbull para diseñar el precio promedio, el precio de límite superior e inferior para la aceptación del seguro agrícola por los agricultores en el estado de Kogi. Esto se ha vuelto imperativo considerando el uso de herramientas estadísticas descriptivas débiles para estudios similares en el país. El estudio describió específicamente las características socioeconómicas de los agricultores de cultivos, evaluó la concientización de los agricultores sobre el plan de seguro agrícola, determinó los factores que influyen en la disposición de los agricultores a tomar un seguro agrícola y evaluó el precio promedio que los agricultores de cultivos están dispuestos a tomar. Se utilizó una técnica de muestreo de varias etapas para seleccionar ciento cincuenta (150) hogares de cultivos agrícolas para el estudio y se utilizó un cuestionario estructurado para obtener datos de los encuestados. Los datos se analizaron mediante estadísticas descriptivas, puntuación sigma, modelo de regresión probit y el estimador de Turnbull. Los resultados mostraron que el 77% de los agricultores eran hombres con una edad media de 40 años y un tamaño promedio de 9 miembros. Se registró un nivel bajo (puntuación sigma de 4.59) de la concientización de los agricultores sobre el seguro agrícola; sin embargo, el 72% de los agricultores estaban dispuestos a tomar un seguro agrícola. Las variables significativas que influyen en la disposición a tomar un seguro agrícola por parte de los agricultores fueron educación (ß= 1.03), estado civil (ß=-0.82), tierra cultivada (ß= -0.01) y propiedad de la tierra (ß= 1.20). El promedio de la disposición a pagar (WTP) para el seguro agrícola por los encuestados fue ₦2, 035 / parcela y ₦8, 140 / ha ($ 1 = ₦306). Por lo tanto, el estudio recomendó un aumento en el nivel de alfabetización entre los agricultores y la provisión de servicios de seguros agrícolas a una tasa asequible.

Palabras clave: seguro agrícola, estimador, prima, participación, turnbull.

Abstract

The study used Turnbull estimator to design the average price, upper and lower bound price for agricultural insurance uptake by crop farmers in Kogi State. This has become imperative considering the use of weak descriptive statistical tools for similar studies in the country. The study specifically described the socioeconomic characteristics of crop farmers, assessed farmers' awareness on agricultural insurance scheme, determined the factors influencing farmers' willingness to take agricultural insurance and evaluated the average price that crop farmers are willing to take agricultural insurance. A multi-staged sampling technique was used to select one hundred and fifty (150) crop farming households for the study and structured questionnaire was used to elicit data from the respondents. The data were analyzed using descriptive statistics, sigma score, probit regression model and the Turnbull estimator. Results showed that 77% of the farmers were males with a mean age of 40years and an average household size of 9 members. A low (sigma score of 4.59) level of crop farmers' awareness on agricultural insurance was recorded; however, 72% of the farmers were willing to take agricultural insurance. The significant variables influencing willingness to take agricultural insurance by the farmers were education (ß=1.03), marital status (ß=-0.82), cultivated land (ß=-0.01) and land ownership (ß=1.20). The average willingness to pay (WTP) for agricultural insurance by the respondents was ₦2, 035/ plot and ₦8, 140/ha ($1 = ₦306). The study therefore, recommended increase in literacy level among crop farmers and provision of agricultural insurance services at affordable rate.

Key words: Agricultural Insurance, Estimator, Premium, Participation, Turnbull

Introduction

Agriculture plays a vital role in the Nigerian economy and serves as a critical source of growth in many developing countries. It is a means of livelihood for rural populace and a source of investment opportunities (Ovansa et al., 2015). However, the sector is exposed to adverse natural events such as drought, flood, wind storm, pests and diseases. The impact and economic cost of natural disasters may continue to increase because of climatic factors occasioned by climatic change; these events in most cases can lead to decrease in output if not controlled (Eleri et al., 2012).

In spite of several schemes designed for promoting and protecting the interests of farmers, reports of suicides by several farmers due to loss of income for various reasons including crop failure are not far-fetched (Selveraj, 2015). Patrick (2010) opined that since farmers cannot forecast the probability of occurrence of these disasters (flood, drought and fire outbreak) and cannot bear these risks alone, they are faced with no other option but to transfer the risks involved in the management of their farms to one or more individuals or firms. In essence, farmers take agricultural insurance to safeguard their investments.

Agricultural insurance is one method by which farmers can stabilize farm income, investments and guard against disastrous effects of losses due to natural hazards or failure in market prices (Babatola et al., 2013). Agricultural insurance is not restricted to crop only, although it is one of the most important and major constituents of agricultural insurance. Every investment made in agriculture carries with itself certain risks and these risks can be accommodated by insurance companies (Shaibu et al., 2016).

In recognition of the special nature of agricultural insurance, the Federal Government of Nigeria established the Nigerian Agricultural Insurance Scheme (NAIS) which is implemented and managed by the Nigerian Agricultural Insurance Corporation (NAIC), launched on the 15th December, 1987. This is part of government efforts to enhance food production in the country (Farayola et al., 2013). Despite this initiative, Eleri et al. (2012) reported that less than 1% of Nigerian crop farmers actually take agricultural insurance. Thus many of these farmers are put out of insurance business immediately they suffer any form of disaster due to lack of insurance cover. Recent statistics by the Nigeria Agricultural Insurance Corporation (NAIC, 2017) showed that only 5% of Nigerian farmers access agricultural insurance which has been blamed on the cold attitude of farmers to Insurance practices, lack of awareness and enlightenment of farmers and the level of penetration of agricultural insurance which is still very low in the country.

The NAIC was situated on the premise that, reduction in the risks associated with adoption of farming practices will have a multiplier effect on adoption.Furthermore, agricultural insurance helps in curbing poverty because farmers who buy the insurance premium for their agricultural business do transfer their losses to a third party (Shaibu, 2016). Furthermore, agricultural insurance is seen as one of the best strategies to address farm risks and to enhance modern production practices with greater potential for better and quality yields (Olubiyo et al., 2009).

Increased agricultural production has become one of the key policy directions of the current government. Despite the numerous government incentives and attention given to the sector, Nigerian farmers are still among the poorest in the world (FAO, 2017). Climatic change, natural disaster, diseases and attacks from pests and insects are seen as threats to the sector's growth. The insurance scheme is intended to minimize such losses faced by farmers. For instance, in recent years, the flood that hit several States in the country, Kogi State inclusive has resulted in huge losses. Hence, there is a significant question on whether farmers in Kogi State are willing to take agricultural insurance for effective management of risks facing their farming operations and activities. Additionally, the use of Turnbull estimator in this study forms a methodological gap as existing empirical studies on price for insurance uptake in the country applied weak descriptive statistical tool such as mean. Application of mean or average cannot provide an upper and lower bounds. To this end, the specific objectives of the study are to: describe the socioeconomic characteristics the respondents; assess crop farmers' awareness of risks and insurance taking; determine the factors that influence farmers' willingness to take agricultural insurance; and evaluate the average price that crop farmers are willing to take agricultural insurance.

Outcome of this study will provide baseline information for designing effective agricultural insurance scheme that will ensure that the best and adequate insurance premium are available to the farmers.

Methodology

The study was carried out in agricultural zone B of Kogi state. Kogi state is located on Latitude 70 55'0" N and Longitude 6025'60"E. For agricultural control and administrative convenience, Kogi state has four agricultural zones as delineated by the Kogi State Agricultural Development Project (Kogi ADP). These zones are: Zone A which comprises of Ijumu, Kabba/Bunu, Mopamuro, Yagba-East, Yagba-West Local Government Areas with headquarters at Aiyetoro-gbede. Zone B, comprises of Dekina, Bassa, Ankpa, Olamaboro, and Omala Local Government Areas, with zonal headquarters at Anyigba. Zone C, comprises of Adavi, Ajaokuta, Koton-Karfe, Kogi, Okene and Okehi Local Government Areas with zonal headquarters at Koton-Karfe. Zone D, comprises of Idah, Ofu, Ibaji, Olamaboro, and Igala-Mela/Odolu Local Government Areas with zonal headquarters at Aloma. The study used the blocks and cells in agricultural zone B to obtain the relevant data for the study.

The target population for this study are registered crop farmers in agricultural zone B, Kogi state. The crops considered include rice, maize and cassava. These crops were considered due to their comparative advantage in the study area and level of risks and uncertainties. A multi-stage random sampling technique was used for the study. First, three extension blocks were randomly selected from the agricultural zone. Second, five extension cells were randomly selected from each of the chosen extension blocks, this gives a total of fifteen extension cells. Third, ten crop farmers were randomly selected from each of the extension cells making a total of 150 respondents for the study.

Model Specification
Sigma Score

A sigma score (z) was calculated using the following steps:
First obtain the percentage of crop farmers who were aware of agricultural insurance

Number of farmers aware of agricultural insurance ×100 = A%

Total number of respondents
This is followed by dividing the percentage (A %) by two and minus the answer from 100
100 – (A % / 2) = B %
Check B% on the statistical table of normal deviates to get the sigma distance (X).
Next increase the value of the sigma distance using a constant figure of 2 and multiplying the result by the same constant.
(X + 2) x 2 = Y

Since sigma method assigns weight in reverse direction on a 10 point scale, the actual sigma score would be 10 minus the answer (Y).
10 – Y = Z

Decision rule: Any mean score (Z) less than 5 was considered as low level of awareness of agricultural insurance.

The empirical model measuring the probability that a farmer was willing to take insurance is expressed as:

$$Pi = F(WTIi) = \frac{1}{1+e^{-WTIi}} = \frac{1}{1+e^{xi+\varepsilon i}} \quad (1)$$

Where i=1, 2, 3….n
Pi is a probability function, which the farmers give a yes/no response to the willingness to take agricultural insurance.
WTI is the willingness to take insurance (1 if yes, 0 if otherwise).

X1 is a factor of observed characteristics of an individual. They include socio-economic and altitudinal attributes of the respondents.
X1 = Age of household head (years)
X2 = Sex (dummy 1 = male 0 = female)
X3=Marital status (dummy 1 = married 0 = unmarried)
X4=Education (years)
X5 = Cultivated land (hectare)
X6 = Income (₦)
X7 = Extension service (dummy 1= access to extension services 0 = otherwise)
X8 = Credit facilities (dummy 1= access to credit facilities 0 = otherwise)
X9 = Land ownership (dummy 1 = inheritance 0 = otherwise)
X10= Association membership (dummy 1= member of an association 0 = otherwise)
X11= Improved varieties (dummy 1= use improved variety 0 = otherwise)
X12= Awareness of insurance (dummy 1 = aware of agricultural insurance 0 = otherwise)

Turnbull Estimator Analysis

$$\text{Average WTP} = \frac{\text{sum of bidding amounts}}{\text{Total number of respondents who were willing to pay}} \quad (2)$$

Following Giolo (2004); to construct the estimator, let $0 = T_0 < T_1 < T_2 < \ldots\ldots < T_m$ be a grid of time which includes all the points L_i, U_i for $i = 1,\ldots,n$.

For the nth observation, define a eight αij to be 1 if the interval $(T_j\text{-}1, T_j)$ is contained in the interval $(L_i U_i)$ and 0, otherwise. The weight indicates whether the event which occurs in the interval $(L_i U_i]$ could have occurred at T_j. An initial guess at $S(T_j)$ is made and the Turnbull's algorithm is as follows:

Step 1: Compute the probability of an event occurring at time Tj by

$P_j = S(T_j - 1) - S(T_j)$ $\quad j = 1,\ldots,m;$

Step 2: Estimate the number of events which occurred at Tj by

$$d_j = \sum_{i=1}^{n} \frac{\sum_{k=1}^{m} (\alpha_{ij} b_k)}{\alpha_{ij} b_j} \quad j = 1,\ldots\ldots, m$$

Step 3: Compute the estimated number at risk at time T_j by $Y_j \sum_{k=j}^{m} dk;$

Step 4: Compute the updated Product-Limit estimator using the pseudo data found in steps 2 and 3. If the updated estimate of S is close to the old version of S for all T_j's, stop the interactive process, otherwise repeat steps 1-3, using the updated estimate of S.

Results and discussion

Selected Socioeconomic Characteristics of the Respondents

Table 1 shows selected socioeconomics characteristics of the respondents. The result shows a mean age of 40years among farmers in the study area. This indicates that crop farmers in the study area are adultsin their productive age. This agrees Michael et al, (2015) who reported a mean age of about 40 years among farmers in Ghana. This productive and active age should enhance farmers' willingness to take agricultural insurance.

The involvement of more males than females could be attributed to the tedious nature of the various activities in crop production. Such activities include land clearing, ridging, planting, weeding, pest/disease management and the various post-harvest operations. The access of males to land use and ownership, production inputs and information more than the females could explain dominance of the males in crop farming. However, FAO (2017) reported female dominance in agricultural activities.

The involvement of moremarried individuals in crop production as presented in Table 1 could suggest crop farming as a means of catering for the family. Married farmers could be involved in production activities by providing labour. This is in line with Kolo (2004), who reported that majority of farmers who were married could receive various forms of assistance from their

wives and children both at home and on the farm. Furthermore, the mean household size of 9 members suggests the possibility of available labour for farming activities. This value is however two way up the national average of 7 members per household (Onuche et al., 2014). The high percentage (80%) of farmers who can read and write could have a positive impact on access to information which may influence participation in agricultural insurance.

Farmers' Awareness on Agricultural Risks and Insurance Taking

The distribution of crop farmers according to their level of awareness on agricultural risks and insurance taking is presented in Table 2. From the results, all the farmers were aware of risk in agriculture. The sigma score for awareness shows that there is a low level of awareness on agricultural insurance in the study area. This is against the findings of Babatola et al. (2013) who reported that 77.5% of farmers were aware of agricultural insurance in Ondo state, Nigeria. The sigma score for access to insurance experts shows that farmers in the study area had little or no access to insurance experts. This maybe be associated with their level of awareness.

Despite the level of awareness, 72% of farmers (those who were aware of agricultural insurance) were willing to adopt agricultural insurance. The high percentage of farmers' willingness to take agricultural insurance couldbe associated with the fact that the researcher was able to create awareness on agricultural insurance technology to the contact farmers with detailed information on the merits, demerits and an overview on how the agricultural insurances services works. The farmers decided to take agricultural insurance as a means of recouping loses since it is almost impossible for agribusiness to survive without risks. This finding agrees with Babatola et al. (2013) who posited that 88.3% of the crop farming population in Ondo state was willing to pay for agricultural insurance services.

Factors Influencing Willingness to Take Agricultural Insurance

The estimates of Probit regression model on factors that influence farmers' willingness to take agricultural insurance in the study area is presented in Table 3. The model's log likelihood ratio of -72.318 and 2value of 32.59 showed that all the variables belong to the model and improved the explanatory power when including them. It also showed that the model is a good fit for the analysis. Out of twelve explanatory variables included in the model, four significantly influenced the likelihood of farmers' willingness to take agricultural insurance. The significant variables include: marital status, education, cultivated land and land ownership.

The coefficient (=-0.82) of marital status was negatively signed and significant at 5%. This means that the probability of willingness to take agricultural insurance decreases with married crop farmers. This is in agreement with the survey of Simon et al., (2013), who reported that marriage will enhance a reduction in hired labour and other services on the farmland as family members will be of help.

The coefficient (=1.03) of education is positive and significant at 1%. This implies that educated farmers are more willing to take agricultural insurance than the uneducated. This conforms to apriori expectation. Farmers who can read and write accept innovations that would help them in farm management more readily than their less educated counterparts (Falola et al., 2012).

The coefficient of cultivated land (=-0.01) is negative and significant at 1%. One would expect that farmers with large number of cultivated land will readily take agricultural insurance than their colleagues with small farm size. However the result of this study gave a reverse implication.

This could be associated with the fact that those who have large farm sizes indulge in some cultural and biological practices to help them manage their farming activities and cope with the vagaries of risks and uncertainties. These activities may include: crop rotation, bush fallowing, mixed farming, irrigation, and diversification to mention but a few. This position agrees with Okwoche et al. (2012), when they reported similar findings among farmers in Benue state.

The coefficient (ß=1.20) of land ownership is significant at 1% and positively affects farmers' willingness to take agricultural insurance. Farmers who inherited their farmland can expand their scale of production and diversify their farming enterprise; hence, more willing to take agricultural insurance.

Average Price Crop Farmers are Willing to Pay for Agricultural Insurance

The distribution of crop farmers according to the average price they are willing to-pay for agricultural insurance is presented in Table 4. The contingent valuation (CV) was used by describing agricultural insurance to the clientele and asking each crop farmer directly what he/she is willing to pay; this is as described by Wan (2014). The elicitation method used for the study was payment card method were prices were presented to the farmers to help them make a choice on how much they are willing to pay per plot. Also, a single dichotomous choice approach was used to ask the farmers how much he/she is willing to pay without providing choices. The researchers used the combination of both elicitation techniques in deriving WTP information to reduce biases to the barest minimum and to improve the level of accuracy.

The average WTP using the turnbull estimator was estimated as ₦2,035/plot which is equivalent to ₦8,140 per hectare. The decision to pay this amount as premium could be due to the income level of the farmers, and the rate of return on investment. This result is almost similar to the findings of Babatola et al. (2013) who reported that the average WTP for agricultural insurance services was ₦11087.5/ha in Ondo state, Nigeria.

Conclusion and recommendations

This study examined the willingness-to- take and pay for agricultural insurance by crop farmers in Kogi state, Nigeria. It originated from the need to manage risk militating against crop production in the State. It can be concluded from the findings that most of the farmers were aware of agricultural risks but few are aware of agricultural insurance. Also a good number of the farmers are willing to have agricultural insurance cover to manage agricultural risks effectively. On the average, the farmers were willing to take insurance if the premium is not greater than ₦2035 per plot and ₦8,140 per hectare. Additionally, marital status, education, cultivated land and land ownership influenced crop farmers' decision to take agricultural insurance.

Based on the findings of this study, it is recommended that:

1. Extension agents and other agricultural insurance stakeholders should be able to sensitize crop farmers on the importance of agricultural insurance policy as this will help to improve their level of awareness. Also, agricultural insurance centers should be located in each extension block in the study area, this will ensure easy access to insurance experts, increase the level of awareness and the rate of insurance uptake.
2. Farmers should be encouraged to further their education as it has a significant effect on their adoption of agricultural insurance.

3. Agricultural insurance corporations should provide agricultural insurance to farmers at affordable rates to encourage them to adopt it. From the study, an average premium of N 2,035/plot and ₦8,140/hectare was estimated. Having this in view, NAIC should consider this price tag accepted by the crop farmers and reach a conclusion below or equal to this premium.

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Annexes

Annexe 1: Selected Socioeconomic Characteristics of the Respondents.

Variables	Frequency	Percentage	Mean/Mode
A. **Age**			
20-40	81	54.00	
41-60	67	44.67	40 years
61 and above	2	1.33	
B. Sex			
Female	34	22.67	
Male	116	77.33	Male
C. **Marital status**			
Single	19	12.67	
Married	117	78.00	
Divorced	3	2.00	
Widow	3	2.00	Married
Widower	8	5.33	
D. **Household size**			
1-5	31	20.67	
6-10	77	51.33	9 persons
11 and above	42	28.00	
E. **Educational background**			
No formal education	30	20.00	
Primary education	21	14.00	
Secondary education	67	42.67	Secondary education
Tertiary education	32	21.33	

Source: Field Survey, 2018. No. of respondents= 150.

Annexe 2: Level of Farmers' Awareness on Agricultural Risk and Insurance Taking.

Items	**Frequency**	**Percentage**	**Sigma Score**
A. Awareness on risk	150	100	6.00
B. Awareness on agricultural insurance	72	48.0	4.59
C. Access to Insurance experts	10	6.7	2.32
D. Willingness to Take Insurance			
Willing	108	72.0	
Not Sure	09	6.0	
Not Willing	33	22.0	
Total	150	100	

Source: Field Survey, 2018.

Annexe 3: Estimates of Probit regression on factors influencing willingness to take agricultural insurance by the respondents.

Variables	Parameter	Coefficient	Std. error	Z-value	P>/z/
Age (years)	β_1	.0042076	.0150971	0.28	0.780
Sex (dummy)	β_2	-.4639931	.3559947	-1.30	0.192
Marital status (dummy)	β_3	-.8185917	.3933455	-2.08	0.037**
Education (dummy)	β_4	1.029801	.3112277	3.31	0.001***
Cultivated land (hectare)	β_5	-.0147034	.0057837	-2.54	0.011**
Income (₦)	β_6	1.18e-07	3.20e-07	0.38	0.702
Extension service (dummy)	β_7	-.092951	.1942522	-0.48	0.632
Credit facilities (dummy)	β_8	-.2651344	.323948	-0.82	0.413
Land ownership (dummy)	β_9	1.200891	.4620627	2.60	0.009***
Membership (dummy)	β_{10}	.3575938	.2997908	1.19	0.233
Improve varieties (dummy)	β_{11}	.0838926	.5249883	0.16	0.873
Awareness of insurance	β_{12}	-.3258304	.2837048	-1.5	0.251
Constant		-.158848	.6844661	-0.23	0.816
Number of Obs.		150			
LR Chi^2		32.59			
Prob> Chi^2		0.0011			
Pseudo R^2		0.1839			
Log likelihood		-72.318283			

Source: Field Survey 2018. *** = 1% sig., **= 5% sig.

Annexe 4: Turnbull Estimates on the average price that crop farmers are willing-to-pay for insurance services.

Premium (₦)	Share Yes	Share No	Change in Share No.	E_{LB} (Marginal Prob. times cost)	Variance
500	0.89	0.11	-	0	304.83
1000	0.59	0.41	0.30	150.00	662.84
2000	0.51	0.49	0.08	80.00	3662.43
3000p & 4000p	0.25	0.75	0.26	520.00	1479.05
5000p & 6000p	0.23	0.77	0.02	60.00	5562.37
6500	0.05	0.95	0.18	900.00	2952.32
6500+	0	1.00	0.05	325.00	
Total				**E_{LB}(WTP) 2035.00**	**14623.84**

Source: Field Survey 2018.

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