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FROM PERCEPTION TO DECISION: ANALYSING CONSTRAINTS AND DETERMINANTS OF VOLUNTARY AGRICULTURAL INSURANCE UPTAKE AMONG NIGERIAN RICE FARMERS

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Abstract. This study examines the determinants and perceived constraints of voluntary agricultural insurance uptake among rice farmers in Kwara State, Nigeria, by integrating binary logistic regression and Garrett's ranking technique. A stratified random sampling technique was employed to select 340 rice farmers from a sampling frame of 2,267 registered members of the Rice Farmers Association of Nigeria (RIFAN), comprising both Anchor Borrowers' Programme (ABP) beneficiaries and non-beneficiaries. Binary logistic regression was used to identify the socio-economic and institutional factors influencing voluntary agricultural insurance uptake, while Garrett's ranking technique was employed to assess the severity of farmers' perceived constraints. The logistic regression results show that years of education negatively and significantly influenced voluntary insurance uptake, whereas membership in farmer associations had a positive and significant effect on participation. Other explanatory variables were not statistically significant. The likelihood ratio test showed that the model was statistically significant (χ^2 = 33.68, $p < 0.01$), indicating that the explanatory variables jointly influence participation decisions. Garrett's ranking technique identified inflexible premium payment structures, lack of trust in insurance providers, low farm income, limited insurance coverage, and high premium costs as the most severe constraints to participation. These findings indicate that perceived constraints and statistically significant determinants provide complementary insights into farmers' insurance adoption behaviour. The study recommends introducing flexible premium payment options, improving transparency in insurance administration and claims settlement, expanding insurance coverage, and strengthening farmer-based organizations to enhance voluntary agricultural insurance uptake among rice farmers in Nigeria.

Keywords: agricultural insurance, binary logistic regression, Garrett's ranking technique, Nigeria, constraints

INTRODUCTION

In Nigeria, awareness of agricultural insurance is relatively widespread, largely through the activities of the Nigerian Agricultural Insurance Corporation (NAIC) and its integration with government credit and input support programmes. Most rice farmers in Nigeria are familiar with agricultural insurance and have been exposed to it through automatic enrolment linked to government or sponsored interventions. Despite this

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level of awareness and exposure, voluntary uptake of agricultural insurance remains remarkably low (Olajide-Adedamola and Akinbile, 2019) and also voluntary Agricultural insurance coverage among Nigerian farmers has been reported to be below 5% (Obasoro et al., 2016). As a result, many farmers remain highly vulnerable to production risks, where a single climatic event, pest outbreak, or disease incidence can significantly reduce farm income and threaten household livelihoods.

The persistence of low voluntary participation suggests a disconnect between awareness and adoption. Although many farmers are insured through compulsory arrangements attached to government credit schemes, they often exhibit limited engagement with the insurance product itself (Baba et al., 2024). Furthermore, when insured losses occur, farmers frequently fail to submit claims because of their inadequate understanding of policy provisions, claim procedures, and insurance benefits, reflecting substantial information asymmetries (Eforuoku et al., 2023). Religious and ethical concerns have also been identified as barriers to insurance participation among some farming households (Olajide-Adedamola and Akinbile, 2019). Importantly, previous exposure to compulsory insurance does not necessarily translate into subsequent voluntary purchase decisions, indicating that automatic enrolment alone is insufficient to generate sustained demand for agricultural insurance (Nwankwo and Ajemunigbohun, 2023). Consequently, a perception-to-,decision gap persists in which farmers recognize the existence of agricultural insurance but do not independently choose to participate in it.

Empirical evidence further suggests that insurance decisions are influenced not only by risk perceptions but also by structural and institutional factors. For instance, Wąs and Kobus (2018) found that farm size, educational attainment, and previous subsidy experience significantly impacted crop insurance utilization among Polish farmers. Their findings demonstrate that insurance uptake is shaped by a combination of socioeconomic characteristics, institutional arrangements, and policy incentives.

Despite growing interest in agricultural insurance in developing countries, existing studies in Nigeria largely examined either the determinants of insurance adoption or the constraints to participation in isolation. Previous studies (Eforuoku et al., 2023; Baba et al., 2024; Okpukpara et al., 2020; Nwankwo and Ajemunigbohun, 2023) have contributed substantially to understanding farmers' adoption behaviour and the challenges associated with insurance participation. However, little empirical attention has been given to whether farmers' perceived constraints correspond with the factors that statistically influence uptake decisions. This represents an important knowledge gap because perceived barriers may not necessarily align with the actual determinants of adoption identified through econometric analysis.

To address this gap, this study adopts an integrated analytical framework combining Garrett's ranking technique and binary logistic regression to examine voluntary agricultural insurance uptake among rice farmers in Kwara State, Nigeria. The main aim of the study is to examine the socio-economic and institutional determinants of voluntary agricultural insurance uptake while identifying and ranking the major perceived constraints influencing farmers' participation in agricultural insurance. Specifically, the study seeks to: (i) identify the socio-economic and institutional factors influencing voluntary agricultural insurance uptake using binary logistic regression; (ii) identify and rank the major perceived constraints to agricultural insurance uptake using Garrett's ranking technique; and (iii) draw policy implications for improving voluntary agricultural insurance uptake among rice farmers. By integrating perception-based ranking with econometric modelling, the study provides complementary insights into both farmers' perceived constraints and the factors influencing their actual participation decisions, thereby generating evidence to support the design of targeted agricultural risk management policies in Nigeria and other Sub-Saharan African countries.

The remainder of this paper is organised as follows. Section 2 describes the materials and methods, including the study area, sampling procedure, data collection, and analytical techniques. Section 3 presents the empirical results and discusses the findings in relation to previous empirical studies. Finally, Section 4 concludes the paper by highlighting the major findings, policy implications.

Research hypothesis

Null hypothesis (H_0): None of the socio-economic and institutional factors included in the logistic regression model significantly influences the probability of voluntary agricultural insurance uptake among rice farmers.

MATERIALS AND METHODS

The study was conducted in Edu Local Government Area (LGA) of Kwara State, Nigeria. Edu LGA is located in the northern part of Kwara State, within the Guinea Savanna agro-ecological zone. It lies approximately between Latitudes 8°45'N and 9°15'N and Longitudes 4°30'E and 5°15'E. Edu LGA has its headquarters in Lafiagi. The Area is bounded by Pategi LGA to the north, Moro LGA to the west, Ifelodun LGA to the south, and the River Niger in Niger State to the east. According to the 2006 National Population Census, Edu LGA had a population of 201,642 people. The National Population Commission projected the population at 265,400 for 2016, at an annual growth rate of 3.2%. The area is predominantly rural with farming communities spread across districts such as Lafiagi, Tsaragi, Shonga, and Bacita. Agriculture is the main economic activity, engaging over 80% of the population. Edu LGA is one of the major rice-producing areas in Kwara State due to its extensive floodplains along the River Niger and its tributaries. The area has a comparative advantage in lowland rice cultivation, supported by irrigation facilities around Bacita and seasonal flooding. The area experiences a tropical wet and dry climate with mean annual rainfall of 1000–1500 mm, between April and October. The dry season lasts from November to March. Mean temperatures range from 25°C to 32°C. Soils are predominantly hydromorphic and alluvial along the floodplains.

Edu LGA was a major beneficiary of the Central Bank of Nigeria's Anchor Borrowers' Programme (ABP) for rice. Under ABP, agricultural insurance was compulsory for loan beneficiaries, providing farmers with prior exposure to formal insurance. Edu LGA was purposively selected due to its status as a rice hub in Kwara State, the high concentration of ABP beneficiaries, and reported low voluntary uptake of agricultural insurance post-ABP, despite high production levels.

Sampling and sample size

The target population comprised all registered rice farmers under the Rice Farmers Association of Nigeria (RIFAN), Edu Local Government Area (LGA) chapter, who cultivated rice during the 2023/2024 production season. RIFAN serves as the sole implementing association for the Anchor Borrowers' Programme (ABP) for rice farmers in Edu LGA and therefore provided the sampling frame for both ABP beneficiaries and non-beneficiaries.

A stratified random sampling technique was employed. The population was stratified into two mutually exclusive groups based on participation in the ABP:

- Stratum 1: ABP beneficiaries (825 farmers) who received CBN input loans and compulsory insurance coverage.
- Stratum 2: Non-ABP beneficiaries (1,442 farmers) who did not participate in the ABP but were registered members of RIFAN.

The total sampling frame (N) was 2,267 rice farmers. The sample size was determined using the Yamane (1967) formula:

$$n = \frac{N}{1 + N(e^2)}$$

$$\frac{2267}{1 + 2267\ (0.05^2)} = 340$$

Rather than adopting proportional allocation, the study employed an equal allocation strategy by selecting 170 respondents from each stratum. This approach ensured adequate representation of both strata in the sample and provided sufficient observations within each stratum for reliable estimation of the binary logistic regression model. Equal allocation in stratified sampling is an accepted sampling design when adequate representation of all strata is required for robust statistical analysis, even when the strata differ in size (Cochran, 1977; Lohr, 2021).

Lists of eligible rice farmers were obtained from the RIFAN Edu LGA register. Each eligible farmer was assigned a unique identification number, and 170 respondents were selected independently from each stratum using a computer-generated simple random sampling procedure without replacement. A total of 340 structured questionnaires were administered and successfully retrieved, representing a 100% response rate. Primary data were collected using a structured questionnaire. Two analytical tools were employed to achieve the study objectives: Garrett's ranking technique and binary logistic regression. Garrett's ranking technique was employed to identify and rank farmers' perceived constraints to voluntary agricultural insurance uptake, while binary logistic regression was used to examine the socio-economic and institutional factors influencing voluntary agricultural insurance uptake.

Respondents were asked to rank pre-identified constraints from the most severe to the least severe. The ranks were converted into percent positions using the formula:

$$\text{percent position} = \frac{100\ (R_{ij} - 0.5)}{N_j}$$

where R_{ij} is the rank assigned to the ith constraint by the jth respondent, and N_j is the number of constraints ranked. The percent positions were then converted into scores using Garrett's conversion table. The mean score for each constraint was computed, and constraints were ranked in descending order of mean scores.

Binary logistic regression was used to estimate the determinants of willingness to purchase agricultural insurance. The dependent variable *Y* takes the value 1 if a farmer is willing to purchase agricultural insurance in the subsequent season excluding ABP compulsory insurance coverage, and 0 otherwise.

Model specification

$$\text{logit}(P_i) = ln\ (\frac{P_i}{1 - P_i}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \\ + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11}$$

P_i = {1 *if willing to uptake insurance*; 0 *otherwise*}
$\beta_0 - \beta_{11}$ = logit coefficients
X_1 – education (years)
X_2 – farming experience (years)
X_3 – association membership (years)
X_4 – farm size (Ha)
X_5 – extension contact (number of times)
X_6 – farm income (N)
X_7 – risk experience (years)
X_8 – trust in insurance company (Yes or No)
X_9 – high premium cost (Yes or No)
X_{10} – knowledge of insurance policy (Yes or No)
X_{11} – age (years)

RESULTS AND DISCUSSIONS

Table 1 presents the results of Garrett's ranking analysis used to determine and prioritize the constraints affecting agricultural insurance adoption among farmers. The constraints were ranked based on their mean Garrett scores derived from respondents' rankings, with higher mean values indicating more severe constraints. This approach allows for the transformation of ordinal rankings into quantitative scores, thereby providing a more reliable basis for comparison across different constraints. The ranked constraints highlight the most and least significant factors influencing farmers' participation in agricultural insurance schemes in the study area.

Table 1. Result of Garret ranking of contraints

Constraints	Mean Score	Rank
Inflexible premium	51.80	1
Lack of trust in insurance companies	50.50	2
Low farm income	50.39	3
Narrow insurance coverage	50.20	4
High premium cost	49.99	5
Inadequate insurance education	49.94	6
Complex documentation	49.90	7
Delay in claim settlement	49.67	8
Limited access to insurance agents	48.92	9
Poor awareness	48.70	10

Source: authors analysis computation.

An inflexible premium structure ranked 1 (Mean = 51.80) is the most severe constraint affecting farmers' willingness to uptake agricultural insurance voluntarily. This indicates that farmers perceive premium payment systems as not well adapted to their seasonal income patterns. This finding is consistent with Baba et al. (2024), who reported that affordability and financial constraints significantly influence the adoption of agricultural insurance among Nigeria's crop farmers. Similarly, Eforuoku et al. (2018) found that payment structure and affordability are key determinants of farmers' utilization of agricultural insurance schemes.

The second ranked constraint, lack of trust in insurance companies (Mean = 50.50), reflects concerns about the reliability and performance of insurance providers. Farmers' trust issues are often linked to perceptions of poor service delivery and claim settlement experiences. This aligns with Ehiogu and Chidiebere-Mark (2019), who noted that institutional challenges, including weak trust in insurance systems, hinder the development of agricultural insurance markets in Nigeria.

The third constraint, low farm income (Mean = 50.39), highlights the economic limitation faced by farmers. Low incomes reduce farmers' ability to pay insurance premiums and invest in risk management tools. This is supported by Madaki et al. (2023), who observed that financial constraints remain a major barrier to the adoption of agricultural insurance as a climate risk adaptation strategy in developing countries. The fourth constraint, narrow insurance coverage (mean = 50.20), suggests that farmers perceive existing insurance products as limited in scope. Okpukpara et al. (2020) reported that limited coverage and design issues reduce farmers' access to and satisfaction with agricultural insurance schemes in Nigeria.

The fifth ranked constraint, high premium cost (mean = 49.99), further confirms that affordability remains a key challenge. Obasoro et al. (2016) found that farmers' willingness to pay for agricultural insurance is influenced by premium levels, with higher costs discouraging participation.

Constraints such as inadequate insurance education is ranked 6th and complex documentation Ranked 7 indicates informational and procedural barriers. These findings align with Nwankwo and Ajemunigbohun (2023), who highlighted that behavioural and knowledge-related constraints, including low awareness and administrative complexity, limit insurance uptake among farmers.

The eighth constraint which is delay in claim settlement, reflects concerns about service efficiency. Delayed compensation usually reduces confidence in insurance schemes. This is consistent with Ehiogu and Chidiebere-Mark (2019), who emphasized that inefficiencies in claim processing weakens trust and reduce effectiveness of agricultural insurance systems.

Finally, limited access to insurance agents (Rank 9) and poor awareness (Rank 10) were the least ranked constraints, but they still indicate gaps in outreach and service delivery. These findings suggest that although awareness exists, accessibility and engagement mechanisms may still be inadequate in rural areas.

Table 2 shows the variance inflation factor (VIF) result. These results indicate that multicollinearity is not a concern in the model. All VIF values are well below the commonly accepted threshold of 5.0 (and even below the more conservative threshold of 3.0), while all tolerance values exceed 0.10, suggesting that the explanatory variables do not exhibit problematic linear dependence.

Table 2. Variance Inflation Factor (VIF) results

Variable	VIF	Tolerance (1/VIF)
Age	2.126	0.470
Years of education	1.054	0.949
Farming experience	2.418	0.414
Membership	1.397	0.716
Farm size	1.236	0.809
Extension contact	1.181	0.847
Farm income	1.145	0.873
Risk experience	1.286	0.778
Trust in insurance	1.215	0.823
High premium	1.620	0.617

Source: own elaboration.

Prior to estimating the binary logistic regression model, multicollinearity among the explanatory variables was assessed using the variance inflation factor (VIF). The results showed that VIF values ranged from 1.05 to 2.42, with a mean VIF of 1.45, while tolerance values ranged from 0.41 to 0.95. Since all VIF values were well below the commonly accepted threshold of 5.0, multicollinearity was not considered a problem in the model (Gujarati and Porter, 2009).

Table 3 presents the results of logit estimates, odds ratios and average marginal effects of determinants of farmers' willingness to patronize agricultural insurance. The model estimates the effect of selected socioeconomic, institutional, and perception-related variables on the likelihood of up taking agricultural insurance. The coefficients are expressed in log-odds, indicating the direction and magnitude of influence of each predictor on the probability of willingness to uptake agricultural insurance. Positive coefficients suggest an increase in the likelihood of adoption, while negative coefficients indicate a reduction. Statistical significance is assessed using p-values at conventional levels. The results therefore provide insight into the key factors that significantly influence farmers' insurance adoption decisions in the study area. Education has a significant negative relationship ($\beta = -0.0603$, $p < 0.05$) with willingness to participate. This implies that an increase in years of education decreases the likelihood of participating in agricultural insurance. The odds ratio (0.942) suggests that a one-unit increase in education reduces

Table 3. Logit Estimates, Odds Ratios and Average Marginal Effects of Determinants of Farmers' Willingness to Patronize Agricultural Insurance

Variable	Coefficient (β)	Std. error	*z*-value	Odds ratio	AME (*dy*/*dx*)	*p*-value
Constant	0.4821	0.8010	0.602	1.619	–	0.547
Age	–0.0087	0.0154	–0.563	0.991	–0.0020	0.573
Years of education	–0.0603**	0.0291	–2.069	0.942	–0.0137**	0.034
Farm experience	–0.0117	0.0158	–0.739	0.988	–0.0026	0.458
Membership	0.1088***	0.0270	4.034	1.115	0.0247***	0.000
Farm size	0.1151	0.2740	0.420	1.122	0.0261	0.674
Extension contact	–0.0301	0.0592	–0.509	0.970	–0.0068	0.610
Farm income	–0.0000	0.0000	–1.316	1.000	–0.00000042	0.185
Risk experience	–0.2125	0.1807	–1.176	0.809	–0.0482	0.236
Trust insurance company	0.6134	0.3842	1.596	1.847	0.1392	0.105
High premium cost	0.1644	0.2886	0.570	1.179	0.0373	0.568
Knowledge of insurance	–0.0742	0.2616	–0.284	0.928	–0.0168	0.777
Log-Likelihood	–218.83					
LR Chi-square	33.68					
Prob > Chi-square	0.0004					
McFadden Pseudo R^2	0.071					
AIC	461.67					
Number of observations	340					

Significant at *** 1%, ** 5%.
Source: own elaboration.

the odds of participation by about 5.8%. Membership of association (β = 0.1088, $p < 0.001$) is positive and significantly influences willingness to participate. The odds ratio (1.115) indicates that farmers who belong to associations are approximately 11.5 times more likely to participate in agricultural insurance compared to non-members.

The negative relationship between education and willingness to take out agricultural insurance in this study can be explained by the contextual realities of agricultural insurance markets in Nigeria, where education does not necessarily translate into higher uptake. Empirical evidence suggests that although education may enhance awareness, it does not eliminate structural and institutional constraints that discourage participation. This concurred with Madaki et al. (2023), who found that while education improves awareness and initial consideration of agricultural insurance, factors such as trust in insurance providers, perceived effectiveness, and institutional reliability play a more decisive role in uptake decisions. Similarly, Olajide-Adedamola and Akinbile (2019) reported that even among informed farmers, adoption remains low due to procedural complexity, accessibility challenges, and limited confidence in insurance systems. Baba et al. (2024) further emphasized that agricultural insurance adoption is influenced not only by socio-economic characteristics such as education but also by extension access and institutional support systems. These findings imply that more educated farmers may exhibit greater critical evaluation of institutional inefficiencies and risk exposure in insurance markets, thereby reducing their willingness to subscribe. The average marginal effect (AME = –0.0137; $p < 0.05$) also implies that additional year of formal education reduces

the probability of willingness to use agricultural insurance by 1.37 percentage points.

The positive and significant effect of cooperative membership on willingness to adopt agricultural insurance indicates that social capital plays a crucial role in reducing barriers to insurance uptake among farmers. Farmers who belong to associations are more likely to adopt agricultural insurance due to improved access to information, shared experiences, and reduced uncertainty regarding insurance products. This finding is consistent with Madaki et al. (2023), who identified low awareness and weak trust in agricultural insurance systems as major constraints to adoption in Nigeria. Accordingly, the result suggests that farmer organizations help to address these constraints by enhancing information dissemination and strengthening trust in insurance schemes, thereby increasing the likelihood of adoption. The average marginal effect (AME = 0.0247; $p < 0.01$) indicates that an additional year of membership in a farmer association increases the probability of willingness to patronize agricultural insurance by approximately 2.47 percentage points. Consequently, farmers with longer membership duration are more likely to appreciate the benefits of agricultural insurance and exhibit greater willingness to patronize insurance schemes.

Although trust in insurance providers exhibited a relatively large positive marginal effect (AME = 0.1392), its coefficient was not statistically significant after controlling for other explanatory variables. This suggests that while trust is perceived by farmers as an important consideration, its independent effect on actual participation is outweighed by other socio-economic and institutional factors. Similarly, age, farming experience, farm size, extension contact, farm income, risk experience, perceived high premium cost, and knowledge of insurance were not statistically significant. This finding implies that these factors may influence insurance decisions indirectly or through interactions with other institutional characteristics rather than exerting a direct effect on voluntary insurance uptake.

Although only education and association membership were statistically significant, the remaining variables were retained because they are theoretically important determinants of insurance uptake identified in previous empirical studies. Logistic regression estimates the independent contribution of each predictor while controlling for the effects of the others; therefore, non-significant coefficients do not necessarily imply that these variables lack practical relevance.

The likelihood ratio (LR) chi-square statistic was 33.68 and was significant at the 1% level ($p = 0.0004$). This indicates that the explanatory variables included in the model jointly exert a significant influence on farmers' willingness to patronize agricultural insurance. The relatively low pseudo R^2 is not unusual in cross-sectional studies involving behavioural decisions. Farmers' willingness to patronize agricultural insurance is influenced by numerous psychological, institutional, and contextual factors that may not be fully captured by the explanatory variables included in the model. The McFadden pseudo R^2 of 0.071 indicates that the explanatory variables account for a modest proportion of the variation in farmers' voluntary agricultural insurance uptake. Unlike the coefficient of determination (R^2) in ordinary least squares regression, pseudo R^2 values in binary logistic regression are generally much lower and should not be interpreted using the same criteria. Consequently, the statistical significance of individual predictors, the likelihood ratio test, and the direction of estimated coefficients provide more meaningful measures of model performance than the magnitude of the pseudo R^2 alone (Hosmer et al., 2013).

Garrett's ranking technique and binary logistic regression provide complementary perspectives on agricultural insurance uptake. While the Garrett analysis identifies the constraints, farmers perceive as most important, the logistic regression identifies the factors that significantly influence actual participation after controlling for other explanatory variables. The differences between the two findings suggest that farmers' perceptions do not always translate directly into adoption behaviour, highlighting the importance of combining perception-based and econometric approaches to better understand insurance decisions.

CONCLUSION

This study contributes to the literature by integrating econometric modelling and perception-based ranking to examine both the determinants of insurance uptake and the severity of perceived constraints within a unified analytical framework. The findings indicate that farmers perceive financial and institutional factors including inflexible premium payment structures, lack of trust in insurance providers, low farm income, and limited insurance coverage as the major constraints to voluntary agricultural

insurance uptake. In contrast, the binary logistic regression analysis revealed that years of education and cooperative membership were the only significant determinants of actual participation decisions. These findings suggest that perceived barriers and statistically significant determinants capture different but complementary dimensions of farmers' insurance adoption behaviour. While Garrett's ranking technique identifies the challenges farmers consider most important, the logistic regression identifies the socio-economic characteristics that significantly influence their actual participation decisions.

Based on the binary logistic regression results, the study rejects the null hypothesis that socio-economic variables and institutional factors have no significant effect on voluntary agricultural insurance uptake among rice farmers. The significant effects of years of education and cooperative membership demonstrate that selected socio-economic and institutional factors influence farmers' participation decisions.

Policy efforts should therefore focus on improving the flexibility of premium payment structures, strengthening trust in insurance institutions through transparent and timely claim settlement, and making insurance products more affordable and accessible. In addition, strengthening farmer cooperatives can improve access to information, build confidence in insurance schemes, and encourage greater participation in agricultural insurance programmes.

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