

Research Article

Factors Influencing the Socio-economic Characteristics of Rice-farming Households on the Probability of Operating Large Farms in Northwest Nigeria: Evidence from an Ordered Logit Model

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Abstract

This study examined factors influencing socio-economic characteristics of rice-farming households on the probability of operating large farm sizes in Northwest Nigeria. Multistage sampling procedure was used to select 387 rice-farming households from Kano, Kebbi, and Jigawa States. Primary data were collected with the use of a structured questionnaire. Farm size was categorised into small (0.1–1.99 ha), medium (2.00–4.99 ha), and large (5.00 ha and above) holdings. Descriptive statistics and an Ordered Logit model to analyse the data. The results showed that 69.0% of the households operated small farms, 23.0% operated medium farms, while 8.0% operated large farms, with a mean farm size of 1.45 ha. The Ordered Logit model revealed that sex ($\beta = 1.05$; $p < 0.01$), household size ($\beta = 0.29$; $p < 0.05$), and land tenure security ($\beta = 0.65$; $p < 0.01$) had significant positive effects on the likelihood of operating larger farm sizes. The findings indicate that household characteristics and security of land tenure are important determinants of farm-size category among rice-farming households. The study concluded that improving land tenure security and strengthening farmers' access to productive resources could increase the likelihood of rice-farming households operating larger and more economically viable farm holdings. It recommended policies that enhance secure access to agricultural land, promote efficient land utilisation, and improve access to productive resources for rice-farming households in Northwest Nigeria.

Keywords: Rice-farming households; Large farms; Socio-economic characteristics; Northwest Nigeria.

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1. INTRODUCTION

Farm size is an important structural characteristic of agricultural production because it influences the scale of production, choice and adoption of technologies, input utilisation, labour requirements, access to agricultural credit, and farm income. Farmers operating larger holdings generally have greater opportunities to expand production and spread fixed production costs over a larger area (Hao et al., 2025). However, the ability of farming households to acquire and retain larger parcels of agricultural land is not determined by land availability alone. Household characteristics, economic resources, institutional arrangements, and access to productive assets can influence the farm-size category in which a household operates. Understanding these factors is therefore important for designing policies aimed at improving agricultural productivity and promoting sustainable farm expansion.

In Nigeria, agricultural land is characterised by differences in access, ownership, inheritance, leasing arrangements, and tenure security (Nara et al., 2021). These factors can contribute to differences in farm size among farming households. Household

demographic characteristics may also influence farm-size decisions. For instance, household size can affect the availability of family labour and the capacity of a household to cultivate additional land. Similarly, gender differences in access to land, credit, labour, and other productive resources may affect the ability of male- and female-headed households to operate larger farms (Daudu et al., 2026). Farming experience, education, access to credit, extension contact, and other socio-economic characteristics may likewise influence farmers' capacity to acquire resources, make production decisions, and expand their farm holdings.

The issue is particularly important in Northwest Nigeria, where rice farming constitutes an important agricultural activity and provides a major source of livelihood for rural households. Kano, Kebbi, and Jigawa States are among the important rice-producing areas in the region. However, rice-farming households operate farms of different sizes, ranging from relatively small holdings to larger commercial-oriented farms. Differences in farm size may reflect variations in household characteristics, access to productive resources, land tenure arrangements, and farmers' capacity to mobilise resources for agricultural production. Consequently, identifying the factors associated with the probability of operating a larger farm is essential for understanding the structural conditions affecting rice production in the region.

Although previous studies (Enyew & Gobie, 2025) have examined agricultural productivity, access to credit, landholding patterns, and the socio-economic characteristics of farmers in Nigeria, relatively limited attention has been given to the factors influencing the probability of rice-farming households moving across different farm-size categories, particularly in Northwest Nigeria. Much of the existing literature treats farm size as a continuous variable, thereby overlooking the ordered nature of farm-size categories. In reality, farm holdings can be classified into small, medium, and large categories, and movement from one category to another represents an ordered outcome. Analysing farm size in this manner provides useful information on the characteristics associated with the likelihood of operating a larger farm. The Ordered Logit model provides an appropriate analytical framework for this purpose because the dependent variable consists of farm-size categories that have a natural order from small to medium and large holdings. The model makes it possible to estimate how household characteristics and other relevant factors influence the probability that a rice-farming household belongs to a higher farm-size category. Such evidence is useful for identifying the characteristics and institutional conditions that may facilitate or constrain farm expansion among rice-farming households.

Against this background, this study examines the determinants of the probability of operating large farm sizes among rice-farming households in Northwest Nigeria, using an Ordered Logit model. Specifically, the study identifies the socio-economic and institutional characteristics associated with farm-size distribution and assesses their influence on the likelihood that a rice-farming household operates a larger farm. The findings are expected to provide empirical evidence for policies and programmes aimed at improving farmers' access to land and productive resources, strengthening land tenure security, and promoting efficient and sustainable expansion of rice-farm holdings in Northwest Nigeria.

2. MATERIALS AND METHODS

Study Area

The study was conducted in Northwest Nigeria, comprising Kano, Katsina, Kaduna, Kebbi, Jigawa, Sokoto, and Zamfara States. The region lies between latitudes 10°N and 13°N and longitudes 4°E and 9°E, covering approximately 216,956 km², which represents



about 24% of Nigeria’s total land area (Amfani, 2018, and National Bureau of Statistics (NBS), 2021). The climate is characterised by distinct wet and dry seasons, with annual rainfall ranging from 600 to 1,200 mm and temperatures reaching about 40°C during the dry season (Steve Hatfield-Dodds, 2007). Agriculture is the dominant economic activity, with rice, maize, sorghum, millet, and cowpea being the major food crops, alongside livestock production (Abel & Chukwuka, 2024). The region is one of Nigeria’s principal rice-producing zones but continues to face challenges such as limited access to agricultural finance, poverty, and insecurity, which have implications for agricultural production and farmers' access to credit.

Sampling Procedure and Data Collection

The sample size was determined using Cochran (1977) formula for an unknown population at a 95% confidence level and a 5% margin of error, which yielded a minimum sample size of 387 rice farming households. Multistage sampling procedure was used to select the households, with the first stage involving a purposive selection of Kano, Kebbi, and Jigawa States. Finally, simple random sampling was used to select 43 rice-farming households from each community, giving a total sample of 387 respondents(Table 1).

Table 1: Questionnaire Distribution (n = 387)

State	Selected ADP Zone	Community	Sample Size
Kano	Kano South	Kura	43
		Bunkure	43
		Garyn Malam	43
		Total	129
Kebbi	Argungu	Bunza	43
		Zagga Bagudo	43
		Dakingari Suru	43
		Total	129
Jigawa	Hadejia	Guri	43
		Kafin Hausa	43
		Jahun	43
		Total	129
Grand Total			387

Source: Field Survey, data 2025

Demographic characteristics such as age, gender, education, and farm size were obtained using a structured questionnaire. To obtain information on access to agricultural credit, Focus Group Discussions (FGDs) were held with rice farmers. Information about the institutional factors was obtained through Key Information Interviews (KIIs)

Analytical Technique

The Ordered Logit model was employed to analyse the factors influencing farm-size distribution because the dependent variable comprises inherently ordered categories: small-scale (0.10–1.99 ha), medium-scale (2.00–4.99 ha), and large-scale (≥5.00 ha). The model was considered appropriate because it preserves the ranking information contained in the dependent variable and has been widely applied to empirical studies involving ordered outcomes(Jambo and Mukanyau, 2025). The observed ordinal outcome is determined as:The dependent variable for farm size distribution was defined as:

- F₁ = Small farm size (0.1 – 1.999ha)
- F₂ = Medium farm size (2.00 – 4.999ha)
- F₃ = Large farm size (≥ 5.00ha)

The latent variable of the ordered logit model was specified as;

$$F_i^* = \beta_0 + \beta_1 b_1 + \beta_2 b_2 + \beta_3 b_3 + \beta_4 b_4 + \beta_5 b_5 + \beta_6 b_6 + \beta_7 b_7 + \beta_8 b_8 + \beta_9 b_9 + \beta_{10} b_{10} + \beta_{11} b_{11} + \beta_{12} b_{12} + \beta_{13} b_{13} + \epsilon_i \dots\dots\dots (1)$$

The observed farm size categories were expressed as;

$$F_i = \begin{cases} 1, & \text{if } F_i \leq \mu_1 \\ 2, & \text{if } \mu_1 < F_i \leq \mu_2 \\ 3, & \text{If } F_i > \mu_3 \end{cases}$$

Where;

F_i = latent variable representing the probability of a household operating in a large farm size category.

F_i = Observed farm size category

$F_i = 1$ represents a small farm size

$F_i = 2$ represents a medium farm size

$F_i = 3$ represents a large farm size

μ_1 and μ_2 = threshold (cut-points) parameter to be estimated

β_0 = Constant

$\beta_1 - \beta_{13}$ = Coefficients of explanatory variables

ϵ_i = stochastic error term assumed to follow a logistic distribution

The explanatory variable included in the model was defined as follows;

b_1 = Age of household head (years)

b_2 = Sex (male = 1, female = 0)

b_3 = Access to agricultural credit (yes = 1, no = 0)

b_4 = Contact to extension agent (yes = 1, no = 0)

b_5 = Cooperative membership (yes = 1, no = 0)

b_6 = Educational level (none = 0, primary = 1, secondary = 2, tertiary = 3)

b_7 = Household size (number of household members)

b_8 = Off-farm income (₦)

b_9 = Farming experience (years)

b_{10} = Distance to market (km)

b_{11} = Total rice output harvested per year (kg)

b_{12} = Collateral requirement (yes = 1, no = 0)

b_{13} = Land tenure security (secured title = 1, otherwise = 0)

The cumulative probability function for the Ordered Logit model is specified as follows:

$$P(F_i \leq j) = \frac{1}{1 + e^{-Z_i - X_i \beta}} \dots\dots\dots (2)$$

Where;

$J = 1, 2, \dots\dots\dots J-1$

Apriori expectation was that b_1 to $b_{11} > 0$, b_{12} to $b_{13} < 0$.

3. RESULTS AND DISCUSSION

Socioeconomic Characteristics of the Respondents

The socioeconomic characteristics show that most respondents were within the economically active age group. About 30.5% were aged 51 years and above, while 27.4% and 25.3% were within the 21-30 and 31-40 age brackets, respectively. The mean age index of 3.40 (SD = 1.272) indicates a predominantly economically active farming population, consistent with Sadiq et al., (2022), who reported that rice farmers in Nigeria largely fall within the productive age range.

Educational attainment indicates that 38.2% of respondents had secondary education, 37.7% had primary education, 18.6% had no formal education, and 5.5% had tertiary

education. The mean educational index of 1.30 (SD = 0.833) suggests that most farmers had basic formal education. This finding is consistent with Muhammad et al. (2025), who reported that Nigerian smallholder rice farmers predominantly possess primary or secondary education.

Household size was relatively large, with 45.5% of respondents having 6–10 members and 27.9% having 11–15 members, while 15.5% and 11.1% had 0–5 and 16–20 members, respectively. The mean household-size index was 2.35. The predominance of medium-to-large households suggests considerable availability of family labour, which remains important in rural agrarian economies where mechanisation is limited. This finding agrees with Olaitan et al. (2025), who reported that rice-farming households in Nigeria are predominantly characterised by medium-to-large household sizes.

Farming experience was relatively high, as 41.9% of respondents had at least 16 years of experience, 31.8% had 6–10 years, 17.3% had 11–15 years, and 9.0% had less than five years. The mean experience index of 2.92 (SD = 1.046) indicates substantial accumulated production knowledge and managerial experience among respondents. Such experience can enhance production decisions, input utilisation, and adaptive capacity. This is consistent with Amadi et al. (2026), who found that farming experience improved total factor productivity among Nigerian rice farmers through enhanced production efficiency and input utilisation.

Rice output was concentrated in the medium and high categories: 23.3% of respondents produced below 1,000 kg, 42.1% produced 1,000–4,999 kg, and 34.6% produced at least 5,000 kg. The mean output index of 2.11 (SD = 0.759) indicates a concentration in the medium- and high-output categories. This pattern suggests that a substantial proportion of rice farmers operate beyond purely subsistence production, potentially reflecting access to productive resources such as land, labour, improved seed, fertilizer, mechanisation, and credit. The finding is supported by Vihi et al. (2024), who established that improved seed, fertilizer, and pesticides significantly influence rice productivity among Nigerian farmers.

Access to extension services was relatively high, with 88.1% of respondents reporting contact with extension agents compared with 11.9% without contact. This contrasts with Effiong et al. (2023), who reported that 77.5% of cassava farmers in Anambra State lacked extension contact, and Solomon (2018), who found that 85.83% of smallholder farmers in Bayelsa State had no access to extension services. The relatively high extension coverage observed in the study area may enhance farmers' access to technical information and improved production practices.

Cooperative membership was also high, with 81.4% of respondents belonging to cooperative societies compared with 18.6% who did not. This indicates the importance of collective action and social capital within the rice-farming system. Cooperatives can facilitate access to credit, inputs, training, and markets, thereby reducing some of the transaction and information constraints faced by smallholders. The finding is consistent with Kehinde et al. (2025), who reported that cooperative participation improves income stability and reduces poverty among Nigerian smallholder farmers.

Regarding collateral requirements, only 5.7% of respondents reported that collateral was required to obtain agricultural credit, whereas 94.3% accessed credit without collateral requirements. The low incidence of collateral requirements may reflect the importance of informal and cooperative-based lending arrangements, where physical collateral is often substituted with social trust, group guarantees, or membership obligations. This is

particularly relevant to smallholders who may lack formal land titles and other pledgeable assets. The finding supports Simons-Cappa et al. (2026), who observed that informal lending institutions contribute to rural financial inclusion through flexible collateral conditions. Table 2 shows the socioeconomic characteristics of respondents.

Table 2: Socioeconomic Characteristics of Respondents

Variable	Frequency	%	Mean ($\bar{x}$)	Std. Dev
Age(years)			3.40	1.272
Below 20	14	3.6		
21-30	106	27.4		
31-40	98	25.3		
41-50	51	13.2		
Above 51	118	30.5		
Sex				
Male	275	71.1		
Female	112	28.9		
Education Level				
No Formal Education	72	18.6		
Primary Education	146	37.7		
Secondary Education	148	38.2		
Tertiary Education	21	5.5		
Household Size			2.35	0.872
1 - 5	60	15.5		
6 - 10	176	45.5		
11- 15	108	27.9		
16 – 20	43	11.1		
Farming Experience (Years)			2.92	1.046
Below 5	35	9.0		
6 – 10	123	31.8		
11 – 15	67	17.3		
≥16	162	41.9		
Total Rice Output(kg)			2.11	0.759
Below 1,000	90	23.3		
1,000 – 4,999	163	42.1		
≥5,000	134	34.6		
Access to Extension				
Extension Contact	341	88.1		
Non-Contact	46	11.9		
Cooperative Membership				
Cooperative Member	315	81.4		
Non-member	72	18.6		
Off-farm Income(₦)				
No off-farm income	116	30.0		
Below 100,000	153	39.5		
Above 100,00	118	30.5		
Agricultural Credit Access				
Access	337	87.1		
Non-access	50	12.9		
Collateral Requirement				
Use Collateral	22	5.7		
No Collateral	365	94.3		

Source: Field Survey, 2025

Determinants of Farm Size Category - Odds Ratio Estimates for the Ordered Logit Analysis

The odds ratios from the Ordered Logit model indicate how the explanatory variables affect the cumulative odds of rice-farming households being in a higher farm-size category. An odds ratio (OR) greater than one indicates an increased likelihood of occupying a higher category, whereas an OR below one indicates a reduced likelihood.

The model was statistically significant (LR $\chi^2 = 65.65$; $p < 0.01$), confirming that the explanatory variables jointly influenced farm-size distribution among rice-farming households in Northwest Nigeria.

Sex had a positive and highly significant effect (OR = 2.844; $p < 0.01$), indicating that male farmers had approximately 2.8 times higher cumulative odds of being in a higher farm-size category than female farmers. This may reflect gender disparities in access to land, labour, capital, and farm expansion opportunities under customary tenure arrangements. The finding agrees with Adenegan (2013) and Hamidu (2025), who reported that unequal access to productive resources constrains female farmers' capacity for farm expansion and agricultural commercialisation.

Access to agricultural credit had a positive and significant effect at the 10% level (OR = 1.793), implying that farmers with credit access had approximately 1.8 times higher cumulative odds of operating within a higher farm-size category. Credit can relax financial constraints and facilitate land acquisition, labour hiring, input purchase, and farm expansion. This finding is consistent with Yuni et al., (2022), who found that credit access significantly improved farm investment decisions and expansion among rice-producing households.

Educational level was positive and significant at the 10% level (OR = 1.244), indicating that an additional level of education increased the cumulative odds of occupying a higher farm-size category by approximately 24.4%. Education can improve managerial capacity, access to information, technology adoption, and resource mobilisation, thereby supporting farm expansion. The finding is consistent with Kabiru (2019), who reported that educational attainment enhances agricultural productivity and commercialisation in Nigeria and other Sub-Saharan African countries.

Household size had a positive and significant effect at the 5% level (OR = 1.330), indicating that a unit increase in household size increased the cumulative odds of operating within a higher farm-size category by approximately 33.0%. This may be attributed to the greater availability of family labour, which reduces dependence on hired labour and facilitates cultivation of larger areas, particularly where mechanisation is limited. The result corroborates Ibrahim-Olesin et al. (2023), who identified household labour availability as an important determinant of farm expansion among rice and maize farming households in Northern Nigeria.

Total rice output had a negative and weakly significant effect at the 10% level (OR = 0.836), indicating that an increase in output reduced the cumulative odds of occupying a higher farm-size category by approximately 16.4%. This seemingly counterintuitive result may reflect productivity intensification, whereby farmers achieve higher output through improved technology, input use, and management practices without expanding cultivated land. Thus, productivity growth does not necessarily imply farm-size expansion, consistent with Byerlee et al. (2014), who highlighted the increasing role of intensification in agricultural productivity growth.

Collateral requirement had a negative and weakly significant effect ($OR = 0.382$; $p < 0.10$), implying that farmers facing collateral requirements had approximately 61.8% lower cumulative odds of occupying a higher farm-size category. This result underscores the potential constraint imposed by collateral requirements on access to agricultural finance, particularly among smallholders with limited acceptable assets. The finding supports the credit rationing perspective and is consistent with Balana and Oyeyemi (2022), who identified collateral requirements as an important constraint to agricultural investment among smallholder farmers.

Land tenure security had a positive and highly significant effect ($OR = 1.921$; $p < 0.01$), indicating that farmers with secure tenure arrangements had approximately 1.9 times higher cumulative odds of operating within a higher farm-size category. Secure land rights can reduce tenure-related uncertainty and strengthen incentives for land improvement, investment, and farm expansion. This finding agrees with Dabessa Iticha and Han (2025), who emphasised the role of tenure security in promoting agricultural investment, productivity growth, and rural transformation.

Age ($OR = 0.995$), extension contact ($OR = 0.971$), cooperative membership ($OR = 0.846$), off-farm income ($OR = 1.100$), farming experience ($OR = 0.833$), and distance to market ($OR = 0.881$) were statistically insignificant, indicating that they did not independently explain differences in farm-size categories during the study period.

Overall, the odds-ratio estimates show that sex, access to agricultural credit, education, household size, and land tenure security increased the likelihood of occupying higher farm-size categories, whereas rice output and collateral requirements reduced it. Sex and land tenure security emerged as particularly important determinants, highlighting that farm-size distribution is shaped not only by productive capacity but also by institutional factors governing access to finance, resources, and secure land rights.

Table 3: Determinants of Farm Size Category - Odds Ratio Estimates for the Ordered Logit Analysis
Variable: Farm Size Distribution Category (Small = 1, Medium = 2, Large = 3)

Variable	Odds Ratio (OR)	95% Confidence Interval	P-value
Age	0.995	0.849 - 1.168	0.955
Sex	2.844***	1.710 - 4.730	0.000
Credit Access	1.793*	0.980 - 4.730	0.058
Ext Contact	0.971	0.514 - 1.836	0.058
Coop Membership	0.846	0.485 - 1.475	0.555
Edu Level	1.244*	0.976 - 1.586	0.078
Household Size	1.330**	1.026 - 1.724	0.031
Off-farm Income	1.100	0.916 - 1.321	0.307
Farm Exp	0.833	0.656 - 1.957	0.132
Distance to Mkt	0.881	0.721 - 1.077	0.216
Total Rice Output	0.836*	0.698 - 1.001	0.051
Collateral Requirement	0.382*	0.134 - 1.089	0.072
Land Tenure Security	1.921***	1.220 - 1.024	0.005

Source: Field Survey, 2025

Determinant of Farm Size Category - Average Marginal Effects of the Explanatory Variables on the Probability of Operating a Large Farm-Size Category

Table 4 presents the Average Marginal Effects (AME) of the explanatory variables on the probability of a rice-farming household operating within the large farm-size category. The marginal effects indicate the change in the predicted probability associated with a unit change in each explanatory variable, holding other factors constant. Positive coefficients indicate an increased probability of operating a large farm, while negative coefficients indicate a reduced probability.

Sex had a positive and highly significant effect at the 1% level ($dy/dx = 0.107$), indicating that being male increased the probability of operating a large farm by approximately 10.7 percentage points. This may reflect gender disparities in access to land, labour, agricultural finance, and other productive resources that facilitate farm expansion. The finding is consistent with Charles et al. (2023), who reported that male-headed households generally operate larger farm holdings due to better access to land, capital, and commercialisation opportunities in Nigeria and Sub-Saharan Africa.

Access to agricultural credit had a positive and weakly significant effect at the 10% level ($dy/dx = 0.060$), increasing the probability of operating a large farm by approximately 6.0 percentage points. This suggests that credit access relaxes financial constraints and facilitates land acquisition, input purchase, labour hiring, and farm expansion. The finding supports Balana et al. (2022), who observed that improved access to agricultural credit facilitates investment and expansion of farm enterprises among rural households.

Educational level had a positive and weakly significant effect ($dy/dx = 0.022$; $p < 0.10$), indicating that an additional level of education increased the probability of operating a large farm by approximately 2.2 percentage points. Education may enhance managerial capacity, access to information, technology adoption, and the ability to identify profitable opportunities. This finding aligns with Padhy and Kumar (2015), who reported a positive relationship between education and farm commercialisation among Nigerian farmers.

Household size also increased the probability of operating a large farm by approximately 2.9 percentage points. This relationship may reflect the contribution of family labour to farm expansion, particularly where mechanisation is limited, and larger households can reduce dependence on hired labour. The finding is consistent with Tennhardt et al. (2024), who reported that household labour availability significantly influences farm-size and agricultural production decisions among smallholder farmers.

Total rice output had a negative and significant effect at the 5% level ($dy/dx = -0.018$), indicating that an increase in output reduced the probability of operating a large farm by approximately 1.8 percentage points. This may reflect agricultural intensification, whereby farmers achieve higher output from existing land through improved technologies, inputs, and management practices rather than through land expansion. Similar evidence was reported by Huang and Wang (2024), who showed that productivity gains can be achieved through improved technologies and management without proportional increases in farm size.

Collateral requirement had a negative and weakly significant effect at the 10% level ($dy/dx = -0.099$), reducing the probability of operating a large farm by approximately 9.9 percentage points. The result indicates that collateral constraints may restrict access to the financing required for land acquisition and farm investment, particularly among farmers

with limited acceptable assets. This finding supports Balana and Oyeyemi (2022b), who identified collateral requirements as a major constraint to agricultural financing among Nigerian smallholder farmers.

Land tenure security had a positive and highly significant effect at the 1% level ($dy/dx = 0.067$), implying that secure tenure increased the probability of operating a large farm by approximately 6.7 percentage points. Secure land rights reduce uncertainty and strengthen farmers' incentives to undertake long-term investments and expand cultivated areas. This finding is consistent with Rupert and Sherlock (2025), who reported that secure land tenure encourages agricultural investment, productivity improvement, and expansion of cultivated land.

Age, extension contact, cooperative membership, off-farm income, farming experience, and distance to market were statistically insignificant, indicating that these variables did not independently affect the probability of operating within the large farm-size category during the study period.

The marginal effects indicate that sex, access to agricultural credit, educational attainment, household size, and land tenure security increased the probability of operating large farms, whereas total rice output and collateral requirements reduced it. Sex and land tenure security exerted the strongest positive effects, highlighting the importance of gender-related resource access and secure land rights in farm expansion. The findings further suggest that farm-size growth is not necessarily synonymous with productivity growth, as higher output may be achieved through intensification rather than expansion of cultivated land.

Table 4: Determinant of Farm Size Category - Average Marginal Effects of Explanatory Variables on the Probability of Operating a Large Farm Size Category

(Dependent Variable: Probability of operating a Large Farm Size Category)

Variable	AME dy/dx	St. Error	z- value	p- value	95% Confidence Interval
Age	-0.000	0.008	-0.6	0.955	-0.017 - 0.016
Sex	0.107***	0.027	4.03	0.000	0.055 - 0.159
Credit Access	0.060*	0.032	1.90	0.057	-0.002 - 0.122
Ext. Contact	-0.003	0.033	-0.09	0.929	-0.068 - 0.062
Coop Membership	-0.017	0.029	-0.59	0.553	-0.074 - 0.040
Educational Level	0.022*	0.013	1.76	0.078	-0.002 - 0.047
Household Size	0.029**	0.014	2.15	0.032	0.003 - 0.056
Off-farm Income	0.010	0.010	1.02	0.306	-0.009 - 0.029
Farming Exp	-0.019	0.013	01.50	0.134	-0.043 - 0.006
Distance to Market	-0.013	0.011	-1.24	0.216	-0.34 - 0.008
Total Rice Output	-0.018**	0.009	-1.97	0.049	-0.37 - -0.000
Collateral Req	-0.99*	0.056	-1.77	0.076	-0.208 - 0.010
Land Tenure Security	0.067***	0.024	2.81	0.005	0.020 - 0.114

Note: Average Marginal Effects (AMEs) measure the change in the probability of operating within the large farm size category associated with a one-unit change in each explanatory variable, holding other variables constant. Positive marginal effects indicate an increase in the probability of operating a large farm size category, while negative marginal effects indicate a decrease in that probability.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Source: Field Survey, 2025

4. CONCLUSION AND RECOMMENDATIONS

Farm-size category is significantly influenced by sex, access to agricultural credit, education, household size, rice output, collateral requirements, and land tenure security. In particular, male farmers, households with greater labour availability, educated farmers, those with access to credit, and farmers with secure land tenure were more likely to operate larger farms. In contrast, collateral requirements and higher rice output reduced the likelihood of occupying larger farm-size categories. The findings, therefore, indicate that farm-size distribution is shaped not only by land availability but also by financial, demographic, and institutional conditions.

Based on the findings, the study recommends improving land tenure security and access to agricultural credit, particularly through alternative collateral arrangements that reduce financing constraints for smallholder farmers. Gender-responsive land and agricultural policies should also improve women's access to land and productive resources. Finally, agricultural interventions should promote productivity-enhancing intensification, enabling farmers to increase rice output through improved technologies and input use without relying solely on expansion of cultivated land.

Reference

1. Abel, E., & Chukwuka, A. (2024). Livestock Industry in Nigeria : Challenges, Current State, and Path to Transformation. 2020, 247–249.
2. Adenegan, K. (2013). Gender Impacts of Small-Scale Farm Households on Agricultural Commercialisation in Oyo State, Nigeria. *British Journal of Economics, Management & Trade*, 3(1), 1–11. <https://doi.org/10.9734/bjemt/2013/1910>
3. Amadi, M. U., Aluwong, J. S., Bayei, J. D., & Shaba, M. G. (2026). Factors Influencing the Total Factor Productivity among Upland Rice Farmers in Niger State and the Federal Capital Territory, Nigeria. *Nijerya'nın Nijer Eyaleti ve Federal Başkent Bölgesi'ndeki Dağlık Pirinç Çiftçileri Arasında Toplam Faktör V*. 9(4), 1045–1057.
4. Amfani, A. (2018). Revisiting the Linguistic Situation in the North West Geopolitical Zone of Nigeria. III, 392–398.
5. Balana, B. B., Mekonnen, D., Haile, B., Hagos, F., Yimam, S., & Ringler, C. (2022). Demand and Supply Constraints of Credit in Smallholder Farming: Evidence from Ethiopia and Tanzania. In *World Development* (Vol. 159). <https://doi.org/10.1016/j.worlddev.2022.106033>
6. Balana, B. B., & Oyeyemi, M. A. (2022). Agricultural Credit Constraints in Smallholder Farming in Developing Countries: Evidence from Nigeria. *World Development Sustainability*, 1(November 2021), 100012. <https://doi.org/10.1016/j.wds.2022.100012>
7. Byerlee, D., Stevenson, J., & Villoria, N. (2014). Does Intensification Slow Crop Land Expansion or Encourage Deforestation? *Global Food Security*, 3(2), 92–98. <https://doi.org/10.1016/j.gfs.2014.04.001>
8. Charles, C., Nneka, C., & Okpara, U. (2023). Household Headship, Resource Ownership and Food Security : New Evidence from Southeast Nigerian Cities. *Scientific African*, 22(11), e01974. <https://doi.org/10.1016/j.sciaf.2023.e01974>
9. Cochran, W. G. (1977). Estimation of Population Ratio in Post-Stratified Sampling Using Variable

Transformation.

10. Dabessa Iticha, M., & Han, J. (2025). The Impact of Land Tenure Security on Agricultural Productivity in Ethiopia: A Meta-Analysis. *Sustainable Environment*, 11(1). <https://doi.org/10.1080/27658511.2025.2551990>
11. Daudu, A. K., Aderinoye-Abdulwahab, S. A., Karakara, A. A., Kareem, O. W., Dolapo, T. A., Azeez, K. K., & Egbewole, H. O. (2026). Gender Differences in Access to Risk Management Tools and their Effects on Farm Productivity in Nigeria. *Discover Sustainability*, 7(1). <https://doi.org/10.1007/s43621-026-03313-7>
12. Enyew, S., & Gobie, W. (2025). Adoption of Climate-Smart Agricultural Practices Impactson Food Security of Smallholder Farmers in North Western Ethiopia. *Discover Sustainability*, 6(1). <https://doi.org/10.1007/s43621-025-01793-7>
13. Hamidu, D. (2025). Integrating Women Issues into Agricultural and Rural Development Agenda in Adamawa State. *13(3)*, 16–23. <https://doi.org/10.5281/zenodo.16648336>
14. Hao, W., Hu, X., Wu, G., Zhang, Z., Cai, M., Zhou, H., & Liu, X. (2025). The Impact of Plot Size and Farm Size on Crop Production: Evidence from Mechanization and Labor Input Perspectives. *Energy Nexus*, 19(1), 100530. <https://doi.org/10.1016/j.nexus.2025.100530>
15. Huang, W., & Wang, X. (2024). The Impact of Technological Innovations on Agricultural Productivity and Environmental Sustainability in China. *Sustainability (Switzerland)*, 16(19). <https://doi.org/10.3390/su16198480>
16. Ibrahim-Olesin, S., Chidozie Azuamairo, G., & Loveday Njoku, C. (2023). Determinants of Farm Labour Utilisation in Rice Production Among Rural Households in South-East, Nigeria. *23(1)*, 68–74. <https://www.researchgate.net/publication/372061692>
17. Jambo, N., & Mukanyau, R. (2025). An Ordered Logistic Regression Analysis of the Factors Associated with Smallholder Farmers' Decision to Fully Embrace Conservation Agriculture in Zimbabwe. *Sustainable Environment*, 11(1), 1–12. <https://doi.org/10.1080/27658511.2025.2521948>
18. Kabiru, S. A. (2019). The Effect of Education on Agricultural Productivity: Implication for Rural Development. *1(6)*, 28–35. <https://doi.org/10.26677/TR1010.2019>.
19. Kehinde, A. D., Adesiyon, T. F., Hassan, S. O., & Familusi, I. G. (2025). Leveraging Membership in Agricultural Cooperatives to Alleviate Abject Poverty Among Smallholder Farming Households in Nigeria. *Sustainable Futures*, 9(November 2024). <https://doi.org/10.1016/j.sftr.2024.100399>
20. Muhammad, A., Mohammed, A. M., Muktar, B. G., Bala, A. H., Aliyu, Y. M. & Makinta, U. (2025). Nigerian Journal of Agriculture and Agricultural Technology (NJAAT). *Nigerian Journal of Agriculture and Agricultural Technology*, 5(1), 265–272. <https://njaat.com.ng/index.php/njaat/article/view/992/746>
21. Nara, B. B., Lengoiboni, M., & Zevenbergen, J. (2021). Land Use Policy Assessing Customary Land Rights and Tenure Security Variations of Smallholder Farmers in Northwest Ghana. *Land Use Policy*, 104, 105352. <https://doi.org/10.1016/j.landusepol.2021.105352>
22. National Bureau of Statistics. (2021). Nigerian Gross Domestic Product Report (Q4 & Full Year 2020).

Nigerian Gross Domestic Product Report, February, 1–152.

23. Olaitan, M. A., Oyediji, B. I., Bamidele, J., & Alabuja, F. O. (2025). Economics of Rice Production and its Effect on Household Food Security Status in Abaji Area Council of Abuja, Nigeria. 10.
24. Padhy, C., & Kumar, B. (2015). Effect of Agricultural Education on Farmers'Efficiency : A Review. *International Journal of Engineering Technology, Management and Applied Sciences*, 3(2), 247–258. <https://doi.org/10.3390/pathogens>
25. Rupert Grint, Sherlock Holmes, F. N. (2025). Impact of Land Tenure Security on Agricultural Production. Author : Rupert Grint, Sherlock Holmes, Florence Nightingale.
26. Sadiq, M. S., Singh, I. P., & Makarfi, M. A. (2022). Labour-Use Efficiency of Rice Farmers in Nigeria's North-Central Region. *Siembra*, 9(2), e3969. <https://doi.org/10.29166/siembra.v9i2.3969>
27. Simons-Cappa, D. D., Huaranga-Rivera, H. V., Sánchez-Castro, A., Ruiz-Camus, C. E., Cabezas-Ramírez, T. V., Juárez-Rivero, A. A., & Vega-Chávez, R. A. (2026). Informal Financial Credit and Sustainable Livelihoods: Determinants and Delinquency Patterns Among Microentrepreneurs in the Peruvian Amazon. *Sustainability (Switzerland)*, 18(9), 1–29. <https://doi.org/10.3390/su18094249>
28. Steve Hatfield-Dodds, R. N. and D. C. (2007). This document is discoverable and free to researchers across the globe due to the work of AgEcon Search. Help ensure our sustainability. Factors Influencing Price of Agricultural Products and Stability Count. AgEcon Search, 18.
29. Tennhardt, L. M., Lazzarini, G. A., Schader, C., Martin, K., & Lambin, E. F. (2024). The Role of Household Labour for Sustainable Intensification in Smallholder Systems: A Case Study in Cocoa Farming Systems. *Regional Environmental Change*, 24(2). <https://doi.org/10.1007/s10113-024-02243-2>
30. Vihi, S. K., Jesse, B., Tanko, P. K., Selzing, P. M., & Sulaiman, J. K. (2024). Adoption of Improved Production Technologies among Rice Farmers in Wase Local Government Area of Plateau State, Nigeria. *Agricultural Socio-Economics Journal*, 24(1), 23–37. <https://doi.org/10.21776/ub.agrise.2024.024.1.3>
31. Yuni, D. N., Agbanike, T. F., Chukwu, A. B., Anochiwa, L. I., Enyoghasim, M. O., Uwajumogu, N. R., Mothae, L., Ogbuagu, A. R., & Ogwuru, H. O. R. (2022). Access to Credit for Rice Farmers and Its Impact on Productivity: The Case Of Ebonyi State, Nigeria. *Studies in Agricultural Economics*, 124(1), 37–43. <https://doi.org/10.7896/j.2236>

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