

Informal Credit and Rice Production in Benue State, Nigeria

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Abstract

The study examines the effect of informal credit on rice production in Benue State, Nigeria. Primary data were collected through a structured questionnaire administered to small-scale rice farmers in the study area. A cross-sectional research design was adopted, and a sample size of 403 farmers was determined using the formula proposed by Cochran (1977). Out of the distributed questionnaires, 372 were successfully retrieved and analysed using Ordinary Least Squares (OLS) regression. OLS was employed because the model is

linear in parameters and provides efficient and unbiased estimates under the classical regression assumptions, which were also tested in the study. The results show that access to informal credit has a negative and statistically insignificant effect on rice output. This indicates that although farmers access informal credit, it does not translate into a measurable increase in rice production within the study area. Other key variables such as farm size, labour, fertiliser and agrochemicals were found to significantly influence rice output, suggesting that productivity is mainly driven by input use rather than credit access. Although informal credit is not statistically significant, it remains an important financial support channel for farmers. However, its effectiveness appears limited, possibly due to non-productive use of funds or weak financial structure. Therefore, policy should emphasise linking credit systems directly to input supply channels to reduce the risk of cash diversion.

Keywords: Informal Credit, Input Utilisation, Rice Productivity, Smallholder Farmers

JEL Classification Codes: G21, O13, Q12, Q14

1. Introduction

Rice is one of the most widely consumed staple foods globally, second only to wheat and maize in terms of both consumption and cultivated land area. Its cultivation spans a variety of ecosystems, from flood-prone plains to drought-affected regions, reflecting its adaptability and resilience as a food source. More than half of the world's population relies on rice as a primary dietary staple (Food and Agricultural Organisation [FAO], 2020; Kim et al., 2020). In Nigeria, rice farming has evolved from a traditional subsistence activity into a major economic and nutritional enterprise. It provides employment for millions, supports rural livelihoods, and has become a core element of dietary consumption across all socioeconomic classes (Akande et al., 2020). The increasing importance of rice is linked not only to nutritional security but also to economic growth, as the crop is cultivated in diverse agro-ecological zones and contributes significantly to agricultural output (National Bureau of Statistics [NBS], 2021; Ogbonna et al., 2021).

Rice production in Nigeria has long faced systemic challenges including drought, low fertiliser usage, pest infestations, limited mechanisation, land access issues, and insufficient government support. Consequently, domestic production has historically lagged behind consumption. Production grew from 3.1 million tonnes in 2014 to 3.7 million tonnes in 2017, while consumption increased from 5.8 million tonnes to 6.4 million tonnes (Okeke et al., 2019). More recent statistics indicate that production declined to 5.23 million metric tonnes in 2024, whereas consumption reached approximately 7.6 million tonnes, leaving domestic output to meet only about 57% of national demand (United States Department of Agriculture [USDA], 2025; Federal Ministry of Agriculture and Rural Development [FMARD], 2024). Although government interventions have expanded land under cultivation and introduced programmes such as input support and fertiliser initiatives, many small-scale farmers still lack the financial capacity to take full advantage of these opportunities.

Informal credit systems therefore play an important role in supporting rice production, particularly among small-scale farmers who have limited access to formal finance. Informal credit refers to non-regulated financial arrangements that operate outside the formal banking system and rely largely on trust, social ties, and local norms rather than legal collateral requirements (Adams & Fitchett, 2019;

Adisa & Okoruwa, 2021; Obagbemi et al., 2022). In Nigeria, more than 70% of rural farmers rely on informal sources of finance, while less than 10% access commercial bank loans (Central Bank of Nigeria [CBN], 2022). In Benue State, over 75% of rice farmers depend on cooperative societies, rotating savings groups, and local lending arrangements for seasonal production finance (Asom et al., 2023). Despite their accessibility, these credit systems often involve high interest rates and weak regulation, which may expose farmers to debt cycles and financial vulnerability.

However, despite the growing reliance on informal credit, there is limited empirical evidence on its effect on rice productivity among small-scale farmers in Benue State, Nigeria. Existing studies have largely focused on general agricultural finance or aggregate output, with insufficient attention to productivity outcomes at the farm level. This creates a gap in understanding whether informal credit significantly improves rice productivity in the study area. Consequently, this study determined the effect of informal credit on rice production in Benue State, Nigeria. Specifically, this study investigated the effect of access to informal credit on rice productivity among farmers in Benue State, and is guided by the following hypothesis: H0: Informal credit has no significant effect on rice productivity among farmers in Benue State.

2. Literature Review

2.1 Conceptual Clarifications

2.1.1 Informal Credit

Informal credit refers to financial resources provided outside formal banking systems, often based on trust and social networks rather than collateral (Jain, 2023). Common forms include ROSCAs, moneylenders, family and friends, cooperative societies, and trader-supplied credit (Adisa & Okoruwa, 2021). While informal credit provides essential financing, drawbacks such as high interest rates and potential debt cycles exist (Adisa & Okoruwa, 2021). Nonetheless, these networks enable farmers to manage seasonal production challenges (Deiningner & Liu, 2019). While Jain (2023) emphasises the accessibility and flexibility of informal credit, Adisa and Okoruwa (2021) highlight its cost implications, particularly high interest rates. In contrast, Deiningner and Liu (2019) suggest that informal credit plays a stabilising role in agricultural production by enabling timely

access to inputs. These differing perspectives indicate that informal credit can be both productive and constraining, depending on the terms and conditions under which it is accessed.

This study adopts the Jain (2023) definition and evaluates the effect of informal credit on small-scale rice farming in Benue State, using both quantitative measures (loan amounts, interest rates, and repayment terms) and qualitative assessments (usage, social impact, financial sustainability). Metrics such as credit volume, interest rates, and repayment structures determine its effectiveness in fostering agricultural growth (Carruthers & Arias, 2018). However, existing studies have not reached a consensus on whether informal credit significantly improves productivity, as some emphasise its positive role in input financing while others stress its negative implications for farm profitability. This lack of consensus suggests the need for context-specific empirical analysis.

2.1.2 Rice Production

Rice production is a complex process encompassing operations from land preparation to post-harvest processing for both personal consumption and commercial distribution. Johnson (2010) identifies key agricultural tasks such as land preparation, planting, water management, pest control, and harvesting. Cheng and Lee (2012) extend this definition to include the entire supply chain, emphasising post-harvest activities like milling. Smith (2005) highlights the management of water, soil, and environmental conditions throughout the growing season, connecting cultivation and post-harvest stages as an interdependent system. While Johnson (2010) focuses on field-level activities, Cheng and Lee (2012) adopt a broader supply chain perspective, and Smith (2005) integrates environmental management into production processes. These perspectives collectively show that rice production is multidimensional, involving both input utilisation and environmental efficiency.

This study adopts Kumar and Yadav (2018) comprehensive definition, integrating all stages from seed selection to harvesting, including fertilisation and pest management, aligning with Smith (2005) holistic approach. Rice production is measured by yield (kg/acre or t/acre), total area harvested, yield per unit area, and total production volume, providing insight into the effectiveness and

sustainability of the process. Despite these comprehensive definitions, limited empirical attention has been given to how financial factors such as informal credit influence productivity outcomes within the rice production process, particularly at the smallholder level in Benue State.

2.1.3 Rice Productivity

Rice productivity refers to the efficiency with which rice is produced, commonly measured as yield per unit area of land. As defined by Smith et al. (2019), it focuses on the quantity of rice harvested relative to the size of cultivated land. This approach provides a clear and direct measure of output, making it suitable for empirical analysis. However, broader perspectives extend beyond yield to include the efficiency of resource utilisation. Zhang et al. (2020) emphasise that rice productivity also reflects how effectively inputs such as land, labour, water, and nutrients are combined. This view introduces an economic and environmental dimension, highlighting that higher productivity depends not only on output levels but also on efficient input use.

These perspectives suggest a gap in the literature. While yield-based measures offer simplicity and ease of comparison, resource-based approaches provide a more comprehensive view of production efficiency. Studies such as Bhattacharyya and Pal (2018) and Tefera et al. (2023) further stress that technological innovation and sustainable practices are critical in improving productivity without degrading environmental quality. This study adopts the yield per acre measure, consistent with Smith et al. (2019), to provide a precise and observable indicator of rice productivity. Nonetheless, it recognises that productivity outcomes are influenced by input utilisation and farming practices. In this context, access to informal credit is expected to enhance productivity by enabling farmers to acquire necessary inputs and improve cultivation efficiency.

Overall, the literature reveals a clear gap in establishing a consistent link between informal credit and rice productivity, particularly through input utilisation. Most studies treat credit access and production processes separately, with limited empirical evidence connecting the two within a single framework. This study addresses this gap by investigating the effect of access to informal credit on rice productivity among farmers in Benue State, focusing on how credit

2.2.2 Agricultural Household Model

The Agricultural Household Model by Singh et al. (1986), integrates household production and consumption decisions. Households maximise utility subject to production technology, budget, and market conditions. Informal credit provides liquidity to purchase inputs, hire labour, and adopt improved practices, indirectly affecting output through production and consumption behaviour. Within this framework, informal credit provides liquidity that allows households to purchase inputs, hire labour, and adopt improved cultivation practices, indirectly influencing rice productivity. This integration explains the inclusion of input variables (labour, fertiliser, planting materials, fixed inputs, agrochemicals) alongside credit in the model, showing the theoretical pathway from financial access to output.

In Benue State, informal credit from cooperatives, ROSCAs, or microfinance enables households to finance seeds, fertilisers, agrochemicals, and small-scale mechanisation. The model captures how variations in credit access affect input use and output, accounting for market imperfections, liquidity constraints, and risk. Its complexity is offset by its flexibility in evaluating credit effects on productivity. This theoretical lens justifies the selection of rice productivity (RP_i) as the dependent variable and access to informal credit (AIC_i) as a key independent variable, while other inputs represent the mediating mechanisms through which credit influences output.

2.3 Theoretical Framework

This study applies credit constraint theory, viewing informal credit as critical for alleviating liquidity constraints. Access to cooperative societies, ROSCAs, and microfinance enables farmers to purchase inputs, hire labour, and invest in mechanisation. Credit affects input use, labour allocation, risk-taking, and production timing, justifying its inclusion as a key explanatory variable in analysing rice productivity in Benue State. Applying this theory, informal credit in Benue State is modelled as a mechanism that alleviates financial limitations, enabling the purchase of seeds, fertilisers, hiring of labour, and small-scale mechanisation. The theoretical link shows that rice productivity depends on both the availability of credit and its effective utilisation through input acquisition and allocation.

Under this framework, rice output is modelled as a function of access to informal credit, labour, input usage, household characteristics, and institutional factors. Credit constraints directly influence input acquisition while indirectly affecting labour allocation, risk-taking, and production timing. This approach explicitly connects theory to model specification: the dependent variable (rice productivity) is influenced by independent variables selected based on theoretical considerations, including farm inputs such as farm size, labour, fertiliser, planting materials, fixed inputs, and agrochemicals and access to informal credit. Each variable is linked to the theoretical premise that productivity depends on both resources and the ability to access them financially.

2.4 Empirical Review

Empirical evidence on agricultural credit and rice production generally indicates that access to finance plays an important role in improving farm productivity, although results vary across contexts. In Nigeria, Afolabi et al. (2012) found that membership in cooperative societies among rice farmers in South-West Nigeria did not significantly influence gross margin, suggesting that cooperative participation alone may not guarantee improved productivity outcomes. Similarly, Mgbakor et al. (2014) reported that small-scale farmers in Enugu State relied mainly on informal credit sources such as relatives, neighbours, and moneylenders due to their accessibility and timely disbursement.

Several studies provide evidence that credit access improves rice production and efficiency. Duy (2015) showed that both formal and informal credit significantly enhanced rice production and production efficiency among farmers in the Mekong Delta, Vietnam, highlighting the need for expanded rural financial services. In Nigeria, Musa (2016) found that informal credit reduced financial constraints and supported rice production among farmers in Plateau State, while Okoye (2017) observed that informal credit enabled farmers in Northern Nigeria to invest in farm inputs and improve productivity. These findings are consistent with studies that emphasise the importance of credit availability for agricultural investment and production.

Further evidence shows that informal credit remains a dominant financing source for farmers in many developing

economies. Rizwan et al. (2019) found that the majority of farmers in Pakistan depended on informal credit rather than formal financial institutions. Similarly, Asom and Ijirshar (2019) reported that although farmers in Benue State had some access to loans from the Bank of Agriculture, inadequate loan volumes compelled many farmers to depend on informal credit sources.

Empirical studies also demonstrate that informal credit can significantly improve agricultural productivity. For instance, Sekyi et al. (2020) found that informal credit significantly increased agricultural productivity among rural farmers in Ghana. Adeleke (2020) reported a positive relationship between informal credit and rice production in Kogi State, while Shehu (2018) and Adewale (2016) observed that access to informal credit positively influenced rice production and farm investment in Nigeria. In Benue State, Asom et al. (2023) also confirmed that informal credit significantly increased farm output, emphasising the importance of strengthening informal financial institutions. Similarly, Obagbemi et al. (2022) found that access to microcredit, particularly through cooperatives, significantly improved farm productivity in Kwali Area Council, Abuja.

Evidence from other countries further supports the role of informal credit in agricultural development. Ahuja (2019) reported that informal credit significantly boosted rice production in underserved areas of India, while Owusu and Mensah (2019) highlighted that informal credit improved the livelihoods of farmers in Ghana. In Tanzania, Šánka and Makhura (2025) found that farmers participating in a smallholder agricultural credit guarantee scheme recorded higher productivity due to improved access to farm inputs and financial resources. However, Nwankwo (2008) observed a positive but statistically insignificant relationship between informal credit and agricultural productivity in Awka South, indicating that the effectiveness of informal credit may depend on local institutional conditions.

Other studies emphasise structural and policy factors influencing rice production beyond credit access. Dauda et al. (2021) examined rice production trends in Benue State and identified quality and processing constraints affecting consumption, while Ugbor et al. (2022) found that the Central Bank of Nigeria Anchor Borrowers' Programme improved rice production and employment in Kebbi State. In contrast, Sopian et al. (2024) reported that agricultural subsidies in

selected Asian countries increased rice prices but did not significantly improve productivity, suggesting that policy support must be complemented by effective financing and institutional arrangements to achieve sustainable productivity growth.

3. Methodology

3.1 Sampling and Data Collection

A structured questionnaire was used to collect primary data, containing both open- and close-ended items divided into sections. The first section captured socioeconomic backgrounds of small-scale rice farmers, while subsequent sections addressed the study objectives: the effect of access to informal credit on rice productivity, income, and investment. Questionnaires were chosen for their ability to gather factual and opinion-based information across wide areas while maintaining respondent anonymity (Etikan et al., 2016). A sample size of 403 farmers was determined using the formula proposed by Cochran (1977) for sample size determination for large and unknown populations, expressed as:

$$n_0 = \frac{Z^2 \times P \times (1 - P)}{E^2} \dots \dots \dots 2$$

Where: n_0 = Sample size for an unknown population; Z = Z-score calculated based on confidence level; P = Population proportion assumed at 50%; $1 - P$ = Population proportion excluded (proportion not assumed, that is, Q); E = Margin of error assumed at 5%. Thus, at 95% confidence level, $Z = 1.96$.

The proportion of the population assumed at 50% = 0.5, $Q = 1 - 0.5 = 0.5$ and $E = 0.05$. Therefore,

$$n_0 = \frac{1.96^2 \times 0.5 \times 0.5}{0.05^2}$$

$n_0 = 384.16$; approximately 384 respondents. However, given an initial sample of 384, a 5% allowance for non-response increased this to 403 questionnaires.

A multistage sampling technique was employed. First, three (3) Local Government Areas (LGAs) including Ushongo, Gwer-East, and Otukpo were purposively selected due to their active participation in rice production and informal credit activities. Next, wards within each LGA were selected based on proportional estimates of farmer populations from cooperative registers, extension officers, and IFAD-

Value Chain Development Programme (VCDP) lists. Finally, households within the selected wards were systematically sampled to ensure representativeness. For illiterate farmers, the researcher, with the help of interpreters, read and recorded responses. This approach ensured inclusivity and comprehensive coverage of the population, whose exact size was unknown.

Table 1: Variable Definition and Measurement

S/N	Variable	Data Type	Coding/Measurement	Description
1	Gender (GEN)	Binary	Male = 1, Female = 2	Biological sex of respondent
2	Marital Status (MS)	Categorical	Married = 1, Single = 2, Divorced = 3, Widowed = 4	Civil status of respondent
3	Age (AGE)	Categorical	<30 = 1, 30–39 = 2, 40–49 = 3, 50–59 = 4, ≥60 = 5	Age group of respondent
4	Religion (REL)	Categorical	Christianity = 1, Islam = 2, Traditional = 3	Religious affiliation of respondent
5	Educational Level (EDL)	Categorical	None = 0, Primary = 1, Secondary = 2, Tertiary = 3	Highest level of education attained by respondent
6	Occupation (OCC)	Binary	Farming = 1, Civil service = 2	Primary work activity of the respondent
7	Farming Experience (FX)	Categorical	1–5 = 1, 6–10 = 2, 11–15 = 3, ≥16 = 4	Number of years engaged in rice farming
8	Technology Adoption (TA)	Binary	Adopted = 1, Not adopted = 0	Use of modern farming technologies

9	Soil Quality (SQ)	Ordinal	Poor = 1, Moderate = 2, Good = 3, Excellent = 4	Farmer-rated quality of farmland soil
10	Rice Quantity (RQ)	Continuous	Tonnes of rice harvested per unit area	Volume of rice output adjusted for farms below one acre
11	Farm Size (FS)	Continuous	Acres	Total land area cultivated by the farmer
12	Labour (LAB)	Continuous	Naira (₦)	Total expenditure on hired labour
13	Fertiliser (FET)	Continuous	Kilogrammes (Kg)	Quantity of fertiliser applied
14	Planting Materials (PM)	Continuous	Naira (₦)	Cost of seeds/seedlings purchased
15	Fixed Inputs (FI)	Continuous	Naira (₦)	Cost of farm tools, machinery, irrigation, and other fixed items
16	Agrochemicals (AC)	Continuous	Litres	Quantity of chemicals used within the farming season
17	Access to Informal Credit (AIC)	Continuous	Naira (₦)	Total amount of informal loan obtained within the farming season

Source: Researcher's Computation, 2024

3.2 Model Specification

This study investigates the effect of access to informal credit on rice productivity among farmers in Benue State. Grounded in credit constraint theory by Stiglitz and Weiss (1981), the analysis posits that farmers’ production decisions are conditioned by liquidity limitations, where farmers’ input use (investment) depends on income, assets, and access to credit:

$$I_i = f(Y_i, A_i, C_i) \dots \dots \dots 3$$

Drawing from this theoretical framework, a behavioural production model is specified in which rice productivity (RP_i) is expressed as a function of input use and access to credit.

The functional relationship for the first objective is specified as:

$$RP_i = f(FS_i + LAB_i + FET_i + PM_i + FI_i + AC_i + AIC_i) \dots \dots \dots 4$$

For estimation using regression analysis, the model was linearised as:

$$RP_i = \beta_0 + \beta_1 \ln FS_i + \beta_2 \ln LAB_i + \beta_3 \ln FET_i + \beta_4 \ln PM_i + \beta_5 \ln FI_i + \beta_6 \ln AC_i + \beta_7 \ln AIC_i + \varepsilon_i \dots \dots \dots 5$$

Where RP_i = Rice output (tonnes or bags per acre); lnFS_i = Farm size (acre); lnLAB_i = Labour (₦); lnFET_i = Fertiliser (Kg); lnPM_i = Planting materials (₦); lnFI_i = Fixed inputs (₦); lnAC_i = Agrochemicals (litres); lnAIC_i = Access to informal credit (₦). β₀ is the intercept, β₁ – β₇ are the parameters of the explanatory variables, and ε_i is the error term.

Data were analysed according to the research objectives. Descriptive statistics, including frequencies and percentages, summarised respondents’ socio-economic characteristics. Ordinary Least Squares (OLS) regression was employed to estimate the effect of access to informal credit and other farm inputs on rice productivity among farmers in Benue State (RP_i). OLS was chosen because it provides unbiased, consistent, and efficient estimates under classical linear regression assumptions.

Diagnostic tests were conducted to validate OLS assumptions. Normality of residuals was evaluated using the Shapiro–Wilk test, heteroskedasticity using the Breusch–Pagan test, and autocorrelation using the Durbin–Watson statistic. Results indicated approximately normal residuals and no autocorrelation. The regression model used a log–log functional form, allowing all coefficients to be interpreted as

elasticities, representing the percentage change in rice productivity associated with a one percent change in each predictor.

4. Results and Discussion

Table 2: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Rice Quantity [RP] (bags)	372	40.00	99.00	69.29	17.57610	0.037	-1.155
Farm Size [FS] (in acres)	372	3.00	9.98	6.50	1.97	0.158	-1.100
Labour [LAB] (Amount spent on hiring labour in naira)	372	103267.00	497827.00	284238.68	121026.28	0.193	-1.228
Fertiliser [FET] (Kg of fertiliser applied to farm)	372	100.00	497.00	300.87	113.63	-0.051	-1.053
Planting Materials [MT] (Cost in naira)	372	50235.00	199849.00	129996.03	44298.68	-0.195	-1.175
Fixed Inputs (Cost in naira)	372	200126.00	499363.00	345074.91	84656.00	0.063	-1.097
Agrochemicals (Number of litres)	372	50.00	79.00	63.93	8.58	0.027	-1.249
Access to Informal Credit (Total amount accessed from informal sources)	372	407657.00	998260.00	697043.92	179200.13	0.074	-1.368

Source: Researcher's Computation, 2025

The descriptive statistics in Table 2 indicate that the average rice quantity produced was 69.29 bags, with a minimum of 40 bags and a maximum of 99 bags. This suggests a moderate level of output among farmers, with some degree of variation across the sample. The average farm size was 6.50 acres, ranging between 3.00 and 9.98 acres, indicating that most farmers operate on a relatively small to medium scale. The mean amount spent on labour was ₦284,238.68, reflecting the significant role of hired labour in rice production activities. Similarly, the average fertiliser usage stood at 300.87 kg, suggesting a considerable level of input application aimed at enhancing soil fertility and crop yield. On average, farmers spent

₦129,996.03 on planting materials, and ₦345,074.91 on fixed inputs, indicating substantial financial commitment towards production inputs.

In addition, the average usage of agrochemicals was 63.93 litres, which reflects the effort to control pests and diseases in order to sustain output levels. The average amount of informal credit accessed was ₦697,043.92, with values ranging from ₦407,657 to ₦998,260, suggesting that informal financing constitutes an important source of capital for farming operations. The relatively wide ranges between the minimum and maximum values across the variables point to disparities in resource endowment and input utilisation among farmers. This variation may have important implications for differences in productivity and efficiency within the study area.

Table 3: Ordinary Least Square (OLS) Regression Results
Dependent Variable: Rice Output (lnRP)

Variable	Coefficient	Standard Error	t-statistic	Prob.
LnFS	2.185	0.122	17.910	0.000*
LnLAB	0.415	0.085	4.882	0.000*
LnFET	0.522	0.092	5.674	0.000*
LnPM	0.012	0.045	0.267	0.789
LnFI	0.031	0.058	0.534	0.593
LnAC	-0.028	0.038	-0.211	0.833
LnAIC	-0.014	0.042	-0.333	0.739
_cons	-8.742	1.215	-7.195	0.000*
Number of obs	= 372			
R	= 0.836			
R ²	= 0.745			
Adj. R ²	= 0.740			
DW	= 1.995			
Std. Error	= 0.108			
F-Test	= 151.6			
p-value	= 0.000*			

**significance at 5% level

**significance at 1% level

Note: lnFS = Farm Size, lnLAB = Labour, lnFET = Fertiliser, lnPM = Planting Materials, lnFI = Fixed Inputs, lnAC = Agrochemicals and lnAIC = Access to Informal Credit.

Source: Researcher’s Computation from STATA 17, 2026

The Ordinary Least Squares (OLS) regression results presented in Table 3 provide empirical evidence on the determinants of rice output (lnRP) among farmers. Farm size (lnFS) exhibits a positive and highly significant effect on rice output. The coefficient of 2.185 implies that a 1% increase in farm size leads to a 2.185% increase in rice output, *ceteris paribus*. This result aligns with a priori expectations and underscores the importance of land expansion in enhancing agricultural productivity. The p-value (0.000) indicates statistical significance at the 1% level, confirming that farm size is a major driver of rice production.

Labour (lnLAB) also shows a positive and statistically significant relationship with rice output. The coefficient of 0.415 indicates that a 1% increase in labour input results in a 0.415% increase in rice output. This conforms to theoretical expectations, as increased labour utilisation enhances farm operations such as planting, weeding, and harvesting. The effect is statistically significant at the 1% level ($p = 0.000$), suggesting that labour remains a critical input in rice production. Fertiliser (lnFET) has a positive and statistically significant influence on rice output. The coefficient of 0.522 implies that a 1% increase in fertiliser application leads to a 0.522% increase in rice output. This result is consistent with agronomic theory, which emphasises the role of fertiliser in improving soil fertility and crop yield. The p-value (0.000) confirms significance at the 1% level, indicating that fertiliser use is a key determinant of productivity.

Planting materials (lnPM) display a positive but statistically insignificant effect on rice output. The coefficient of 0.012 suggests that a 1% increase in expenditure on planting materials leads to a marginal 0.012% increase in output. However, the high p-value (0.789) indicates that this effect is not statistically different from zero. This may reflect issues such as variability in seed quality, improper timing of planting, or inadequate complementary inputs, which limit the effectiveness of planting materials. Fixed inputs (lnFI) also show a positive but statistically insignificant relationship with rice output. The coefficient of 0.031 implies that a 1% increase in fixed inputs results in a 0.031% increase in output. However, with a p-value of 0.593, the effect is not significant. This suggests that fixed inputs may not play a substantial role in determining rice productivity within the

study area, possibly due to underutilisation or inefficiencies in their application.

Agrochemicals (lnAC) exhibit a negative and statistically insignificant effect on rice output. The coefficient of -0.028 indicates that a 1% increase in agrochemical use leads to a 0.028% decrease in output. Although contrary to a priori expectations, the effect is not statistically significant ($p = 0.833$). This could be attributed to misuse, over-application, or poor-quality agrochemicals, which may reduce their effectiveness or even harm crop yield. Access to informal credit (lnAIC) has a negative and statistically insignificant impact on rice output. The coefficient of -0.014 suggests that a 1% increase in access to informal credit reduces rice output by 0.014%. However, the effect is not statistically significant ($p = 0.739$). This unexpected result may indicate that borrowed funds are not efficiently allocated to productive farm activities, or that high interest rates and repayment pressures associated with informal credit constrain productive investment.

The model shows an Adjusted R^2 of 0.740, implying that approximately 74% of the variation in the log of rice quantity is explained by the independent variables included in the model (Farm size, Labour cost, Fertiliser, etc.), while the remaining 26% is attributed to factors outside the scope of this study.

Table 4: Diagnostic Test Results (Multicollinearity)

Test	Statistic
Ho: No Multicollinearity	
Variable	VIF
FS	1.054
LAB	1.821
FET	1.790
PM	1.112
FI	1.087
AC	1.141
AIC	1.035

Source: Researcher’s Computation from STATA, 2026

The diagnostic test results presented in Table 4 assess the presence of multicollinearity among the explanatory variables using the Variance Inflation Factor (VIF). The computed VIF values for all variables are relatively low: farm size (FS = 1.054), labour (LAB =

1.821), fertiliser (FET = 1.790), planting materials (PM = 1.112), fixed inputs (FI = 1.087), agrochemicals (AC = 1.141), and access to informal credit (AIC = 1.035). These values are substantially below the more conservative benchmark of 5 suggested in empirical literature. This indicates that the explanatory variables are not highly correlated with one another, and therefore, multicollinearity is not a concern in this model (Gujarati & Porter, 2009; Wooldridge, 2016).

Furthermore, the relatively close proximity of all VIF values to 1 suggests minimal inflation in the variance of the estimated coefficients. This implies that each explanatory variable contributes distinct information to the model without significant overlap. As a result, the estimated coefficients are stable, efficient, and reliable for inference. There is no evidence to reject the null hypothesis of no multicollinearity. The absence of multicollinearity enhances the robustness of the OLS regression results and strengthens confidence in the validity of the estimated relationships between the explanatory variables and rice output.

Table 5: Diagnostic Test Results (Normality of Residuals)

Test	Statistic	Df	p-value
Shapiro–Wilk	0.994	372	0.205

Source: Researcher’s Computation from STATA, 2026

The normality of residuals was assessed using the Shapiro–Wilk test, as reported in Table 5. The test statistic ($W = 0.994$) with a p-value of 0.205 indicates that the null hypothesis of normal distribution of residuals cannot be rejected at the 5% level of significance. This implies that the residuals are approximately normally distributed. The result satisfies the normality assumption of the classical linear regression model, suggesting that the estimated parameters are unbiased and that statistical inferences drawn from the model are valid.

Table 6: Diagnostic Test Results (Heteroskedasticity Test)

Test	Statistic	Df	p-value
Breusch–Pagan	5.21	7	0.157

Source: Researcher’s Computation from STATA, 2026

Table 6 presents the results of the Breusch–Pagan test for heteroskedasticity. The test statistic ($\chi^2 = 5.21$) with a p-value of 0.157 indicates that the null hypothesis of homoskedasticity cannot be rejected at the 5% level. This suggests that the variance of the error terms is constant across observations. The absence of heteroskedasticity implies that the OLS estimators are efficient and that the standard errors are reliable for hypothesis testing.

Table 7: Diagnostic Test Results (Autocorrelation Test)

Test	Statistic	df	p-value
Durbin–Watson	1.995		

Source: Researcher’s Computation from STATA, 2026

The Durbin–Watson statistic reported in Table 7 (DW = 1.995) is approximately equal to 2, which indicates the absence of first-order autocorrelation in the residuals. This confirms that the error terms are independent across observations, satisfying another key assumption of the OLS model. The lack of serial correlation enhances the credibility of the regression results and ensures that the estimated coefficients are not biased due to correlated disturbances.

4.1 Discussion of Findings

The empirical result of this study shows that access to informal credit (lnAIC) has a negative and statistically insignificant effect on rice output. This contrasts with much of the existing literature, which generally reports a positive relationship between credit access and agricultural productivity. The finding does not align with studies such as Duy (2015); Musa (2016); and Okoye (2017), which show that credit access improves rice production by easing liquidity constraints and enabling investment in farm inputs. Similar evidence is reported by Sekyi et al. (2020) and Adeleke (2020), who found that informal credit enhances agricultural productivity through increased input use and better farm management. Asom et al. (2023) and Obagbemi et al. (2022) also confirm a positive effect of credit access on farm output. This position is further supported by Ahuja (2019), Owusu and Mensah (2019), and Šánka and Makhura (2025), who emphasise that improved access to credit enhances farmers’ ability to acquire inputs and increase productivity across different contexts.

However, the result is consistent with Afolabi et al. (2012), who found no significant effect of cooperative membership on productivity, and Nwankwo (2008), who also reported an insignificant relationship between informal credit and agricultural output. These studies suggest that credit access alone may not guarantee productivity gains. The divergence may be explained by the use of borrowed funds for non-farm purposes such as household consumption or social obligations, which reduces its productive effect. High interest rates and short repayment periods associated with informal credit may also discourage productive investment. In addition, inefficiencies in input use, poor timing, and weak technical knowledge may limit output gains even when credit is available. This aligns with Mgbakor et al. (2014) and Rizwan et al. (2019), who noted that informal credit is often small in scale, consumption-oriented, and poorly structured.

Structural constraints such as limited access to improved seeds, extension services, and mechanisation may further weaken the effect of credit. This supports Sopian et al. (2024), who argue that financial support alone is insufficient without strong institutional backing. Dauda et al. (2021) similarly noted that production constraints can limit output regardless of financial access, while Asom and Ijirshar (2019) highlight that inadequate loan volumes restrict effective utilisation of credit among farmers. Overall, the findings suggest that informal credit does not automatically translate into higher productivity. Its effect depends on utilisation patterns, credit conditions, and the presence of complementary inputs and institutional support.

5. Conclusion and Recommendations

The study concludes that farm size, labour, fertiliser and agrochemicals are the key significant determinants of rice productivity in Benue State, Nigeria. These results indicate that output is largely driven by the scale of land under cultivation and the intensity of productive input use. In particular, expansion of cultivated land, adequate labour utilisation and proper application of fertiliser and agrochemicals jointly enhance rice output among farmers. Access to informal credit, although included in the model, does not show a statistically significant effect on rice productivity. This suggests that credit alone, without efficient allocation and strong production linkages, does not automatically translate into higher output. It further

implies that the effectiveness of informal credit depends on how it is channelled into productive farm activities rather than its availability.

Based strictly on these findings, policy attention should prioritise interventions that directly strengthen the significant production drivers.

First, land access should be improved through clearer tenure arrangements and support for land expansion schemes, enabling farmers to operate on more productive farm sizes.

Second, labour productivity should be enhanced through support for mechanised farming tools such as planters, weeders and small-scale harvesters, reducing reliance on inefficient manual labour and improving farm efficiency.

Third, fertiliser use should be made more effective through targeted input distribution systems that ensure timely availability at subsidised rates. This should be complemented with soil testing services to guide appropriate fertiliser application rather than uniform usage.

Fourth, agrochemical usage should be supported through regulation and extension services that promote correct application methods, dosage control and safe handling. This will help maximise effectiveness while preventing misuse that could reduce productivity.

Finally, although informal credit is not statistically significant, it remains a financial support channel for farmers. Therefore, rather than expanding credit alone, policy should focus on linking credit access directly to input supply systems. This can be achieved by integrating informal lending groups with input suppliers so that loans are converted into fertiliser, seeds and agrochemicals rather than cash diversion.

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