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IMPACT OF CREDIT POLICY ON PADDY AREA IN NIGERIA

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Abstract:

Nigeria's rice industry is supported by a number of policies with the ultimate goal of boosting its production to meet a growing demand. Among these policies, the agricultural credit guarantee scheme fund is one of the earliest policy directives implemented to encourage paddy producers' access to formal credits from commercial banks. Considering decades-long debates on the effectiveness of credit policies in improving various aspects of agricultural production, the question is whether this policy has been effective in driving an expansion in paddy area in Nigeria. To answer this question, this study designed a model representing paddy area with the credit policy as one of the determining variables. Empirical results from an autoregressive distributive lag cointegration estimation technique suggests that Nigeria's credit guarantee policy has a positive and statistically significant impact on paddy area. The finding, therefore, provide suggestions for sustaining the effectiveness of the agricultural credit policy in the country.
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JEL Codes: *C13, C22, C51, C52, Q18*

1. Introduction

Recent years have witnessed some transformation of agriculture, featuring modern production techniques and a steady evolution of inputs. For many countries today, technological change, increase in technical efficiency and innovation in their agriculture sectors has accelerated growth in their agricultural production, thus generation of substantial revenue from trade in agricultural commodities (Bahşi & Çetin, 2020), necessary for economic development. This growth requires financing for the provision of production factors as well as the fulfillment of agricultural activities (Ozden, et al., 2012). For many developing countries, the provision of formal agricultural credit offers a reliable way through which these growths can be realized. This is because, agricultural credit is considered a key driver in the

development of the production and investment structure of the agricultural sector across countries and is an essential catalyst for the development of agriculture (Adanacioglu et al., 2017).

In Nigeria where rice is an important staple, paddy production is a common and viable feature of the agricultural production system that is supported by favourable production environment. Unfortunately, there is an imbalance in demand-supply, requiring the country to rely on imports to meet a growing demand. Available statistics show that in the last decade, rice consumption has increased at an annual average rate of 4.13% (USDA online database), primarily driven by population growth, means that rice demand is expected to continue growing far into the future. Rice production in the country is estimated at 3.8 million metric tonnes while domestic demand is estimated at 6.2 million metric tonnes and the shortfall (2.4 million metric tonnes) is met by imports (USDA online database). As a developing country, Nigeria's paddy system is mainly smallholder based, characterised by low use of modern inputs, inefficiency, negligible savings potential, and a rather low investment capacity. Such a system poses a challenge for the country's rice self-sufficiency policy goal which was declared in 2016. In 2016, the government set targets of becoming self-sufficient in rice production by 2018 and becoming a net exporter by 2020. This target was not met as rice self-sufficiency level for the country was 66.7% in 2018 (USDA online database).

Several policies are designed to support Nigeria's rice industry. Among these, the credit guarantee scheme fund was introduced in 1978 and through various government regimes, has occupied a critical position in the strategy for development of agricultural production environment and the rice industry. This was in recognition of the important role of formal credit in agriculture as supported by Salami & Arawomo (2013) who emphasised that a lack of credit in many cases may be a limiting factor in small-holder agriculture. Agricultural formal credit extends beyond the monetary value of the credit, on a deeper consideration, the sources of credits offer some benefits, such as the acquisition of agricultural land, equipment, and modern technologies (Bahşi & Çetin, 2020). Besides, the resources provided are capable of improving farmers' entrepreneurial skills and their operational potentials (Bahşi & Çetin, 2020). Bearing this in mind, the agricultural guarantee scheme fund has the purpose of guaranteeing commercial bank loans for approved agricultural projects with the aim of increasing the flow of banks' credit to the agricultural sector (Anifowose & Ladanu, 2015). Although, government interventions in financial markets has been a topic of contention, with opponents arguing that government intervention in the financial markets serves as a critical setback to growth, investment, and savings mobilization. Contrasting arguments such as by Narayanan (2016) favour its role in developing and transition countries who depend on extensive government interventions in rural credit markets to address market failures and widespread usurious informal lending that might suppress agricultural growth and productivity.

Despite being an enduring feature in the Nigerian policy environment, which paddy producers are supposed to be benefiting from, with a hope of increasing their investments and production capacities, there is no certainty as to whether the benefits of the credit policy is being transmitted to expansion in paddy area. Arguments against the policy by Rahji & Adeoti, (2010) suggests that the policy suffers from misplaced priorities because many small-scale farmers had limited access to the fund.

Empirical studies on the impact of formal credit in Nigeria have mostly focused production which is a broad component and avoided examining individual sub-components that make up production. Although such studies provide useful insights into the relationship between formal credit and paddy production, they are unable to reveal a more detailed insight by breaking down the production component to reveal a more complex relationship that may exist between credit and those sub-components such as paddy area. Against this backdrop, this study seeks to provide some empirical evidence to complement the available formal credit studies in

Nigeria's paddy and rice industry. It is hoped that findings from this study will further our understanding of the impact of rice credit policy in Nigeria – Africa's largest rice producer, by focusing on the impact of the country's rice credit guarantee scheme fund on paddy area. It is hoped that the technique used in this study will reveal any long-run impact of the policy on paddy area harvested. Determining the impact is important because the policy is supposed to be a factor for promoting paddy production and therefore, this study could help to reveal if this policy has been meeting up to its intended objective.

The article comprises five sections. Following the introduction, an overview of Nigeria's credit policy and schemes, and a review of empirical literature is presented in section 2. Section 3 covers the methodology used in this study, focusing on the econometric modelling of dynamic times series regression. Section 4 discusses the empirical results and section 5 concludes the study and offers some policy implications.

2. Literature Review

2.1 General Structure of Nigeria's Credit Markets

It has been a national objective to foster agricultural growth and development, which has compelled the government to intervene in the agriculture sector. Among the key areas of intervention is the provision of formal credit services towards producers, encouraged by the underlying view that assumes credit is necessary for boosting agricultural productivity such that it can establish a causality with productivity. As in most developing countries, the government has often fostered the growth of institutional financial markets mainly to provide credit facilities to farmers on concessionary terms. The concern for agricultural credit manifests itself in the set of policies and institutions put in place to promote it. As a result, Nigeria implemented an agricultural credit policy, that serves as a platform for various schemes and programs. These schemes and programs ranged from regulations and controls of formal financial institutions to the provision of incentives and establishment of specialized lending agencies. A breakdown of the various forms of agricultural credits and their instruments pursued in Nigeria since 1970 are detailed in Balogun & Otu (1991) is summarised in Table 1.

One of the vehicles of Agricultural policy is the agricultural credit guarantee scheme fund which was initiated in 1978. In order to reduce the risk associated with commercial and merchant banks' intermediation in rural financial markets, the Agricultural Credit Guarantee scheme (ACGS) was established under the Central Bank of Nigeria and was initially mandated to guarantee up to 75% of all loans granted by commercial banks for agricultural related purposes. A recent amendment to the ACGS Decree provides for 100% guarantee for small-scale farmers whose credit requirement falls below ₦0,000.00. The objective of the guarantee scheme fund was to encourage the involvement of financial institutions in lending funds to people involved in agricultural production and agro-processing activities with the ultimate aim of promoting export capacity of the nation as well as for domestic consumption (Nwosu et al., 2010).

Other credit schemes include the Commercial Agriculture Credit Scheme (CACS) which was introduced in 2009 to accelerate development of the agricultural sector by providing credit facilities to commercial agricultural enterprises, and to enhance national food security by boosting food supply and minimising food inflation (FAO, 2017). In 2011, the Nigerian government launched the Nigeria Incentive-based Risk-sharing System for Agricultural Lending (NIRSAL), which aims to reduce the risks in agricultural lending to farmers as well as lowering the cost of lending for banks (FAO, 2016). In 2016, a program called 'Anchor Borrowers Programme' was launched by the federal government. The program is managed by the Central Bank of Nigeria and supports farmers by linking them with financial institutions

to access loans. The loan funds are specially reserved for farmers and managed in a way that agricultural input suppliers are paid directly for the cost of supplies they provide to the farmers (USDA, 2017)

Table 1. Categories of Agricultural Credit Polices and Incentives in Nigeria

Agricultural Credit Policies and Incentives	**Description**	**Policy Instruments**
1- Credit allocation and control policies	Involve compelling banks and other financial intermediaries to allocate credit to the agricultural sector	-Credit quota and portfolio ceiling devices -Interest rate regulation -A requirement that certain percentage of rural saving mobilized by commercial banks must be ploughed back as credit -Policies tied to the discount and guaranteed mechanism -Reserve requirement
2- Institutional Credit Incentives and/ or Supportive Financing Facilities	The supportive financing facilities and/ or incentives are meant principally to induce commercial and merchant banks to provide credit to desired economic activities	-Rural Banking Schemes -Agricultural Credit Guarantee Scheme -Export Credit Guarantee and Refinance Schemes -Crops Insurance Schemes -National Economic Reconstruction Fund -World Bank Facility for Small-and-Medium-Scale Enterprises Loan
3- Policies establishing specialized lending institutions.	This is a policy associated with the establishment of specialized agricultural credit institutions	-Nigerian Agricultural and Co-operative Bank -Commercial and merchant banks -Specialized development bank - Nigerian Agricultural and Co-operative Bank (NACB)

Source: Compiled from Balogun & Otu, 1991.

These formal credit schemes and programs are a testament to the government's efforts towards fostering agricultural production which could ultimately lead to a progress in the development of the country's agricultural sector.

2.2 Theoretical Framework for Evaluating the Effects of Credit Policies

Existing evidence on the role of government interventions in agricultural sector financial markets are widespread and ambiguous, which has created long-standing debates. Proponents of government intervention argue that developments of financial systems translate positively to socio-economic development. This argument is supported by Akudugu, (2018), who considered agricultural credit to be an integral part of the process of advancement of agriculture and commercialization of the rural economy. Thus, the provision of affordable credit is a way of fast-tracking growth in agricultural production (Akudugu, 2018). Opponents, however, argue that previous interventions of governments in rural financial markets through

the provision of subsidized credit facilities have had little or no positive effects on socio-economic development. This argument was widespread in the 1970s through to the early 1990s, the late 1990s to early 2000s witnessed decreasing trends in the calls for interventions by governments. Government credit interventions were mostly fuelled following the world food crises in 2007 and economic meltdown in 2008 which saw a widespread state intervention in the financial sectors particularly in developing countries. The popularity of agricultural credit has resulted in a wide documentation of research papers on the relationship between agricultural credits and various aspects of agricultural production, using various techniques that are guided by different theories. In rice dependent countries, access to credit has been noted for its significant impact on boosting paddy yields (Uthamalingam et al., 2020), rice production (Rahman et al., 2014; Duy, 2015; Yakubu, 2016; Thayaparan, 2017; Aung, 2019; Das & Hossain, 2019) increasing paddy productivity (Wicaksono, 2014; Diallo et al., 2020)

To establish a pattern in analytical approach/technique, a search of literatures designed to examine the impact of credit policies on agricultural sectoral performance, observed a widespread use of different approaches. One common approach is comparative based, often set in a framework of 'with and without' credit situation. These studies seek to highlight differences between multiple target groups using statistical techniques such as comparisons of means (example t-tests), analyses of variance (e.g ANOVA) and descriptive statistics. Such an approach, according to Sacay et al. (1980) and Schaefer-Kehaet (1982), makes the results inconclusive as it suffers from "attribution" problem, which stems mainly from the fact that several other factors exist which may explain the differences in "with" and "without" credit situation. These differences according to Balogun & Otu (1991), usually include difference in yield, price uncertainty and management ability; differences in product and input prices and finally differences in household financial constraint on savings. Examples of studies using the with and without approach are Singh & Sihag (2018), who adopted a descriptive statistic technique and Ahmad et al. (2015) who adopted a production function technique, respectively, to determine the positive impacts of credit on their respective variables of interest.

Other research approaches are based on whether certain variables at the unit levels impact other variables measured at the same level (Esser & Vliegenthart, 2017). For this approach, econometric methods offer a number of techniques for analyses based on the studies' objectives. For example, the empirical works of Ahmad et al. (2018), Florence & Nathan (2020), Anh et al. (2020), Osabohien et al. (2020) and Islam (2020) employed the Autoregressive distributive lag technique to evaluate the impacts of formal agriculture credit. Other studies (Chandio et al., 2019) argued that the ARDL approach does not extend a conclusive spirit of causative associations among the forecasted and forecasting variables and thus employed the Vector error correction model (VECM) to establish a bi-directional and unidirectional associations between their variables under considered. In pursuing this same objective of the impact of credit, the ordinary least square technique Chisasa & Makina, (2013), Ammani, (2012) and Ahmad et al. (2015) and the Maximum Likelihood Estimation (MLE) technique (Chandio et al., 2019) were favoured in some credit impact studies.

The results of these empirical studies converge towards a positive impact of agricultural credit on various aspects of agricultural production. Although a few studies found a negative impact of credit on agriculture-based variables, such outcomes are unsurprising and could be attributed to a limitation in their scope of data collection. Although, quantifying the impact of credit on agriculture is a challenge. However, one step to get closer to real outcomes of credit policies/schemes is to verify if beneficiaries of agricultural formal credits actually use the credit funds for their agricultural production activities. Extending credit impact studies to verify the actual use of the credit funds will help reveal cases of misappropriation and diversion of credit funds. Such situations were highlighted by Ahmad et al. (2015) in their study reported that only 30% of credit beneficiaries utilized their loans for the purchase of farm inputs.

3. Methodology

3.1 Sources of Data

This study used time series data covering the period of 1980 to 2018 which were obtained from two main sources - data on paddy area production – measured in hectares, were obtained from International Rice Research Institute (IRRI) online database and producer prices – measured in thousand naira per metric tonnes, were sourced from FAO's FAOSTAT online database. It should be mentioned that paddy area planted should be the ideal dependent variable for this study. However, data on area planted was unavailable which prompted the use of paddy area harvested data as its proxy. In line with the objective of this study, data for only the rice fund part of the agricultural guarantee scheme fund was used in this study.

3.2 Specification of the Model

Based on availability of time series data consistent with the objective of this study, the equation for paddy area harvested was modelled as a function of the following explanatory variables: paddy harvested area measured in hectares, producer price of paddy, producer price of cassava (substitute crop), and the government's rice guaranteed credit scheme were all measured in thousand naira. These variables together were developed into the model given as:

$$PYAH_t = f(PYAH_{t-1}, PYPP_{t-1}, CVPP_{t-1}, CGSF_{t-1}) \quad (1)$$

Equation (1) can be expressed in its empirical form as: -

$$LPYAH_t = \alpha_0 + \alpha_1 LPYAH_{t-1} + \alpha_2 LPYPP_{t-1} + \alpha_3 LCVPP_{t-1} + \alpha_4 LCGSF_{t-1} + \varepsilon_t (2)$$

where $LPYAH_t$ represents the logarithm function of paddy area harvested; $LPYAH_{t-1}$ represents the logarithm function of paddy area harvested lagged one; $LPYPP_{t-1}$ represents the logarithm function of producer price of paddy lagged one; $LCVPP_{t-1}$ represents the logarithm function of producer price of cassava lagged one; $LCGSF_{t-1}$ represents the logarithm function of the rice credit guarantee scheme fund lagged one, respectively. It is expected that all featured variables will be positive except producer price of cassava. The logarithmic form of the equation was preferred because it served the advantage of interpreting the coefficients as elasticities.

3.3 Unit Root Test

An econometric approach was adopted to examine the impact of the policy of rice credit guarantee scheme fund on paddy area harvested in Nigeria. As a procedural step in time series analysis, it is necessary to check for the stationarity statuses of the data. Common tests used in this process are the Augmented Dickey Fuller (Dickey & Fuller, 1979; Dickey & Fuller, 1981) and the Phillips-Perron tests (Phillip & Perron, 1988) to check for the presence of unit roots. The test is conducted under an alternative hypothesis that suggests that the time series under consideration is stationary around two main specifications: A first specification that includes the intercept but excludes the trend term and a second specification consisting of both the trend term and the constant term. Expressing the ADF test for unit root as regression equations gives:

At constant

$$(1 - L)X_t = \alpha + \beta X_{t-1} + 1k_{i\,i}\theta = \sum(1 - L)\, x_{t-1} + \varepsilon_t \quad (3)$$

At constant and trend

$$(1 - L)X_t = \alpha + \beta X_{t-1} + \gamma T + 1k_{i\,i}\theta = \sum(1 - L)\, x_{t-1} + \varepsilon_t \quad (4)$$

where L is a lag operator, t denotes time trend, and ε_t is a white noise. Optimal lags (k) selection was established through the Schwartz criterion. The null hypothesis of the stationarity test is based on a test of $\beta = 0$; revealing that the variable has a unit root.

H_o: $\beta = 0$; (Y_t is Non-Stationary) has unit root

H_a: $\beta < 0$; (Y_t is a Stationary) has no unit root

The decision rule is to reject the null hypothesis if the t-statistic is less than the critical value. Otherwise, the time series is non-stationary at the level if the null hypothesis cannot be rejected. In the latter case, the analysis proceeds by differencing at the first or higher order of the level data until stationarity is established.

3.4 Model Estimation Technique

An autoregressive distributed lag (ARDL) method was employed to examine short-run and long-run cointegration relationships among the variables. The ARDL method was developed by Pesaran & Shin (1999 and extended by Pesaran et al. (2001). It was adopted for this study because of some strengths it possesses. Firstly, it is suitable for data that are integrated of either I(0) or I(1) or a combination of both, but not solely I(2). Secondly, the approach is more efficient and appropriate for small sample data – 38 observations in this case. Thirdly, the technique can estimate the long-run parameters of the data under consideration. Following Pesaran et al. (2001), as summarised in Nkoro & Uko (2016), the ARDL bounds-testing model takes the general form:

$$y_t = \alpha + \beta_{Xt} + \emptyset_{Zt} + e_t \quad (5)$$

the error correction version of the ARDL model has the following structure:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{\rho} \beta_i \Delta Y_{t-i} + \sum_{j=0}^{q} \gamma_j \Delta X_{t-j} + \sum_{k=0}^{r} \delta_k \Delta Z_{t-k} + \emptyset_1 Y_{t-1} + \emptyset_2 X_{t-1} + \emptyset_3 Z_{t-1} + \mu_t \quad (6)$$

In equation (6), Δ symbolises the first difference operator, α_0 represents the drift component, μ_t is the random error term with its classical attributes, and Y, X and Z represent the variables in the structural equations. The first part of equation (6) containing β, γ and δ represents the short-run dynamics of the model while the part with Øs denotes the long-run relationship. This model is run under a null hypothesis of:

$$H_0: \emptyset_1 = \emptyset_2 = \emptyset_3 = 0 \quad (7)$$

Following equation (6), the ARDL structure of the model is specified as follows:

$$\Delta Ln(PYAH_t) = \alpha_0 + \sum_{i=1}^{q_1} \alpha_{1i}\, \Delta Ln(PYAH_{t-1}) + \sum_{i=0}^{q_2} \alpha_{2i} \Delta Ln(PYPP_{t-1}) + \sum_{i=0}^{q_3} \alpha_{3i}\, \Delta Ln(CVPP_{t-1}) + \sum_{i=0}^{q_4} \alpha_{4i}\, \Delta Ln(CGSF_{t-1}) + \alpha_5\, Ln(PYAH_{t-1}) + \alpha_6\, Ln(PYPP_{t-1}) + \alpha_7 Ln(CVPP_{t-1}) + \alpha_8 Ln(CGSF_{t-1}) + \mu_t \quad (8)$$

Where Δ denotes the first difference operator, qi are optimal lag lengths, α_1 through $\alpha 4$ denote short-run dynamics of the model and, α_5 through α_8 represent long-run elasticities of PYAH with respect to their associated variables.

A null hypothesis of non-existence of a cointegration relationship is tested against an alternative of the Ø's being jointly different from zero. The computed F-statistic was compared against the critical values provided by Narayan (2005) which is appropriate for small sample

sizes, in this case, 38. As a conclusion, the null hypothesis is rejected if the computed F-statistic exceeds the upper bound of the critical value. However, in a case where the computed F-statistic falls below the lower bound critical value, the decision is to fail to reject the null hypothesis of no cointegration. The test is considered inconclusive if the computed F-statistic lies within both bounds. An error correction version of the model is represented by the following equation:

$$\Delta Ln(PYAH_t) = \alpha_0 + \sum_{i=1}^{q_1} \alpha_{1i}\Delta Ln(PYAH_{t-i}) + \sum_{i=0}^{q_2} \alpha_{2i}\Delta Ln(PYPP_{t-i}) + \sum_{i=0}^{q_3} \alpha_{3i}\Delta Ln(CVPP_{t-i}) + \sum_{i=0}^{q_4} \alpha_{4i}\Delta Ln(CGSF_{t-i}) - \lambda EC_t \quad (9)$$

Where qi represents the optimum lag length of the associated variable, λ indicates the rate at which deviations from the long-run equilibrium are restored, also referred to as the speed of adjustment and EC represents the error correction term derived from long-run equilibrium relationship as given in equation (8). The error correction term carries a negative sign which ensures that any adjustment made in the short-run is guided by and consistent with the long-run equilibrium relationship (Boansi, 2014). A significant 'λ' is preferred as it validates the existence of long-run relationship between the variables in a model.

3.5 Model Validation

Analyses of time series data follows a series of necessary steps. Following the model estimation, it is necessary to test for its validity. This is a process that involves examining the model's strength and reliability. For this step, three statistical tests were conducted, and these were the mean absolute percentage error (MAPE) – which measures the mean absolute percentage difference between the actual values and the forecast values (Chu, 2009). The root mean squared percentage error (RMSPE) – which estimates the percentage value of the deviation between the forecast value and the mean actual value, and the Theil's Inequality coefficient (U^T) – which measures the fit of the model. Mathematically, these tests are expressed as:

$$MAPE = \frac{1}{T}\sum_{t=1}^{T}\left|\left(\frac{P_t - A_t}{A_t}\right)\right| \quad (10)$$

$$RMSPE = \left[\frac{1}{T}\sum_{t=1}^{T}(P_t - A_t/A_t)^2\right]^{\frac{1}{2}} \quad (11)$$

$$U^T = \frac{1/T\sum_{t=1}^{T}(P_t - A_t)^2}{1/T\sum_{t=1}^{T}(P_t)^2 + 1/T\sum_{t=1}^{T}(A_t)^2} \quad (12)$$

In equations (10) to (12), T is the number of periods in the simulation, P is the predicted value, and A is the actual value. A satisfactory model validity is established if all the test values are close to zero.

4. Results

4.1 Unit Root and Cointegration Tests

In line with time series analyses, the variables were examined for the presence of unit root using the Augmented Dickey-Fuller, and PP tests. Results of these two tests are presented in Table 2. The variables had to be differenced at levels to achieve stationarity at 1% levels of significance. Establishing the stationarity status of the variables lends some confidence in the appropriateness of the use of ARDL technique in this study.

Table 2. Results of ADF and PP Unit Roots Tests

Variable	ADF		PP		Order of Integration
	Level	First Difference	Level	First Difference	
	t-statistic	t-statistic	t-statistic	t-statistic	
ln PYAH	-1.792	-8.090***	-1.998	-8.071***	I (1)
ln PYPP	-2.657	-6.801***	-2.616	-6.772***	I (1)
ln CVPP	-0.438	-8.814***	-0.697	-9.428***	I (1)
ln RCGSF	-1.877	-4.033***	-1.593	-4.010***	I (1)

Note: *** denotes significant at 1% significance level

Results of the ARDL bounds test are shown in Table 3. The estimated outcomes of the F-test reveal the existence of cointegration between paddy area harvested and the featured variables in the equation. This was confirmed by the value of the computed F-test exceeding the value of the upper Narayan critical value at a 10% level of significance. Once the cointegration status was confirmed, the analyses proceeded with the estimating both the long-run and the short-run coefficients of the model.

Table 3. Result of ARDL Bounds Test of Cointegration

Equation	K	F-statistic	Narayan (2005) Critical Values	
			I(0)	I(1)
PYAH	3	4.081*	2.933	4.020

Note: * denote significant at 5% and 10% levels, respectively. K is the number of exogenous variables in the equation.

4.2 Estimated Coefficients

Table 4 contains results of the ARDL bound test, and all the variables carry their expected signs. In addition, results of the diagnostic tests were satisfactory as they rule out the presence of key regression abnormalities such as autocorrelation, serial correlation, misspecification, and heteroscedasticity in the data, and confirms a good fit of the model. Included in Table 4 are the Error correction representation of the estimated ARDL model. The coefficient of a variable represents short-run elasticity of paddy area harvested with respect to the associated variable. The coefficient of credit policy - the key variable in this study demonstrated a positive impact on paddy area. However, this positive impact is statistically significant (at 5%) only in the long run. Specifically, the elasticities mean that, keeping other things constant, a 10% increase in agricultural credit guarantee fund will induce a 1.6% increase in paddy area harvested in the long-run relative to a 0.01% increase in paddy area harvested in the short-run. It is possible that increases in the initial credit funds could be weekly transmitted to expansion in paddy area in the short-run, due to factors like late disbursement of credit funds or diversion of funds which could limit producers' ability to properly plan and prepare their farms for the planting season. In the long run however, following factors like accumulated experience in financial management of and improved planning strategies, the credit funds could transmit to significant area expansion. This is expected since credit is assumed to be an enabling input source through which other production inputs are purchased at sufficient quantities and at the right times. Although, a 10% increase in credit policy observed in time t-1, may be statistically significant by empirical estimates, in reality, such increase may be insufficient to stimulate a remarkable growth in paddy area that could immediately lead to an achievement of Nigeria's

rice self-sufficiency goals. Identifying the significance of formal credit to paddy area is crucial because paddy producers' farming decisions are influenced by availability of financial capital, which consequently has significant implications on future paddy hectarage. Regarding the producer price of paddy, its elasticity was positive and statistically significant at 1%. This is expected because access to credit is expected to work in conjunction with paddy producer price. In situations where credit is inaccessible or insufficient, farmers would rely on prices of their produce to increase their financial capacities so as to sustain their farms.

Table 4. Estimated Long-run and Short-run Coefficients of the ARDL Approach

Regressor	**Coefficient**	**Standard Error**	**t-statistic**	**Probability**
Long-run Estimation				
PYAH (-1)	0.260	0.168	1.555	0.131
$PYPP_t$	0.206	0.049	4.170	0.000***
$CVPP_t$	-0.076	0.053	-1.433	0.161
CGSF (-1)	0.162	0.072	2.252	0.031**
Adjusted R^2	0.951			
BG-LM	0.888			0.422
BP-G	1.051			0.406
DW	2.311			
JB	19.556			0.000
Ramsey RESET	0.084			0.774
Short term dynamics				
$\Delta PYAH_t$	0.538	0.327	1.643	0.110
$\Delta PYPP_t$	0.100	0.092	1.096	0.282
$\Delta CVPP_t$	-0.082	0.079	1.037	0.308
$\Delta CGSF_t$	0.005	0.084	0.058	0.954
ECT_{t-1}	-0.997	0.359	-2.779	0.009***

Note: ***, ** and * denote significant at 1%, 5% and 10% levels, respectively. BG-LM is the Breusch-Godfrey Lagrange Multiplier test, JB is the Jarque-Bera test, RESET is Ramsey's test, BP-G is the Breusch-Pagan-Godfrey test, and Δ represents first difference of the variable.

The estimated coefficient of the producer price for cassava variable is negative and statistically insignificant, indicating that a 10% increase in paddy area harvested will cause paddy producers to switch a 0.8% of area harvested for cassava in favour of paddy in both periods. The coefficient of error correction term is minus 0.997 and indicates that a substantial amount of disequilibrium error from the previous period is corrected in one period. It reveals a fast speed of adjustment and strengthens the existence of long-run relationship among the variables in the model.

Paddy production in Nigeria is an integral part of the country's agricultural and food system that has prompted several policies and programs to stimulate its production. One of these policies – credit policy has been shown by the empirical evidence from this study to have a positive influence on paddy hectarage.

4.3 Validation Tests

To assess the validity of the model, several tests were conducted, and their results are summarised in Table 5. The value of the MAPE is less than 10%, indicating a good forecast accuracy. The U^Ts are less than 1%, suggesting a non-existence of systematic bias and a satisfactory model performance. Based on these statistics, we can conclude that the model offers a fairly accurate representation of the data.

Table 5. Summary of Model Validation Results

Statistic	Notation	Value
Mean Absolute Percent Error	MAPE	0.533
Root Mean Squared Percent Error	RMSPE	0.763
Theil Inequality Coefficient	U^T	0.004

5. Conclusion and Policy Implications

In Nigeria, the use of agricultural credit guarantee scheme as a policy tool with a goal of improving agricultural production of farmers has a long history. The basic thrust of the agricultural guarantee scheme fund is the guaranteeing of up to 75% credit of commercial banks for Nigerian farmers to ease their purchase of modern farm inputs. The effectiveness of such programs has been widely researched, focusing on various aspects of the country's food production systems. Concerning the sub-sector of paddy production, this study narrows down the objective to examine the impact of the credit policy on paddy area. Based on a reliable estimation technique, this paper empirically finds that the rice credit guarantee scheme fund in Nigeria has a positive impact on paddy area. Although, this positive impact is quite weak because it is only statistically significant in the long-run, it suggests that the credit policy seems to be a reliable strategy for pursuing the country's goal of rice self-sufficiency in the long-run. With smallholders being the dominant producers of paddy in the country, expanding their production capacities will require increased access to financial resources to gain the benefits of modern agricultural technology. It justifies prioritising Nigeria's rice industry - a prominent employer, for cogent policy considerations.

A few recommendations that mainly focus on the sustainability of the policy are made considering empirical evidence from this study. First, to ensure that farmers benefit substantially from the credit policy, a timely processing and disbursement of credit funds should be ensured to enable farmers make timely farm management decisions. Secondly, financing institutions should promote sensitisation of farmers on processes related to timely loan applications, documents preparations and other credit application procedures to enhance paddy farmers' accesses to the loans. This is important especially for uneducated farmers. Thirdly, to ensure that farmers use the credit funds for their paddy production activities, the government and/or credit institutions, could link farmers with input supply companies and outlets to ease and encourage farmers' access to modern farm inputs.

The general conclusion implied by the results of this study is that the agricultural formal credit scheme in Nigeria has a positive and in the long run, this positive impact is significant on paddy area. A key limitation of this study that requires mentioning, as they suggest direction for further research, is the lack of available data on some variables. For example, variables representing paddy area planted and fertilizer prices could have improved the model. In addition, the study does not include an explicit analysis that verifies if farmers actually used the funds for their paddy production activities, which could explain why the credit policy was

statistically insignificant in the short run. Thus, a more accurate outcome of the impact of the policy on paddy producers by ascertaining if loan beneficiaries used the funds for their paddy production activities, remains a topic for further studies.

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