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The Impact of Credit Policy Environment on Agricultural Output in Nigeria

Nijerya'da Kredi Politikası Ortamının Tarımsal Üretim Üzerindeki Etkisi

Sunday Brownson AKPAN [1]
Edet Joshua UDOH [2]
Veronica Sebastin NKANTA [2]
Ini-mfon Vincent PATRICK [1]

[1]: Akwa Ibom State University, Ikot Akpaden, Mkpat-Enin, Nigeria

[2]: University of Uyo, Akwa Ibom State, Nigeria

ABSTRACT

The growth of the agriculture sector is a key factor in the survival of the Nigerian economy. However, the production and productivity of this sector have been lower than expected recently. The country is now a net importer of some crops that were previously produced in large quantities. Hence, with the aim to identify factors that influence the sector, the study specifically establishes the relationship between the agricultural sector growth proxy by the agricultural production index and the credit policy variables in Nigeria. The research utilized the flexible autoregressive distributed lag (ARDL) approach to determine the presence of co-integration. The estimated long-run and short-run models demonstrated the best, most efficient, and unbiasedness qualities. The findings revealed that loans from commercial banks and the Agricultural Credit Guarantee Scheme Fund (ACGSF) have a significant positive impact on the agricultural sector's growth in the long run. Conversely, the long-run agricultural growth exhibited a negative relationship with the domestic credit to the private sector and lending interest rate. This finding underscores the importance of boosting commercial bank loans to the agricultural sector and increasing credit volume from the Agricultural Credit Guarantee Scheme Fund. Furthermore, it highlights the necessity of introducing more financial incentives to attract domestic private investments and lowering the lending interest rate on agricultural credit within the country.

Keywords: Credit, Agriculture, Production, Policy, Macroeconomics, Nigeria

ÖZ

Tarım sektörünün büyümesi Nijerya ekonomisinin sürdürülebilirliği için kilit bir faktördür. Ancak son dönemde bu sektörün üretimi ve verimliliği beklenenin altında kalmıştır. Ülke, daha önce büyük miktarlarda üretilen bazı mahsullerin artık net ithalatçısı konumundadır. Bu nedenle, sektörün büyümesini etkileyen faktörlerin belirlenmesi amacıyla bu çalışma, özellikle Nijerya'da tarımsal üretim endeksi yoluyla tarım sektörü büyüme göstergesi ile kredi politikası değişkenleri arasındaki ilişkiyi incelemektedir. Araştırmada, eş bütünleşmenin varlığını belirlemek için esnek otoregresif dağıtılmış gecikme (ARDL) yaklaşımı kullanılmıştır. Tahmin edilen uzun dönem ve kısa dönem modeller en iyi, çok verimli ve yanlılıktan uzak nitelikler sergilemiştir. Bulgular, ticari bankalardan alınan kredilerin ve Tarım Kredi Garanti Fonu (ACGSF)'nun uzun vadede tarım sektörünün büyümesi üzerinde önemli ve olumlu bir etki yaptığını ortaya koymuştur. Bunun aksine, tarımsal büyümenin uzun dönemde özel sektöre sağlanan yurtiçi krediler ve tarımsal kredi faiz oranıyla olumsuz bir ilişki gösterdiği tespit edilmiştir. Bu bulgu, tarım sektörüne yönelik ticari banka kredilerinin artırılmasının ve Tarım Kredi Garanti Fonu'ndan sağlanan kredi hacminin yükseltilmesinin önemini vurgulamaktadır. Ayrıca, yurtiçi özel yatırımları teşvik etmek için daha fazla mali teşvik sağlanmasının ve tarımsal kredi faiz oranlarının düşürülmesinin gerekliliğini ön plana çıkarmaktadır.

Anahtar Kelimeler: Kredi, Tarım, Üretim, Politika, Makroekonomi, Nijerya

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Corresponding author / Sorumlu Yazar: Sunday Brownson AKPAN
E-mail: sundayakpan@aksu.edu.ng
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Introduction

Agricultural credit plays a crucial role in boosting agricultural production, especially among resource-poor rural farm households in developing nations (Jeiyol et al., 2013; Akpan et al., 2020; Balana & Oyeyemi, 2022). Timely provision of farm credit has been associated with increase in agricultural output and factor productivity as noted in several studies in Nigeria (Akpan et al., 2013; Abu, et al., 2017; Adewale et al., 2022). Despite this assertion, some researches have brought to light instances of credit inadequacy among rural farmers in Nigeria (Assogba et al., 2017; Asom et al., 2023). According to Akpan et al. (2012; 2013), credit is an essential tool for income creation, organizing factors of production and creating a sustainable productive environment. In rural areas, where farmers often have limited resources, credit is essential for supporting agricultural activities that are highly time-sensitive. As Beck and Demirguc-Kunt (2006) noted, farm credit increases the welfare of farmers through income smoothing. Jeiyol and Akpan (2013) emphasize the pivotal role of agricultural credit in the sustainability of agricultural production and its value chain. The availability and demand for farm credit are crucial for attaining the overarching national objectives of alleviating rural poverty, generating sustainable employment opportunities, and ensuring food security.

Recognizing the importance of agricultural credit, the government has introduced multiple programs to enhance credit access for farmers. These measures strive to provide cost-effective and subsidized credit with a favorable interest rate to farmers (Akpan et al., 2012). For instance, in 1990, community banks were established within the country's financial landscape to offer banking services and financial assistance to rural areas and small enterprises in urban areas. In 1996, the Central Bank of Nigeria (CBN) introduced guidelines for specialized loans to support the agricultural sector through commercial banks (Manyong et al., 2005). In 2009, the Central Bank of Nigeria (CBN), in collaboration with the Federal Ministry of Agriculture and Water Resources (FMAWR), launched the Commercial Agriculture Credit Scheme (CACS). The objective of the scheme was to collaborate with relevant stakeholders in financing agricultural processing and its rich value chain (Olomola & Yaro, 2015). Also in 2011, NIRSAL (Nigeria Incentive-Based Risk Sharing System for Agricultural Lending) was inaugurated. NIRSAL's primary goal was to incentivize commercial banks to invest in the agricultural value chains. In 2013, CBN introduced The Micro, Small, and Medium Enterprises Development Fund (MSMEDF) to enhance rural farmers' access to credit in the country (Salisu & Alamu, 2023).

Additionally, the CBN has strategically utilized various tools, including the lending rate policy, monetary policy instruments, and fiscal policy measures, to influence the macroeconomic environment. These measures were intended to increase the credit base of the economy and foster growth in key sectors (CBN, 2022). For instance, governments in the country have implemented significant incentives to support farmers and agribusinesses in enhancing their incomes and performances (Akpan et al., 2012). Additionally, a dualistic credit market structure, comprising formal and informal credit markets, has been established to provide farmers with greater flexibility in accessing and demanding for credit. This efficient credit market system has expanded the availability and accessibility of credit to rural farmers. Despite these efforts to strengthen the credit infrastructure and boost credit volume in the agricultural sector, various researchers have argued that the sector's underperformance in the country can be attributed in part to insufficient credit provision (Assogba et al., 2017; Balana & Oyeyemi, 2022; Asom et al., 2023). According to Akpan et al. (2016), Akpan et al. (2019), Balana and Oyeyemi (2022), the underperformance of agro-sector is expected to result in a rise in poverty, hunger, unemployment, and substandard living conditions for most farmers. Similarly, Adewale et al. (2022) shows that access to credit can serve as an effective tool for obtaining resources to enhance agricultural production, boost farmers' earnings, and elevate living standards.

Nigeria's agricultural sector mainly consists of four sub-sectors. These are; Crop production subsector, consisting of food and cash crops; Fisheries subsector, which includes artisanal production and aquaculture production; Forestry sub-sector and livestock sub-sector, consisting of poultry, ruminants and monogastric animals among others. In 2020, 2021 and 2022, the agricultural sector contributed about 24.45%, 23.70% and 24.05% to the GDP of the Nigerian economy, respectively (CBN, 2023). The sector plays a vital role in sustaining the nation's food security by supplying essential nutrients to the population. With over 40% of the workforce employed in this sector, it also serves as a major source of raw materials for the country's agricultural industry. The Nigerian economy is best described as an agrarian economy, meaning that the country is heavily dependent on agricultural production. Despite these traditional functions of the agricultural sector, the country has not achieved self-sufficiency in basic foodstuffs in recent years. Following this incident, Nigeria is a net importer of several staple foods including rice, vegetable oil and fruits among others. The economic consequences of this issue significantly affect Nigeria's economy in the short and long term. The per capita production of the sector is decreasing, hindering the

country's progress towards achieving the second Sustainable Development Goal (SDG). Urbanization and population growth have led to intensified agricultural land use, reducing the available area for farming. Labour demand in the sector remains inelastic in many regions of the country, creating challenges for production (Akpan et al., 2023. In recent years, the agricultural sector has been plagued by political inconsistencies and corruption. Additionally, the cost of agricultural inputs has skyrocketed, with prices increasing by as much as 100% to 150% from January 2021 to January 2024 (Sanchi et al., 2022; FAO, 2024). In order to address these issues effectively, the sector necessitates prompt interventions, including the implementation of advanced technologies to enhance production processes, among other measures.

Credit is seen as a significant factor in financing the adoption of farm technology in developing nations. Adewale et al. (2022) emphasize the vital role credit plays in enhancing and updating agricultural production. Similarly, Mohsin et al. (2011) suggest that agricultural credit offers motivation for farmers to embrace new technologies. Oyelade (2019) further argues that inadequate access to farm credit contributes to a decline in agricultural output in Nigeria. However, the Nigeria government has provided several credit facilities to the sector through specialized agencies and intervened on the banking policies in order to regulate credit availability at the downstream of the sector. For instance, the Agricultural Credit Guarantee Scheme Fund (ACGSF) and the subsidized commercial bank credit and advances to the sector among others were initiated to provide more credit facilities to farmers. Then the relevant question is; have government efforts pointing to credit intervention or provision in the sector helped to boost overall production in the sector? In order to provide an answer to this question, many experts have adopted diverse approaches to analyze this critical issue. For example, Nnamocha and Eke (2015) and Adewale et al. (2022) reported a significant direct association between bank loans and advances and agricultural growth in Nigeria. Similarly, Udoka et al. (2016) in Nigeria revealed a strong positive correlation between the Agricultural Credit Guarantee Scheme Fund (ACGSF) and the agricultural sector's output. The research also highlighted the positive impact of commercial bank loans on agricultural sector output, while noting a negative relationship between lending interest rates and the sector output. Additionally, Asekome and Ikojie (2018) and Iliyasu (2019) demonstrated the detrimental effect of lending interest rates on agricultural investment in Nigeria. Furthermore, Salisu and Alamu (2023) emphasized the significant positive influence of commercial bank total loans to the agricultural sector and lending interest rates on agricultural production in Nigeria. Furthermore, Anetor et al. (2016) found that ACGSF had performed poorly in stimulating growth in agricultural sector, while commercial banks loan to the agricultural sector had a positive significant impact on the sector's production. Moreover, Enilolobo et al. (2018) in Nigeria reported a non-cointegrated relationship between deposit bank lending to the agricultural sector and agricultural sector output. Furthermore, Ajayi et al. (2017) and Emenuga (2019) found that total commercial bank loans and ACGSF have a significant positive effect on agricultural sector's output. On the other hand, lending rate had negative relationship.

The macroeconomic environment of Nigeria has witnessed significant changes in recent times, affecting both the monetary and financial policies in which financial institutions are anchored. For example, the exchange rate has deteriorated to the worst level in the country's history; Interest rates have risen to double-digit rates and other banking policies have been either change or introduced. Given these changes, an assessment or update on the correlation between agricultural growth or production and credit policy environment in Nigeria in light of these new realities is necessary. Therefore, the study was specifically designed to test the correlation between credit policy environment and agricultural production index in Nigeria.

Methods

Study area and source of data

Nigeria, situated in West Africa, covers approximately 923,769 km^2 of land and boasts a coastline stretching 853 km along the northern frontier of the Gulf of Guinea. According to the National Population Commission (NPC, 2023), Nigeria's population exceeds 200 million. The study utilized time series data sourced from reputable sources such as the Central Bank of Nigeria (CBN), World Bank, and Food and Agriculture Organization (FAO). The analysis covered the years 1991 to 2021, chosen based on the availability and relevance of data during this period.

Model Specification/Analytical Techniques

The effect of credit policies on agricultural sector's growth or output (proxy by agricultural gross production index) is expressed implicitly in a double-log functional form, as demonstrated in equation 1. The mode adhered to the principles of production theory. The study assumed that acquired credit was utilized to obtain various factors of production, including labour, capital, and land, among others. Ameh and Lee (2022) and Adewale et al. (2022) have identified a direct link between agricultural credit and factors of production. This indicates that agricultural

production is dependent on access to credit. The coefficients in the model represent the elasticity of specific variables. Our study delves into different types of credit available to the agricultural sector, whether directly or indirectly. Each credit variable in the model underwent a weighting transformation to address any issues with multicollinearity.

$$\mathrm{AGP_t} = \mathrm{f(ACG_t, CAG_t, LEN_t, DCP_t)} \quad (1)$$

Where,

AGP_t = Agricultural gross production index (2014-2016) = 100) (%) proxy of agricultural output or growth

ACG_t = Total loan to Agricultural sector guaranteed by ACGSF (% Agric. GDP)

CAG_t = Commercial bank credit to agricultural sector/GDP (%)

LEN_t = National lending rate (%)

DCP_t = Domestic credit to private sector (% of GDP)

The independent variables in this study are reflective of various credit policy initiatives implemented by the Nigerian government over time. For instance, the Agricultural Credit Guarantee Scheme Fund (ACGt) was established to offer financial assistance to farmers, with the Central Bank of Nigeria acting as the primary guarantor (Akpan et al., 2012; Umoren et al., 2016; Umoren et al., 2018). Additionally, commercial banks have been consistently directed by the CBN to allocate a specific percentage of their total credit and advances to the agricultural sector (CAGt) as part of governmental policy (Mbutor et al., 2013). To further control the flow of credit in the economy, the Central Bank of Nigeria has maintained a market-regulated lending interest rate nationwide (LENt) (Awopegba et al., 2022). Furthermore, the federal government has implemented a credit policy aimed at encouraging private investment through incentives in the financial sector (DCPt) (Anyanwu, 2010).

Credit environment and Agricultural sector's output

The study employed the Autoregressive Distributed Lag (ARDL) model to examine the relationship between agricultural sector's growth and credit variables. Cointegration between the agricultural sector's growth and credit variables was verified through the ARDL-bound test, as proposed by Pesaran and Shin (1998) and Pesaran et al. (2001). Once cointegration was confirmed, the short and long-run models for agricultural sector's growth were generated. Considering both Engle and Granger's two-stage method (1977-98) and Johansen and Juselius's (1990) cointegration technique, the ARDL-bound model offers certain advantages. The ARDL-bound test is capable of handling series with diverse stationarity. This characteristic of ARDL provides alternative path to the analysis of cointegration compared to the previous techniques. The ARDL technique estimate models that contains series integrated at level and first difference. Despite this, the ARDL technique can also be applied to stationary series either at the level or in first difference. A key advantage is that the ARDL test is particularly effective when working with small or finite sample data sizes. The method offers unbiased and reliable estimates of the long-run model (Harris & Sollis, 2003). Compared to other multivariate co-integration techniques, the ARDL bounds test is simple and straightforward. It allows the use of the OLS technique for estimating the co-integration relationship between variables once the lag order of the model is determined.

The ARDL model for agricultural sector's growth or output in double-log form is given in equation 2:

$$\begin{aligned}\Delta AGP_t = {} & \beta_0 + \beta_1 \textstyle\sum_{i=1}^{n_1} \Delta AGP_{t-i} + \\ & \beta_2 \textstyle\sum_{i=1}^{n_2} \Delta ACG_{t-i} + \beta_3 \textstyle\sum_{i=1}^{n_3} \Delta CAG_{t-i} + \\ & \beta_4 \textstyle\sum_{i=1}^{n_4} \Delta LEN_{t-i} + \beta_5 \textstyle\sum_{i=1}^{n_5} \Delta DCP_{t-i} + \delta_1 AGP_{t-i} + \\ & \delta_2 ACG_{t-i} + \delta_3 CAG_{t-i} + \delta_4 LEN_{t-i} + \delta_5 DCP_{t-i} + U_t\end{aligned} \quad (2)$$

When utilizing the ARDL approach, it is assumed that the dependent variable is a vector. Consequently, equation 2 can be specified by making any of the explanatory variable a dependent variable. The short run or ECM parameters are marked by β_1 to β_5. Similarly, the long run coefficients are symbolised by δ_1 to δ_5. Moreover, the β_0 is the constant, "n" denotes lag length, and U_t is a white noise residual. To determine the presence of a stable, long-run relationship (co-integration) between the agricultural sector' output or growth and credit policy variables, we utilized the bounded F-statistic test. If the calculated bound F-statistic exceeds the upper critical thresholds at the established probability levels of 1%, 5%, or 10%, the null hypothesis is rejected, indicating the existence of a co-integration relationship. The hypothesis being investigated is as follows:

$$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$$

$$H_a: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$$

If the estimated F-value is below the lower critical limits, the null hypothesis is not rejected, indicating the absence of a cointegration relationship. When the estimated F-value falls within the lower and upper critical limits, the outcome is considered inconclusive (Pesaran et al., 2001). If the ARDL bound test confirms cointegration, the long-run model and ECM are then estimated. The long-run and short-run models used in the study can be represented by equations 3 and 4, respectively.

The long run model:

$$AGP_t = \delta_0 + \delta_1 ACG_t + \delta_2 CAG_t + \delta_3 LEN_t + \delta_4 DCP_t + \varepsilon_t \quad (3)$$

The short run model (ECM model):

$$\Delta AGP_t = \beta_0 + \beta_1 \sum_{i=1}^{q_1} \Delta AGP_{t-i} + \beta_2 \sum_{i=1}^{q_2} \Delta CAG_{t-i} + \beta_3 \sum_{i=1}^{q_3} \Delta LEN_{t-i} + \beta_4 \sum_{i=1}^{q_4} \Delta DCP_{t-i} + \beta_5 \sum_{i=1}^{n_5} \Delta ACG_{t-i} + \emptyset ECM_{t-1} + U_t \quad (4)$$

In the model, the symbol Ø denotes the error coefficient or the Error Correction Mechanism (ECM). This coefficient reflects how quickly the system adjusts in the short run to achieve long-run stability. Other coefficients in the model measure short-run elasticity or impacts. The stability and reliability of the ECM were assessed through various diagnostic tests, including the RESET test, tests for serial correlation, normality, and heteroscedasticity. Additionally, cumulative sum (CUSUM) and CUSUM of squares (CUSUMSQ) tests were conducted to further validate the reliability of the ECM.

Results

Brief descriptive of variables

Table 1 presents the details of the variables used in the analysis. The coefficient of variability for the loan disbursed by the Agricultural Credit Guarantee Scheme to the agricultural sector (ACG) is 69.60%, indicating a high level of fluctuation during the analysis period. In contrast, the volatility coefficient for the remaining variables is below 50%, suggesting minimal fluctuations. The estimated exponential growth rate for most variables shows a single-digit annual growth rate. However, the loan to the agricultural sector from the Agricultural Credit Guarantee Scheme Fund (ACG) and the lending interest rate (LENt) experienced negative annual exponential growth rates of -0.25% and -1.59% respectively.

Stationarity test

The stationarity of the series was verified using the Augmented Dickey-Fuller (ADF) and ADF-GLS techniques (Dickey & Fuller, 1979; Elliott et al., 1996), with the estimates presented in Table 2. The findings indicated that the lending interest rate (LENt) and agricultural sector's growth (AGPt) were stationary at their levels, while other series were stationary at the first difference for the ADF equation with a constant and trend. However, for the ADF-GLS equation with a constant and trend, all specified series were stationary at their first difference. Therefore, there was a combination of stationary and non-stationary variables identified in the analysis. The unit root test results from the ADF-GLS and ADF supported the use of the Autoregressive Distributed Lag (ARDL) model on the specified series.

The optimum lag length

Before estimating the ARDL model, the optimal lag for the series was identified using various information criteria such as the Akaike Information Criterion (AIC), Schwarz-Bayes Criterion (BIC), and Hannan-Quinn Criterion (HQC). The specific lag length is detailed in Table 3. For this research, a BIC lag of 4 was determined to be the most suitable lag length for the ARDL model. Figure 3 displays 20 ARDL models computed based on the AIC criterion.

Table 1

Brief statistical descriptive of variables

Variable	Min	Max	Mean	Std. deviation	CV	Skewness	Exp. growth rate (%)
AGP_t	45.7700	111.690	79.4970	19.5170	0.246	0.028	2.780
ACG_t	0.0120	0.1550	0.0420	0.0290	0.696	1.943	-0.250
CAG_t	15.8240	76.6610	43.4880	19.6470	0.452	0.193	4.710
LEN_t	11.4830	31.6500	18.7390	3.77350	0.201	1.294	-1.590
DCP_t	5.24110	19.6260	10.4460	3.46070	0.331	0.880	2.690

Source: Prepared by authors. Data obtained from WB, CBN and FAO.

Table 2

Unit root of variables (ADF and ADF-GLS equation)

	ADF-GLS (with constant and trend)				ADF (with constant and Trend)		
	Lag	Level	1st Diff.	Dec.	Lag	Level	1st Diff.	Dec.
AGP_t	0	-3.0895*	-	1(1)	0	-1.7365	-9.3570***	1(1)
ACG_t	0	-1.7014	-5.2228***	1(1)	0	-1.6493	-5.1067***	1(1)
CAG_t	0	-2.9062	-6.1434***	1(1)	0	-2.9158	-5.9859***	1(1)
LEN_t	0	-3.2602**	-	1(0)	0	-3.1941	-5.7211***	1(1)
DCP_t	0	-2.7776	-4.7252***	1(1)	0	-2.8146	-5.2125***	1(1)
		Critical values				Critical values		
1%		-3.7700	-3.7700		1%	-4.2967	-4.3098	
5%		-3.1900	-3.1900		5%	-3.5684	-3.5742	
10%		-2.8900	-2.8900		10%	-3.2184	-3.2217	

Note: the symbols ***, ** and * indicate 1%, 5% and 1% level of significant. Variables in log. Dec. means decision.

Table 3
Optimal lag length of series

Lags	Loglik	P(LR)	AIC	BIC	HQC
1	42.57654		-2.846123	-2.504838	-2.751465
2	47.78198	0.00125	-3.182559	-2.792518	-3.074378
3	55.29627	0.00011	-3.703701	-3.264906	-3.581998
4	57.05201	0.06094	-3.764160	-3.276610*	-3.628935
5	57.74696	0.23842	-3.739757	-3.203452	-3.591009
6	59.64638	0.05129	-3.811711*	-3.226650	-3.649440*

Asterisk level shows optimal lag length.

Table 4
The ARDL Bound Test result (Restricted Constant and No Trend)

Equation	Lags	F-Statistic	Decision
$F_{AGPt}(AGPt \mid ACG_t, CAG_t, LEN_t, DCP_t)$	(4, 2, 2, 2, 1)	5.659	Co-integration
Significant level (Asymptotic n = 1000)	**Lower 1(0)**	**Upper 1(0)**	
10.00%	2.200	3.090	
5.00%	2.560	3.490	
2.50%	2.880	3.870	
1.00%	3.290	4.370	
Critical Values at Bound (at K = 4 and Finite sample: n = 35)			
10.00%	2.4600	3.4600	
5.00%	2.9470	4.0880	
1.00%	4.0930	5.5320	

Source: From analysis.

The test for cointegration using ARDL bound test

The bound test was employed to verify the presence of cointegration between the agricultural sector's growth and the credit policy instrument. The estimated F-test for the chosen equation (5.659) is displayed in the top section of Table 4. This finding indicates that the computed F-test at the 1% significance level surpasses the tabulated upper critical bound value of 4.37. This suggests that there exists cointegration between the agricultural sector's output or growth and the specified credit policy instruments. As a result of this outcome, the null hypothesis is rejected. The bound test outcomes reveal that, for the specified agricultural sector's growth equation, a long-run equilibrium or stability equation exist. Additionally, a short-run or Error Correction Model (ECM) was estimated to capture the short-run dynamics and ascertain the speed of adjustment in response to deviations from the long-run equilibrium. Upon confirming cointegration among the variables, Table 5 displays the coefficients or parameters of the long-run component in the ARDL model.

The long run estimates

The analysis of long-run results revealed a positive and significant inelastic correlation between commercial banks' credit to the agricultural sector (CAGt) and agricultural sector's output or growth in Nigeria, with a probability of 5.00%. The findings indicate that for every unit increase in commercial bank credit to the agricultural sector, there is a corresponding 0.87% rise in Nigeria's total agricultural production (measured by the Agricultural Production Index). These results align with expectations, as agricultural credit is recognized for its ability to boost agricultural output.

The finding emphasizes the significance of government policies that incentivize commercial banks to extend loans and advances to the agricultural sector in Nigeria. This strategy is recognized as a highly effective method for boosting agricultural production in the country. Given that a majority of farmers in Nigeria have limited resources, access to credit is essential for optimizing resource utilization, enhancing production, and improving overall livelihoods. This outcome aligns with similar findings reported by Nnamocha and Eke (2015), Ajayi et al. (2017), Adewale et al. (2022), as well as Salisu and Alamu (2023).

Table 5
The Long- run estimates

Variable	Coefficient	Std. error	t-value	Probability
LEN_t	-0.485301	0.149488	-3.246421***	0.0076
DCP_t	-1.233940	0.594405	-2.075926*	0.0621
CAG_t	0.874230	0.289659	3.018131**	0.0117
ACG_t	0.068078	0.018294	3.721329***	0.0024
Constant	5.719042	1.641741	3.483522***	0.0051

Note: ***, and ** represent 1% and 5% significance respectively. Variables are expressed in logarithm..

The analysis reveals that loans guaranteed by the Agricultural Credit Guarantee Scheme Fund (ACGt) exhibit a stable positive inelastic correlation with agricultural sector's output in the long run, with a significance level of 1%. This indicates that a rise in the agricultural sector guarantee loan

is associated with a 0.07% increase in overall agricultural production. The results imply that loans from the Agricultural Credit Guarantee Scheme Fund (ACGt) to farmers and agribusinesses have played a crucial role in enhancing agricultural production within the country. These findings are consistent with the research conducted by Udoka et al. (2016) and Emenuga (2019).

The study revealed a significant negative relationship between the domestic credit to the private sector and the agricultural output in the long run. Specifically, an increase in domestic credit to the private sector was associated with a 1.23% decrease in the country's agricultural production. Essentially, boosting domestic credit to the private sector would diminish agricultural production in Nigeria in the long run. This suggests that investment opportunities in the agricultural sector are not currently a top priority for private sector investors in Nigeria. Therefore, there is a need to enhance investment incentives in the sector to stimulate private sector interest and drive in the long run.

There is a significant negative relationship between the lending interest rate and agricultural production in Nigeria, suggesting that an increase in the lending rate will likely lead to a decrease in agricultural production or growth in the long-run. For instance, a 1% rise in the national lending rate is associated with a 0.49% reduction in the agricultural production. Consequently, raising the lending interest rate is likely to increase farmer defaults, leading financial institutions to reduce lending to the agricultural sector. This decrease in credit availability for farmers, who are mostly resource-constrained, would hamper production. These findings are consistent with previous studies by Asekome and Ikojie (2018), Iliyasu (2019), and Emenuga (2019).

Table 6

The ARDL Short - run estimates (Restricted constant)

Variable	Coefficient	Std. error	t-value	Probability
D(AGP(-1))	0.320858	0.124513	2.576897**	0.0257
D(AGP(-2))	0.580897	0.074590	7.787897***	0.0000
D(AGP(-3))	-0.348613	0.112971	-3.085860***	0.0104
D(LEN)	-0.336351	0.047497	-7.081554***	0.0000
D(LEN(-1))	0.150923	0.034744	4.343826***	0.0012
D(DCPS)	-0.155891	0.032127	-4.852311***	0.0005
D(DCPS(-1))	0.227531	0.037047	6.141637***	0.0001
D(CAG)	-0.012291	0.023583	-0.521180	0.6126
D(CAG(-1))	-0.089082	0.025275	-3.524461**	0.0048
D(ACG)	0.030449	0.010368	2.936945**	0.0135
ECM (-1)	-0.184222	0.032600	-5.651050***	0.0001
R-Squared	0.887455	Durbin-Watson	2.621310	

Source: Obtained from Eview results. Asterisk ***, and ** indicate 1% and 5% probability respectively. Variables in log., difference. ARDL lag length (4, 2, 2. 2, 1) from Akaike info criterion.

The short run coefficients of ARDL model

The ARDL error correction model or ECM estimates are presented in Table 6. The coefficient for the ECM is negative and statistically significant at the 1% level, affirming the presence of cointegration between the agricultural sector's output or growth and credit policy instruments. The ECM coefficient measures the speed at which the long-run equilibrium is restored following short-run shocks. The result indicates that approximately 18.42% of the short-run disequilibrium is annually adjusted towards the long-run equilibrium. Alternatively, around 18.42% of the previous year's imbalances are adjusted towards long-run equilibrium in the current year. The ECM model diagnostic tests revealed an R2 value of 0.8875, indicating that credit policy variables accounted for roughly 88.75% of the total volatility in agricultural output in the country.

The ECM analysis indicates that there is a negative inelastic relationship between the total credit (CAGt) given to the agricultural sector by commercial banks in the previous year and the current year's agricultural sector's output. Specifically, a 1% rise in total credit to the agricultural sector from commercial banks in the previous year is associated with a 0.089% decrease in the current year's agricultural sector's production. This suggests that an increase in commercial bank credit to the agricultural sector in the previous year could result in a reduction in agricultural sector's production in the current year. However, it is important to note that agricultural production or investment typically requires a significant amount of time to yield results, indicating that a close tie between loan disbursement and farm production may potentially reach its full impact in the long run. Furthermore, the continuous increase in lending interest rates in recent times may offer a plausible explanation for this observation.

In the short run, there was a noticeable positive association between the current value of the agricultural sector guarantee loan from ACGSF and the agricultural sector's output. This indicates that an increase of one unit in the current credit guarantee for the agricultural sector would result in a 0.03% rise in the country's agricultural sector's output. The outcome emphasized the significance of ACGSF policies in stimulating short-run agricultural sector's output. The discovery validates the findings of Anetor et al. (2016), Ajayi et al. (2017), and Emenuga (2019).

The study found that there is a negative inelastic relationship between the current lending rate and the agricultural sector's output. Specifically, a 10% increase in the current lending interest rate results in a 3.36% decrease in the agricultural sector's output. This suggests that an increase in lending interest rates will lead to a corresponding decrease in agricultural sector's production in the short run,

which aligns with a priori expectation. Conversely, the coefficient of the lending interest rate from the previous year (lag 1) shows a significant positive inelastic correlation with the agricultural sector's output in the current year. An increase in the lending rate from the previous year by one unit corresponds to a 0.15% increase in the agricultural sector's output. From the results, it can be inferred that the lending interest rate is intricately linked to the agricultural sector's production. This correlation could be attributed to factors such as the yearly credit cap, loan accessibility, and the type of collateral required for financing. These findings are consistent with the findings of Emenuga (2019).

Moreover, there is a significant inverse correlation observed between the domestic credit given to the private sector in the current year and agricultural sector's output. The findings indicate that an increase in domestic credit to the private sector will result in a 0.16% decline in the agricultural sector's output or growth in the short run, which is consistent with long-run estimation. One potential explanation could be the private sector's hesitance to allocate resources to the agricultural industry due to perceived high risks, limited yields, and diminished returns on investment. Conversely, a lag of one year or the previous year's value of the domestic credit to the private sector is linked to a positive relationship with the agricultural sector's output in the current year. An increase of one unit in the previous domestic credit to the private sector results in a 0.23% rise in the country's current agricultural sector's output. Factors such as past incentives and the state of the macroeconomic environment may have motivated investment in the agricultural sector recently.

Table 7

Diagnostic tests

Test	Value	Probability
Ramsey RESET Test of stability	0.0440	0.9658
Normality test of errors	0.1539	0.9255
Heteroscedasticity test	0.7541	0.0872
Serial Correlation LM test	3.2381	0.0872

Note: prepared by authors.

Diagnostic test of the short run model

In Table 7, the diagnostic test results are presented. The value of the Breusch-Godfrey serial correlation (LM test) is 3.2381, which is found to be statistically significant at the 10% significance level. This indicates that there is significant serial correlation present in the residuals of the estimated short-run model. Despite this, it is worth noting that the ECM model is known to be resilient to residual autocorrelation.

Test of the Stability of the ARDL ECM

The figures displaying the plots of the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) derived from the ARDL-ECM model are presented in Figures 1 and 2, respectively. The findings suggest that the model estimates exhibit stability. These plots fall within the critical bands of the 5% confidence interval (or 95% probability levels) signifying parameter stability.

In addition, the null hypothesis was confirmed for the RESET test, the Breusch-Pagan test for heteroscedasticity, the normality test for the error terms, and the CUSUM test. These results suggest that the estimated ECM model is structurally sound, devoid of heteroscedasticity, features a normally distributed error term, and remains stable throughout the specified timeframe.

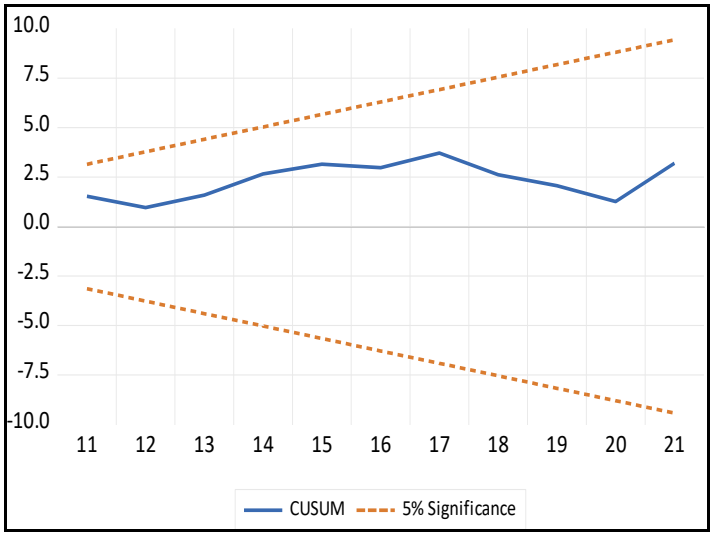

Figure 1.

Plot of CUSUM for coefficients' stability of ARDL mode

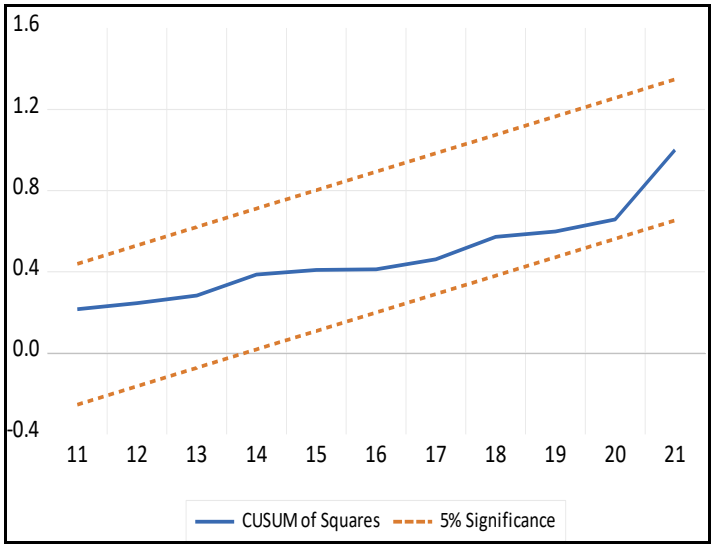

Figure 2.

Plot of CUSUMSQ for coefficients' stability of ARDL model

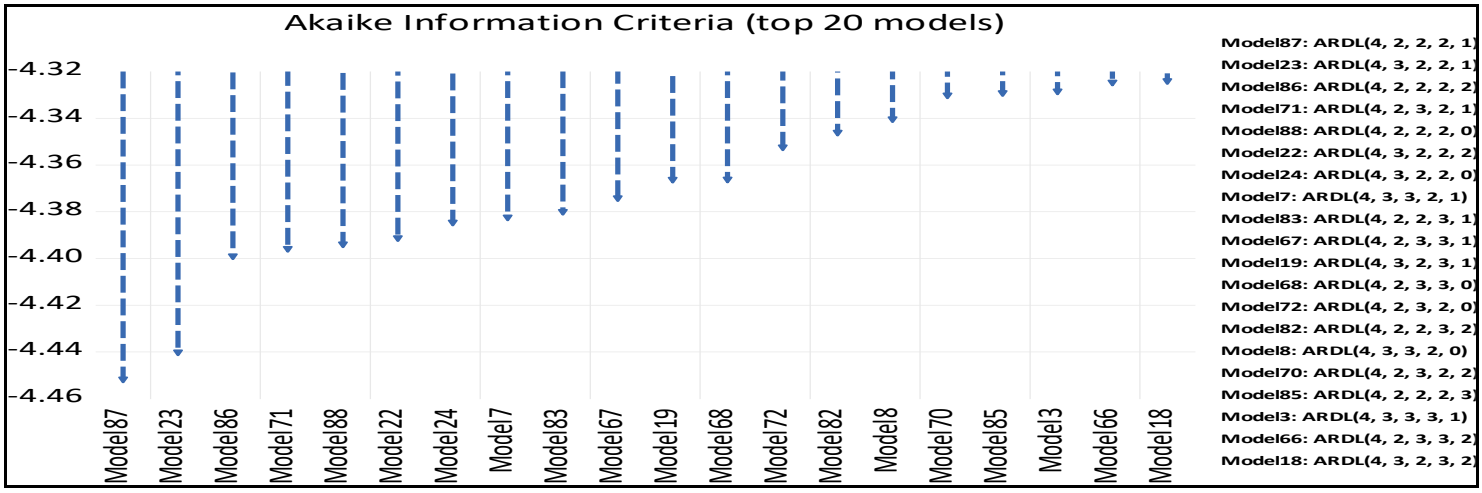

Figure 3.

Akaike information criteria graph

Conclusion and Recommendations

The purpose of this study was to investigate the relationship between the agricultural sector's output and various agricultural credit policy variables in Nigeria. Data from reputable sources (World Bank, Food and Agriculture Organization, and Central Bank of Nigeria) were used for the study. The ADF and ADF-GLS unit root methodologies were employed to test for stationarity of variables. Results showed that some variables were stationary at levels, while others were stationary at first difference. The ARDL bound test confirmed the presence of cointegration among the variables. Subsequently, short and long run models of the agricultural sector's output equation were estimated, with the error term being significant at the 1% level and displaying the expected sign. The research results indicated a strong positive association between commercial bank credit to the agricultural sector and loans from the Agricultural Credit Guarantee Scheme Fund (ACGSF) with the agricultural sector's output in the long run period. In contrast, there was a notable negative correlation between domestic credit to the private sector and lending interest rates with the agricultural sector output in the long run.

Moreover, the total credit extended to the agricultural sector by commercial banks in the previous year exhibited a negative correlation with the agricultural sector's output in the short run. Additionally, the current year's domestic credit disbursed to the private sector demonstrated a negative relationship with the agricultural sector production, whereas a significant positive connection was observed between the previous year's domestic credit to the private sector and the agricultural sector's output in the short run. The current year's lending interest rate influenced the agricultural sector's output adversely, while the previous year's lending interest rate showed a positive association. Furthermore, the loan provided by the Agricultural Credit Guarantee Scheme Fund (ACGSF) displayed a significant positive impact on the agricultural sector's growth in the short run. These findings suggest that the credit policy environment in Nigeria has varying effects on the agricultural sector output in both the short and long run periods.

According to the evidence provided, it is suggested that increasing the total credit allocation to the agricultural sector will offer farmers greater incentives to boost production. Direct disbursement to farmers' groups nationwide can achieve this goal. In addition, strategic incentives should be introduced within the sector to attract ample domestic credit from the private sector. These incentives could include providing free land for large-scale production, subsidies for fertilizers and agrochemicals, free distribution of improved seeds and animal breeds, and establishing land settlement schemes for training and specialized farming practices, among other measures. Furthermore, reducing the current lending interest rate in the country is recommended to improve farmers' access to credit. To enhance agricultural sector production in the country, scaling up the Agricultural Credit Guarantee Scheme loan is also advised.

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