AGRICULTURAL FINANCING AND AGRICULTURAL OUTPUT IN NIGERIA: EVIDENCE FROM VECM APPROACH

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ABSTRACT
This study analyzes the effect of agricultural financing on agricultural output in Nigeria between 1990 and 2021. Using a Vector Error Correction Model (VECM), it evaluates the roles of commercial banks, microfinance banks, and the Agricultural Credit Guarantee Scheme Fund (ACGSF). Secondary time series data sourced from the Central Bank of Nigeria underwent unit root and cointegration testing in E-Views 10. The results confirm a long-run equilibrium relationship between agricultural financing and output. Specifically, microfinance credit and ACGSF disbursements significantly and positively influence agricultural output. In contrast, credit from commercial banks has a negative long-run impact. Short-run dynamics show limited responsiveness, with the error correction term indicating slow adjustment toward equilibrium. The study recommends strengthening microfinance institutions, reforming the ACGSF to ease collateral constraints, and restructuring commercial bank credit to address risk aversion and high interest rates.

Keywords: Agricultural output, Agricultural financing, VECM, Cointegration, Commercial banks, Nigeria
JEL Codes: Q10, Q14, C32

1. INTRODUCTION
Agriculture has long been a pillar of Nigeria's economy, historically contributing the bulk of GDP and providing livelihoods for millions, especially in rural areas. In 1960, agriculture accounted for approximately 63.8% of GDP, firmly positioning it as the nation's economic backbone. However, the discovery of oil in 1959 marked a turning point. As national priorities shifted toward the oil sector, agriculture lost its central role, leading to decades of neglect in policy, investment, and infrastructure. Despite its diminished status, agriculture remains crucial. As of 2023, it employed about 35.76% of Nigeria's labour force (NBS, 2023). Yet the sector continues to face systemic challenges, including inadequate infrastructure, inconsistent policies, and, most persistently, limited access to credit.

Recent efforts to revitalize the sector through increased funding have shown some promise. The Central Bank of Nigeria (CBN) reported that agricultural credit rose from ₦853 billion in early 2020 to over ₦4.2 trillion by the end of 2021 (CBN, 2022). This surge coincided with positive trends: agriculture contributed 30% to GDP in Q3 2021, and agricultural exports increased by more than 57% from the previous year (NBS, 2022). Nevertheless, the sector still receives less than 4% of total bank credit (FAO, 2024; NBS, 2025), a striking contrast to sectors like oil, manufacturing, and services.

This gap raises critical questions. Why is a sector so vital to employment, food security, and rural development still underfinanced? Structural barriers such as high collateral requirements, climate risks, and weak credit infrastructure continue to undermine productivity (Onyenekwe et al., 2025; Nwachukwu et al., 2024). From 2014 to 2019, commercial banks allocated just ₦577.43 billion to agriculture. Microfinance institutions, though more accessible, have limited reach. Ketu (2020) reports that over ₦5 billion was disbursed to about 130,000 farmers, yet the long-term impact on output remains unclear.

Even government-backed programs such as the Agricultural Credit Guarantee Scheme Fund (ACGSF) face major implementation challenges. Delays in disbursement, lack of transparency, and inadequate tracking of outcomes continue to limit their effectiveness (NIRSAL, 2024). These shortcomings have real consequences. Gyong et al. (2022) found that despite access to the Commercial Agriculture Credit Scheme (CACS), 92.9% of farmers recorded low technical efficiency, suggesting poor credit utilization and weak institutional support. Similarly, Andohol et al. (2020) highlight governance issues and corruption as major factors weakening agricultural credit programs.

In summary, while nominal credit to agriculture may be increasing, its actual impact on output remains uncertain. This study investigates the relationship between agricultural financing and output in Nigeria from 1990 to 2021. It focuses on three financing sources: commercial banks, microfinance institutions, and the ACGSF.

The paper is structured as follows. Section 2 reviews relevant literature. Section 3 outlines the theoretical framework and methodology. Section 4 presents the empirical results and analysis. Section 5 concludes with policy recommendations.

2. LITERATURE REVIEW

2.1 THEORETICAL LITERATURE

The relationship between agricultural financing and output has been examined through various theoretical lenses, each offering distinct insights into the mechanisms through which credit influences agricultural productivity. However, the complex realities of developing economies like Nigeria require theoretical frameworks that can adequately capture both structural interdependencies and financial market dynamics.

The Balanced Growth Theory, pioneered by Rosenstein-Rodan (1943), Nurkse (1953), and Lewis (1954), provides a foundational framework for understanding sectoral development dynamics. This theory emphasizes the necessity of synchronized growth across sectors (particularly agriculture and industry) to sustain long-term economic development and prevent structural distortions. In the Nigerian context, where agriculture remains central to employment generation and rural livelihood security, this theoretical perspective is particularly relevant. The theory suggests that underinvestment in agriculture relative to other sectors can create economic imbalances that ultimately constrain overall growth potential.

Complementing this structural perspective, the Quantity Theory of Credit (Werner, 1992) offers crucial insights into the mechanics of credit creation and allocation. Unlike traditional monetary theories that focus primarily on credit quantity, this framework emphasizes the qualitative dimension of credit utilization. According to Werner's formulation, economic growth occurs only when credit is channeled toward productive activities (such as agricultural production) rather than speculative or consumption-oriented uses. This distinction is particularly important in Nigeria's context, where concerns exist about credit misallocation and the productive efficiency of agricultural financing programs.

These primary theoretical frameworks are supported by additional analytical tools that enhance empirical understanding. The Input-Output Model (Leontief, 1986) illuminates agriculture's complex interdependencies with other economic sectors, demonstrating how agricultural credit can generate multiplier effects throughout the economy. This sectoral linkage perspective is crucial for understanding the broader economic implications of agricultural financing policies. Similarly, the Cobb-Douglas Production Function (Cobb & Douglas, 1928) provides a mathematical framework for quantifying the relationship between inputs (including financial

capital) and agricultural output. While this neoclassical tool offers valuable empirical applications, it is most effectively employed as a complement to the richer theoretical insights provided by Balanced Growth and Quantity Theory of Credit frameworks.
The integration of these theoretical perspectives suggests that effective agricultural financing requires both adequate quantity and appropriate quality of credit allocation. Furthermore, it emphasizes that agricultural credit policies must be evaluated not only for their direct sectoral impacts but also for their contributions to broader structural transformation and economic balance.

2.2 EMPIRICAL REVIEW

A wide range of empirical studies has examined the relationship between agricultural credit and output in Nigeria, producing largely positive but mixed findings. Okapala et al. (2022), using the Ordinary Least Squares (OLS) method on data from 1990 to 2020, found that the Agricultural Credit Guarantee Scheme Fund (ACGSF) significantly contributes to real agricultural GDP. Similarly, Reuben et al. (2020) reported a positive effect of ACGSF on output over the 1998–2017 period. Other studies, such as Obioma et al. (2021) and Falaye (2023), focused on broader credit performance and agricultural outcomes, while Sulaimon (2021) employed threshold regression to reveal nonlinear credit-output dynamics.
Recent empirical studies underscore the value of applying advanced econometric techniques to assess the relationship between agricultural financing and output. For instance, Okoro and Anthony (2022) employed a Vector Error Correction Model (VECM) using data from 1986 to 2019 to examine the effects of credit instruments and subsidies. Their findings revealed that while institutional credit has positive long-run effects, it suffers from inefficiencies in the short run. Obialor et al. (2022) utilized the Autoregressive Distributed Lag (ARDL) model with data from 1990 to 2020 and found that microfinance credit positively influences agricultural output, but only in the short term, highlighting the need for sustained policy intervention. Similarly, Babarinde and Daneji (2021), using VECM on 1992–2018 data, confirmed a long-run equilibrium relationship between agricultural finance and economic growth. Yusuf (2022) applied a multiple regression model to explore macroeconomic determinants of agricultural productivity, identifying access to credit as a key driver, especially when supported by stable macroeconomic policies.
Further research has emphasized the role of specific financing instruments such as the Agricultural Credit Guarantee Scheme Fund (ACGSF). Gyong et al. (2022), using stochastic frontier analysis, assessed the impact of the Commercial Agriculture Credit Scheme (CACS) on rice farmers in Kano State. Although the scheme was designed to improve productivity, their findings indicated a decline in technical efficiency, primarily due to poor credit utilization, inadequate capacity, and delays in fund disbursement. In a related study, Andohol et al. (2020) employed the ARDL bounds testing approach to examine the long-run relationship between agricultural credit and food security. While credit was found to have a positive effect on agricultural output, the overall impact was weakened by governance failures and institutional inefficiencies.
Okafor (2020) combined stationarity tests (ADF and PP) with OLS to examine the role of commercial banks' credit, while Eyo et al. (2020) and Osabohien et al. (2020) used ARDL techniques to link credit access with sectoral performance. Udoka et al. (2016) also confirmed a significant positive effect of both ACGSF and commercial bank credit on agricultural production using OLS.
Contrasting perspectives exist as well. Osagimu (2017) found that government credit incentives had little impact on livestock production in Northern Nigeria. Mubaraq (2021) identified a U-shaped but mostly insignificant relationship between ACGSF and real agricultural GDP, though significant effects emerged at certain thresholds using a Threshold Autoregressive (TAR)

model. Aina and Omojola (2017) showed that government spending positively influenced agricultural output using OLS and ECM techniques. At the regional level, Iwegbu and de Mattos (2022) found financial development and trade openness to significantly influence agricultural output in BRICS and WAMZ countries, using panel data. On a global scale, Anderson (2010) argued that the effectiveness of agricultural finance depends heavily on consistent government commitment in the context of global trade dynamics.

Despite these contributions, key gaps persist. Most studies focus on individual financing sources, such as commercial banks, government programs, or ACGSF, without jointly examining their combined effects. Additionally, few studies have treated microfinance bank credit as a distinct or control variable, and many rely on outdated datasets. This study addresses these limitations by employing a Vector Error Correction Model on a more recent and comprehensive dataset (1990–2021), while also incorporating microfinance credit as a core explanatory variable. In doing so, it offers a more integrated and updated understanding of the relationship between agricultural financing and output in Nigeria.

3. METHODOLOGY

This study is anchored in the Balanced Growth Theory (Rosenstein-Rodan, 1943; Nurkse, 1953; Lewis, 1954) and the Quantity Theory of Credit (Werner, 1992). These frameworks emphasize the necessity of productive investment and coordinated development across key sectors, particularly in economies like Nigeria's where agriculture remains a critical driver of employment and livelihood.

The dependent variable in this study is **Agricultural Output (AGOPT)**, which serves as a proxy for the performance and productivity of the agricultural sector. The independent variables represent different channels of agricultural financing:

- **Commercial Bank Credit to Agriculture (CBCA):** This captures formal lending from deposit money banks. It reflects Werner's (1992) assertion that banks create new money, which can stimulate GDP growth if allocated to productive sectors. However, in the Nigerian context, such credit is often constrained by high interest rates and collateral demands.
- **Agricultural Credit Guarantee Scheme Fund (ACGSF):** This variable represents public sector intervention aimed at reducing the risk associated with lending to farmers. It aligns with Nurkse's (1953) emphasis on public investment as a tool to overcome structural barriers and poverty traps in underdeveloped sectors.
- **Microfinance Bank Credit to Agriculture (MFBCA):** This captures credit flows from microfinance institutions, which are often more accessible to smallholder farmers. It reflects Lewis's (1954) focus on transforming traditional agriculture by expanding access to capital at the grassroots level.

Together, these variables provide a structured lens for examining how different sources of financing affect agricultural output. The empirical analysis uses a Vector Error Correction Model (VECM) to assess both short-run dynamics and long-run equilibrium relationships. This approach allows the study to test for cointegration among the variables and evaluate how deviations from long-run equilibrium are corrected over time.

The model is estimated using annual time series data from 1990 to 2021, sourced from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS). Prior to estimation, standard econometric tests are conducted, including unit root testing for stationarity and the Johansen cointegration test to establish the existence of long-run relationships among the variables.

3.1 MODEL SPECIFICATION

The model is thus specified as follows:

$$AGOP = F(CBAC, ACGSF, MFCR) \quad 1$$

$$AGOP_t = \beta_0 + \beta_1 CBCA_t + \beta_2 ACGSF_t + \beta_3 MFBCRA_t + u_t \quad 2$$

To align the variables to the same base (unit of measurement), reduce the incidence of heteroscedasticity and establish an elasticity relationship while ensuring that the estimates are Best Linear and Unbiased (BLUE), the natural logarithm of the variables is taken. Thus, Equation 2 becomes;

$$LNAGOP_t = \beta_0 + \beta_1 LNCBCA_t + \beta_2 LNACGSF_t + \beta_3 LNMFBCA_t + U_t \quad 3$$

Where: AGOP is agricultural output as at time t, CBCA is commercial banks' credit to agriculture as at time t, ACGSF is the Agricultural Credit Guarantee Scheme fund as at time t, and MFBCRA is microfinance banks' credit to agriculture. β0 is the regression constant, β1, β2, and β3 are regression coefficients to be estimated, while Ut is the error term representing unexplained variation.

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Data and Preliminary Tests

Descriptive Statistics

This study utilizes annual time series data from 1990 to 2021, comprising 32 observations for each variable. Agricultural output (AGOPT), serving as the dependent variable, is measured in billions of naira using the agricultural sector's contribution to GDP. The explanatory variables—Commercial Bank Credit to Agriculture (CBCA), Microfinance Bank Credit to Agriculture (MFBCA), and Agricultural Credit Guarantee Scheme Fund (ACGSF)—are measured in millions of naira. All data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin.

Table 1 presents the descriptive statistics for all variables. Agricultural output (AGOPT) recorded a mean value of ₦6,938.83 billion, with a maximum of ₦31,904.14 billion and a minimum of ₦17.05 billion. The standard deviation of ₦8,910.72 billion reflects substantial dispersion around the mean, indicative of structural shifts in the sector over time. The skewness value of 0.017 suggests that the distribution is approximately symmetric, implying no significant departure from normality in the data's shape.

These initial statistics provide a foundation for further econometric analysis, helping to identify trends, outliers, and variability levels that may influence model specification and diagnostic testing in subsequent stages.

Table 1 Summary Statistics

	AGOPT	CBCA	ACGSF	MFBCA
Mean	6938.835	229.5879	3126.097	57.03758
Median	1508.409	41.02890	361.4490	43.37514
Maximum	31904.14	2720.102	12456.25	279.7376
Minimum	17.05218	0.590600	24.65490	0.064340
Std. Dev.	8910.723	554.0901	3973.085	65.54157
Skewness	0.017002	1.058328	0.217002	0.405703
Kurtosis	3.387683	3.538397	2.524992	3.243331
Jarque-Bera	4.234133	6.206212	3.529492	2.291429
P-Value	0.244909	0.045286	0.523429	0.054376
Observations	32	32	32	32

Source: Authors' computation using E-views 10

The observed peak in agricultural output in 2019 aligns with intensified policy interventions, notably the Anchor Borrowers' Programme and expanded fertilizer subsidies. Commercial Bank Credit to Agriculture (CBCA) averaged ₦229.59 million, with values ranging from

₦0.59 million to ₦2,720.10 million. The distribution is positively skewed (skewness = 1.06) and leptokurtic (kurtosis = 3.54), indicating the presence of a few exceptionally large credit disbursements, particularly in the years 2014 to 2021. This distributional asymmetry justifies the application of logarithmic transformation to stabilize variance and normalize the data.

The Agricultural Credit Guarantee Scheme Fund (ACGSF) recorded a steady upward trajectory, with a mean value of ₦3,126.10 million and a maximum of ₦12,456.25 million. Its distribution shows moderate kurtosis (2.52) and low skewness (0.22), suggesting near-normal characteristics. This is supported by the Jarque-Bera test, which yields a p-value of 0.523, indicating no significant departure from normality at the 5% level.

Microfinance Bank Credit to Agriculture (MFBCA) had a mean of ₦57.04 million and a maximum of ₦279.74 million, with a relatively high standard deviation of ₦65.54 million. The distribution is mildly right-skewed (skewness = 0.41) and moderately peaked (kurtosis = 3.24). The near-zero values observed during the early 1990s reflect the underdeveloped state of microfinance institutions during that period. The Jarque-Bera p-value confirms approximate normality.

Among the variables, only CBCA fails the Jarque-Bera normality test at the 5% significance level ($p = 0.045$), reinforcing the rationale for a log-linear transformation to mitigate outlier effects and improve model stability. Overall, the descriptive statistics reveal substantial heterogeneity in credit allocation over time, highlighting structural shifts and the evolving nature of agricultural finance in Nigeria. These characteristics underscore the appropriateness of log-level modelling for robust econometric analysis.

Correlation Analysis

The correlation matrix in Table 2 also reveals strong positive relationships between agricultural output (AGOPT) and various credit sources, including commercial bank credit (CBCA) with a correlation coefficient of 0.943581, Agricultural Credit Guarantee Scheme Fund (ACGSF) with 0.885756, and microfinance bank credit (MFBCA) with 0.837156.

Table 2 Correlation matrix

	AGOPT	**CBCA**	**ACGSF**
AGOPT	1.000000		
CBCA	0.943581	1.000000	
ACGSF	0.885756	0.794565	1.000000
MFBCA	0.837156	0.896772	0.617565

Source: Authors' computation using E-views 10

Additionally, CBCA shows strong positive correlations with AGOPT and MFBCA, with coefficients of 0.943581 and 0.896772, respectively. ACGSF also exhibits a strong positive correlation with AGOPT and a moderate correlation with MFBCA. These findings suggest that increases in agricultural credit from these sources are closely associated with increases in agricultural output, highlighting the importance of access to credit for agricultural development.

Unit Root Test

The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) in Table 3 tests confirm that all variables are integrated of order one, I(1), meaning they are non-stationary in levels but become stationary after taking the first difference

Table 3 Unit Root Test

Variables	**ADF test statistics**	**Remarks**
ADF test at first difference		
LAGOPT	-5.054193***	I(1)
LCBCA	-6.275379***	I(1)
LACGSF	-7.906857***	I(1)
LMFBCA	-4.042120***	I(1)

PP test at first difference		
LAGOPT	-5.053329***	I(1)
LCBCA	-6.717097***	I(1)
LACGSF	-13.79954***	I(1)
LMFBCA	-4.001197***	I(1)

Source: Authors' computation using E-views10

The test statistics for LAGOPT, LCBCA, LACGSF, and LMFBCA are all significant at the 1% level (-5.054193, -6.275379, -7.906857, and -4.042120 for ADF; -5.053329, -6.717097, -13.79954, and -4.001197 for PP), indicating that the null hypothesis of a unit root is rejected after differencing. This confirms that all series are integrated of order one, I(1) and suggests that the variables exhibit stochastic trends and require differencing to achieve stationarity.

Given the results of the Johansen cointegration test confirming a long-run equilibrium relationship among the variables, the Vector Error Correction Model (VECM) is adopted as the appropriate estimation technique. The VECM is well-suited for systems of integrated variables of order one, I(1), that are cointegrated. It captures both short-run dynamics through differenced variables and long-run adjustments via the error correction term, making it ideal for analysing how shocks to agricultural financing channels affect output over time while preserving long-run equilibrium behaviour. Therefore, the VECM specification for this study is as follows:

$$\Delta LAGOPT_t = \alpha_0 + \sum_{p-1}^{i=1} \beta_i \Delta LAGOPT_{t-i} + \sum_{p-1}^{i=1} \gamma_i \Delta LCBCA_{t-i} + \sum_{p-1}^{i=1} \delta_i \Delta LACGSF_{t-i} + \sum_{p-1}^{i=1} \theta_i \Delta LMFBCA_{t-i} + \lambda ECT_{t-1} + \varepsilon_t \quad (4)$$

Where: Δ denotes the first-difference operator, indicating short-run changes in the variables. The term ECT_{t-1} represents the lagged error correction term derived from the cointegrating relationship, capturing deviations from long-run equilibrium. The coefficient λ measures the speed at which the dependent variable adjusts back to equilibrium following a short-run shock. The parameters $\beta_i, \gamma_i, \delta_i$, and θ_i represent the short-run dynamic coefficients associated with the lagged differences of the explanatory variables, while ε_t is the white-noise error term capturing unexplained variation.

Lag Selection Test

The lag selection criteria in Table 4 suggest that the optimal lag length for the VAR model is 1, as indicated by the asterisks (*) next to the LR, FPE, AIC, SC, and HQ values.

Table 4 Lag selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-102.9059	NA	0.014635	7.127062	7.313888	7.186829
1	11.75039	191.0939*	2.06e-05*	0.549974*	1.484106*	0.848811*
2	20.74075	12.58650	3.51e-05	1.017284	2.698720	1.555190

Source: Authors' computation using E-views10

This implies that one lag is sufficient to capture the dynamics of the system, and using this lag length can help improve the model's performance and accuracy.

4.2 COINTEGRATION TEST

The Johansen cointegration test in Table 5 below reveals that the variables share a long-run equilibrium relationship, with both the Trace statistic and Max-Eigenvalue test confirming the presence of one cointegrating equation at the 0.05 significance level. In the Johansen cointegration framework, the Trace test evaluates the null hypothesis that there are at most r cointegrating relationships. Specifically, for r = 0, the null posits no cointegration among the variables, while the alternative asserts the presence of at least one cointegrating vector (r > 0). The computed Trace statistic for r = 0 is 50.085, which exceeds the 5% critical value of 47.856. This result leads to a rejection of the null hypothesis at the 0.05 significance level, indicating the existence of at least one long-run equilibrium relationship among the variables.

Table 5 Cointegration test

Trace Statistics Test				
Hypothesize No. of CE(s)	**Eigen value**	**Trace statistics**	**0.05 critical value**	**Prob.****
None*	0.651061	50.08544	47.85613	0.0304
At most 1	0.339768	18.49970	29.79707	0.5293
At most 2	0.182445	6.044797	15.49471	0.6903
At most 3	0.001233	0.001677	3.841466	0.9650
Max-Eigen Statistic Test				
Hypothesize No. of CE(s)	**Eigen value**	**Max-Eigen statistics**	**0.05 critical value**	**Prob.****
None*	0.651061	31.58574	27.58434	0.0145
At most 1	0.339768	12.45490	21.13162	0.5034
At most 2	0.182445	6.043120	14.26460	0.6077
At most 3	0.344453	0.001677	3.841466	0.9650
Max-Eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of Null hypothesis the 0.05 level				
**Mackinnon-Haug-Michelis (1999) p-value				

Source: Authors' computation using E-views 10

In the Max-Eigen test, the null hypothesis asserts the presence of r cointegrating vectors, while the alternative claims there are r + 1. The computed Max-Eigen statistic stands at 31.586, surpassing the critical threshold of 27.584. This decisive breach leads to the rejection of the null hypothesis. Both the Max-Eigen and trace tests employ the MacKinnon-Haug-Michelis (1999) critical values and p-values as the compass to navigate statistical significance.

Further strengthening this conclusion, the first estimated eigenvalue of 0.6511 signals a robust association within the linear combination of variables that define the cointegrating relationship. Taken together, these results firmly establish the presence of a single cointegrating vector among the variables—an elegant testament to the truth that, though each series is integrated of order one, they harmoniously drift together in the long run. In both cases, the null hypothesis was rejected, indicating strong statistical evidence of at least one cointegrating equation. This suggests that although each variable is individually non-stationary, they maintain a stable long-run relationship when considered together.

As articulated by Johansen (1988) and Johansen and Juselius (1990), the existence of cointegration among I(1) variables calls for the application of the Vector Error Correction Model (VECM). This model is particularly fitting because it gracefully captures the dual nature of the data: the short-run fluctuations, expressed through differenced terms, and the long-run equilibrium, embodied in the error correction term derived from the cointegrating relationship. Thus, employing the VECM in this study is not just appropriate; it is essential, allowing for the simultaneous unveiling of both the immediate adjustments and the enduring ties binding agricultural output to its financing components.

4.3 DISCUSSION OF FINDINGS

The long-run elasticities derived from the Vector Error Correction Model (VECM) indicate that microfinance bank credit to agriculture (MFBCA) and the Agricultural Credit Guarantee Scheme Fund (ACGSF) exhibit positive and statistically significant effects on agricultural output in Nigeria. A 1% increase in MFBCA is associated with a 0.38% rise in agricultural output, while a 1% increase in ACGSF corresponds to a 0.23% increase in output. The positive coefficients observed for MFBCA and ACGSF resonate clearly with findings from Onah et al. (2025), Gyong et al. (2022), Obialor et al. (2022), Babarinde and Daneji (2021), and Andohol et al. (2020). These studies collectively underscore the vital role that targeted credit schemes and grassroots level financing play in bolstering agricultural performance, affirming that well-directed financial support at the community level can indeed cultivate growth and resilience in the sector. These outcomes suggest that both sources of financing contribute positively to long-run productivity in the agricultural sector.

Table 6 Long-run model

	LAGOPT	LCBCA	LACGSF	LMFBCA	C
Coint Coeff	1.000000	-0.080973	0.234149	0.377301	-2.207762
Standard errors		0.04296	0.01655	0.05134	
t-statistics		1.88485	-14.1504	-7.34943	

Source: Authors' computation using E-views 10

Conversely, commercial bank credit to agriculture (CBCA) reveals a negative and statistically significant elasticity of approximately -0.08, indicating that a 1% increase in CBCA is associated with a 0.08% decline in output. Similarly, the negative elasticity observed for CBCA echoes the patterns documented by Mubaraq (2021) and Osagie (2017), where institutional lending constraints curtailed the productivity benefits of commercial credit to agriculture. This inverse relationship likely stems from structural barriers to credit access such as steep lending rates, stringent collateral requirements, and the sector's high-risk reputation, each acting as a hurdle to unlocking the sector's true potential.

The Error Correction Model (ECM) (short-run model) estimates in Table 7 reveal a speed of adjustment of -0.037862, indicating that 3.7% of the previous year's deviation from long-run equilibrium is corrected in the current period. This implies that agricultural output converges to its long-run equilibrium at a rate of 3.7% after experiencing short-run shocks.

Table 7 Short-run model

Error Correction:	Coefficient	Std. Error	t-Statistic	Prob.
ECT(-1)	-0.037862	0.138701	-0.272975	0.0272
D(LAGOPT(-1))	0.078986	0.230089	0.343284	0.0034
D(LCBCA(-1))	0.025076	0.057698	0.434614	0.0277
D(LACGSF(-1))	-0.002616	0.024007	-0.108984	0.0141
D(LMFBCA(-1))	-0.039336	0.107235	-0.366823	0.0170
C	0.051599	0.024835	2.077707	0.0486

Source: Authors' computation using E-views 10

The VECM results reveal that the Agricultural Credit Guarantee Scheme Fund (ACGSF) and Microfinance Bank Credit to Agriculture exert a positive and statistically significant influence on agricultural output in the long run, echoing findings from Reuben et al. (2020), Obialor et al. (2022), Mubaraq (2021), and Babarinde and Daneji (2021). In contrast, Commercial Bank Credit to Agriculture exhibits a negative and significant effect, likely stemming from inadequate credit allocation driven by the sector's perceived high risk. This pattern suggests that loan-based financing, particularly through targeted and grassroots channels, plays a more crucial role in fostering agricultural productivity in Nigeria.

The VECM results carry profound economic lessons for agricultural policy and credit delivery in Nigeria. The positive long-run elasticities for microfinance bank credit (0.38) and the Agricultural Credit Guarantee Scheme Fund (0.23) illuminate the power of grassroots financing, anchored in reduced collateral demands and finely targeted support for smallholder farmers, to truly nurture agricultural output. These findings resoundingly affirm the necessity of fortifying inclusive, risk-mitigated credit channels as vital instruments for sustained agricultural growth.

In stark contrast, the negative elasticity of commercial bank credit (-0.08) serves as a cautionary note, suggesting that conventional lending practices may, in fact, stifle productivity. High interest rates, rigid loan conditions, and misallocated credit resources combine to erect barriers rather than bridges for farmers. Compounding this challenge is the sluggish adjustment speed of a mere 3.7% per year, revealing that short-term credit injections alone are no panacea; without enduring, well-structured support systems, progress remains painfully slow.

Together, these insights compel a reimagining of credit policy, one that values the quality and accessibility of finance over sheer volume. Only through such a thoughtful, inclusive approach can Nigeria hope to ignite a meaningful and lasting transformation in its agricultural landscape.

4.4 ROBUSTNESS CHECKS

The diagnostic tests collectively validate the model's reliability and robustness. The tests for autocorrelation, normality of residuals, and heteroskedasticity in Table 8 confirm that the model's residuals are well-behaved, indicating no issues with serial correlation, non-normality, or variance instability. Furthermore, the Ramsey RESET test provides evidence of correct model specification, as the p-values exceed the significance threshold, failing to reject the null hypothesis of no specification errors.

Table 8 Diagnostics test

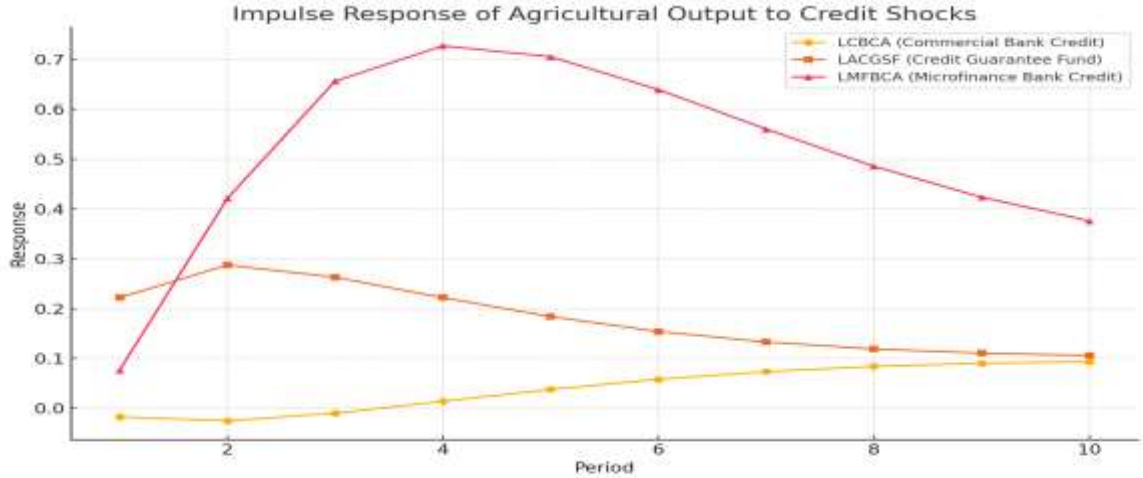
Diagnostic Checks		
Test	Statistics	p-value
Autocorrelation LM Test	23.38988	0.5568
Jarque-Bera Test	824.4698	0.2457
Heteroskedasticity Test	347.7412	0.3641
Ramsey RESET Test		
	Value	Df
t-statistic	1.041782 (0.3068)	27
F-statistic	1.085309 (0.3068)	(1, 27)
Likelihood ratio	1.261113 (0.2614)	1

Source: Authors' computation using E-views 10

The robustness checks conducted affirm the stability and reliability of the model. The Breusch-Godfrey LM test for autocorrelation ($p = 0.5568$) indicates that the residuals are free from serial correlation, while the heteroskedasticity test ($p = 0.3641$) reveals no evidence of variance instability, suggesting the model adheres to the classical linear regression assumptions. The Ramsey RESET test results, with all p-values comfortably above the 5 percent threshold, confirm that the model is correctly specified and free from omitted variable bias or functional form misspecification. Although the Jarque-Bera test reports a high statistic (824.47), the associated p-value (0.2457) suggests that residuals do not significantly deviate from normality, despite slight departures that may exist. Taken together, these results affirm the model's statistical robustness and stability, bolstering the validity of the empirical findings and their implications for agricultural credit policy in Nigeria.

Furthermore, the impulse response and variance decomposition analyses in Figure 1 below reveal that different sources of agricultural credit have varying effects on output over time. Microfinance bank credit produces the strongest and most sustained positive impact, peaking in the fourth period, indicating its effectiveness in supporting short- to medium-term agricultural productivity. The Agricultural Credit Guarantee Scheme Fund also delivers an immediate but gradually declining positive effect, highlighting its usefulness for quick stimulus but potential limitations over time.

Figure 1 Impulse response of Agricultural Output to Credit Shocks in Nigeria



Source: Authors' computation using E-views 10

In contrast, commercial bank credit shows a delayed and initially negative response, suggesting that rigid lending conditions and structural barriers may limit its immediate usefulness, though it has a modest positive effect in the long run. Overall, the findings underscore the superior performance of inclusive and targeted credit channels over conventional commercial lending in enhancing agricultural output in Nigeria.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study investigated the long-run and short-run effects of various agricultural financing mechanisms on agricultural output in Nigeria over the period 1990 to 2021, using a Vector Error Correction Model (VECM). The results revealed that credit from the Agricultural Credit Guarantee Scheme Fund (ACGSF) and microfinance banks had positive and statistically significant long-run effects on agricultural output, underscoring their effectiveness in supporting sustained agricultural productivity. In contrast, commercial bank credit exhibited a negative long-run impact, suggesting that institutional lending constraints and structural barriers limit its developmental role in the agricultural sector.

The study, therefore, advocates for the enhancement of inclusive and targeted credit delivery through farmer cooperatives and grassroots financial channels. Policymakers must bolster the operational capacity of the Agricultural Credit Guarantee Scheme Fund, incentivize microfinance institutions to broaden their agricultural lending portfolios, and provide structured financial education to farmers to improve both credit access and effective utilization. The Central Bank of Nigeria should deepen its risk-sharing facilities to attract greater participation from commercial banks, while empowering the National Agricultural Credit Council to vigilantly monitor and reform agricultural credit practices. Furthermore, state-level Ministries of Agriculture ought to forge strong partnerships with financial institutions to deliver tailored credit solutions and strengthen repayment systems, ensuring the sustainability of agricultural financing.

Furthermore, future research could focus on disaggregating the impact of agricultural credit across different sub-sectors such as crop production, livestock, fisheries, and agro-processing. While this study establishes an overall positive relationship between certain credit sources and aggregate agricultural output, it does not capture the nuanced ways in which credit affects specific value chains. Understanding which sub-sectors respond more efficiently to different financing mechanisms would enable policymakers and financial institutions to design more targeted interventions, optimize resource allocation, and enhance sectoral productivity. Such analysis could also reveal hidden inefficiencies or credit mismatches that may not be evident at the aggregate level.

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