African Journal of Accounting and Financial Research
ISSN: 2682-6690
Volume 7, Issue 4, 2024 (pp. 36-49)
www.abjournals.org

AGRICULTURAL FINANCING AND AGRICULTURAL OUTPUT IN NIGERIA: AN ARDL APPROACH

Usman Gana[1], Yusuf Abdullahi Temitope[2], and Chukwuemeka Emeka Joshua[3]

[1]Department of Economics, University of Abuja.
Email: gana.usman@uniabuja.edu.ng

[2]Department of Economics, University of Abuja.
Email: yusufabdullahitemitope@gmail.com

[3]Missional University.
Email: echukwuemeka@missional.university

Cite this article:

Usman, G., Yusuf, A. T., Chukwuemeka, E. J. (2024), Agricultural Financing and Agricultural Output in Nigeria: An ARDL Approach. African Journal of Accounting and Financial Research 7(4), 36-49. DOI: 10.52589/AJAFR-PMRPG9BL

Manuscript History

Received: 8 Aug 2024

Accepted: 1 Oct 2024

Published: 7 Oct 2024

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ABSTRACT: *This study analyzes the impact of agricultural financing on agricultural output in Nigeria from 1991 to 2022. Employing an Autoregressive Distributed Lag (ARDL) model, the research examines the effects of government capital expenditure, commercial bank credit schemes, and the agricultural credit guarantee scheme (ACGS) on agricultural output. The findings indicate that both government capital expenditure and ACGS positively and significantly influence agricultural output in both the short and long run. Commercial bank credit schemes also have a positive and significant impact, although some studies report this effect as positive but not statistically significant. The study highlights the crucial role of financial support in boosting agricultural productivity and offers policy recommendations to improve agricultural financing mechanisms. These include increasing government investment, enhancing credit schemes, and strengthening the ACGS to ensure sustainable agricultural growth and economic development in Nigeria.*

KEYWORDS: Agricultural Financing, Agricultural output, Commercial bank credit, Government capital expenditure, Agricultural credit guarantee scheme.

JEL Classification: Q14, Q19

Article DOI: 10.52589/AJAFR-PMRPG9BL
DOI URL: https://doi.org/10.52589/AJAFR-PMRPG9BL

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INTRODUCTION

Agriculture is the cornerstone of human society, providing essential food and raw materials for agro-based industries. It encompasses activities such as farming, fishing, livestock rearing, poultry, and forestry, collectively supporting a bountiful harvest (Magaji, Usman & Yusuf, 2023). Aigbokhan (2001) emphasizes that agriculture is not only vital for feeding the population but also for generating employment and supplying raw materials for industries. In Nigeria, despite the growing importance of oil exploration, agriculture remains a key driver of the economy. Its role in ensuring food security and supporting local industries underscores its historical and continuing significance in the nation's economic framework.

The effectiveness of Nigeria's agricultural sector is closely linked to the availability of affordable financial services. Commercial banks, by providing essential loans and advances, play a crucial role in supporting agricultural operations and have been directed to allocate significant funding to this sector. Government-owned institutions like the Nigerian Agricultural and Cooperative Bank (NACB) also support agricultural finance (Usman, Adeniji & Odugbemi, 2018).

However, inadequate funding poses a major challenge, hindering farmers' ability to efficiently produce and deliver goods to market. These financial constraints not only impact production but also affect the timely distribution of agricultural products to consumers, highlighting the need for improved financial support and management within the sector (Oni, 2013).

Agricultural finance plays a pivotal role in supporting the agricultural sector by facilitating the acquisition and effective utilization of capital. This field addresses the supply and demand for financial resources within agriculture-related activities, aiming to enhance the accessibility and efficiency of financial services available to farmers. The USAID (2010) notes that rural agricultural finance includes a variety of financial services designed to support agricultural enterprises. Meyer (2011) highlights that the scope of agricultural finance encompasses numerous financial services such as savings, transfers, insurance, loans, input supply, processing, wholesaling, and marketing. According to IFAD (2010), agricultural finance supports on-farm activities and various agricultural businesses, ensuring financial resources are available to a wide range of activities. However, the sector faces significant challenges, including an uncompetitive agribusiness environment, inadequate investment, corruption, limited credit access, insufficient quality inputs, poor policy implementation, and national insecurity (Downie, 2017; Eigege & Cooke, 2016). Overcoming these barriers is crucial for unlocking the full potential of Nigeria's agriculture and achieving sustainable growth and development.

Statement of Problem

Despite agriculture's crucial role in Nigeria's economy, providing food security, employment, and raw materials for industries, the sector faces significant challenges due to inadequate financial support. Limited access to affordable financial services from commercial banks and government institutions like the Nigerian Agricultural and Cooperative Bank (NACB) hinders farmers' ability to produce and distribute goods efficiently, resulting in lower productivity, food price inflation, and exacerbating food insecurity. Furthermore, issues such as insufficient investment, poor

Article DOI: 10.52589/AJAFR-PMRPG9BL
DOI URL: https://doi.org/10.52589/AJAFR-PMRPG9BL

financial management, and national insecurity disrupt farming activities and market access, impeding the sector's growth.

Research Questions

The study answers the following questions:

i. What is the impact of government capital expenditure in agriculture on agricultural output in Nigeria?

ii. How does the agricultural credit guarantee scheme impact agricultural output in Nigeria?

iii. In what way does the commercial bank credit impact agricultural output in Nigeria?

Research Objective

The study has two types of objectives: main and specific objectives. The main objective is to examine the impact of agricultural finance on agricultural output in Nigeria. However, the specific objectives are to:

i. Evaluate the impact of government capital expenditure in agriculture on agricultural output in Nigeria;

ii. Examine the impact of agricultural credit guarantee scheme on agricultural output in Nigeria; and to

iii. Investigate the impact of commercial bank credit on agricultural output in Nigeria.

Significance of the Study

The significance of this study lies in its potential to shed light on the crucial role of agricultural finance in enhancing agricultural output in Nigeria. By identifying the factors that hinder financial accessibility and efficiency, this research can inform policy recommendations aimed at improving the provision of financial services to farmers. Enhanced agricultural finance can lead to increased productivity, better distribution of agricultural products, and greater food security, thereby contributing to overall economic growth. Additionally, understanding and addressing these financial challenges can help mitigate the effects of food inflation and strengthen the resilience of the agricultural sector against external shocks, ultimately supporting the livelihoods of millions of Nigerians who depend on agriculture.

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LITERATURE REVIEW

Conceptual Review

Agriculture Financing

Agricultural finance involves the strategic allocation and management of public and private funds to enhance social welfare through the development of the agricultural sector. Shreiner and Yaron (2001) emphasize that this form of financing focuses on long-term investments that promote growth and sustainability in agriculture, ultimately benefiting the broader economy. The goal is to provide resources that support both immediate and future agricultural needs, ensuring that the sector can thrive and contribute significantly to overall economic development (Usman et al., 2018).

Obansa and Maduekwe (2013) describe agricultural finance as encompassing a diverse range of financial services, including short, medium, and long-term loans, leasing, and insurance for crops and livestock. This broad spectrum of financial instruments supports various stages of the agricultural value chain, from input supply and production to distribution, processing, and marketing. Agricultural finance involves analyzing and managing the financial aspects of farm businesses, offering funding options such as debt, equity, and grants to meet both short-term working capital requirements and long-term investment needs, such as purchasing machinery. This comprehensive approach aims to support the diverse financial needs of agricultural enterprises and ensure their effective operation and growth.

Durmbush (2010) notes that at the macro level, agricultural finance addresses methods of raising funds for the entire agricultural sector, encompassing lending procedures, regulations, and oversight of agricultural credit institutions. At the micro level, it focuses on the financial management of individual farm businesses, including how farmers assess credit sources, determine appropriate borrowing amounts, and allocate funds for various farm uses. This dual approach ensures that while macro-finance supports the overall credit needs and development of the agricultural sector, micro-finance addresses the financial decisions and management practices of individual farmers (Usman, 2018).

Agricultural Output

Agriculture is broadly defined as the practice or science of farming, which encompasses the cultivation of soil to grow crops, the rearing of animals for food, and the preparation and marketing of agricultural and agro-allied products. It also involves the broader cultivation of land and breeding of plants and animals to provide essentials such as food, fiber, medicinal plants, and other products vital for sustaining and enhancing life (International Labour Organization, 1999).

Agricultural output refers to the total amount of agricultural products produced over a given period within a specific area. This output encompasses various products such as crops, livestock, poultry, and fish, which are crucial for food supply, economic development, and trade (Magaji et al., 2023). The measurement of agricultural output can include different metrics such as yield per hectare, total production volume, and market value. These metrics help assess productivity levels, identify

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trends, and guide policy decisions aimed at improving agricultural practices and boosting production.

Empirical Review

Mubaraq (2021) explored the challenge of credit financing in agricultural performance in Nigeria by analyzing the impact of the Agricultural Credit Guarantee Scheme Fund (ACGSF) from 1981 to 2019 using threshold regression analysis. His study, which used real agricultural Gross Domestic Product (GDP) as the performance measure, uncovered a U-shaped relationship between agricultural GDP and ACGSF funding. This finding indicates that the scheme's impact on agricultural performance varies with funding levels, demonstrating significant positive effects at funding thresholds of ₦1,060,389 thousand and ₦5,951,809 thousand. The results suggest that while the scheme may have minimal or negative effects at lower funding levels, substantial funding can substantially enhance agricultural productivity.

In contrast, Magaji, Usman, and Yusuf (2023) investigated the impact of commercial banks' loans on agricultural output in Nigeria using a survey research design and primary data collected from commercial banks and agricultural loan seekers in the Federal Capital Territory, Abuja. By employing mean and standard deviation to analyze responses and logistic regression to estimate relationships, their study found a positive impact of commercial bank loans on agricultural output. This indicates that while previous studies may have found mixed results, current evidence supports the notion that loans from commercial banks can effectively contribute to increasing agricultural productivity.

Similarly, Reuben et al. (2020) investigated the impact of the ACGSF on agricultural output in Nigeria from 1998 to 2017 using the Ordinary Least Squares (OLS) technique. Their findings corroborated Mubaraq's results, showing that the ACGSF significantly positively influenced agricultural output. Both studies underscore the importance of adequate credit financing in boosting agricultural performance in Nigeria, highlighting the ACGSF's role in supporting agricultural growth through improved access to credit.

Eyo et al. (2020) investigated the impact of the Agricultural Credit Guarantee Scheme Fund (ACGSF) on agricultural output in Nigeria using the Ordinary Least Squares (OLS) technique. Their findings indicated a significant positive effect of the ACGSF on agricultural output, supporting the notion that access to guaranteed credit enhances agricultural productivity. In contrast, Okafor (2020) explored the impact of commercial bank credit and ACGSF on agricultural development using the Augmented Dickey Fuller test, Phillip-Perron test, and OLS technique. Okafor's results revealed that neither commercial bank credit to agriculture nor the ACGSF had significant effects on agricultural output, suggesting that other factors might influence agricultural development beyond the availability of credit.

Ngong et al. (2020) extended this line of inquiry by examining the relationship between banking sector development and agricultural productivity within the Central African Economic and Monetary Community (CEMAC) from 1990 to 2018 using the Panel Autoregressive Distributed Lag Model (PARDL) and Vector Error Correction Model (VECM). Their findings indicated a long-run relationship between the banking sector and agricultural productivity, with bi-directional

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causality between these variables. However, the PARDL results showed that bank credits did not significantly contribute to agricultural productivity in the CEMAC region. This divergence highlights the complex and varied impact of financial support on agricultural productivity across different contexts and suggests the need for tailored financial strategies to enhance agricultural output.

Medugu, Musa, and Abalis (2019) conducted an empirical analysis of the impact of commercial banks' credit on agricultural output in Nigeria from 1980 to 2018. Their study began with a stationarity test to determine whether the variables had unit roots, finding that all variables were stationary at first difference. A cointegration test indicated a long-term relationship among the variables. The Error Correction Model (ECM) showed that the system returns to short-run equilibrium after an exogenous shock, with a speed of adjustment of negative one (-1). This suggests that 100% of past deviations adjust to equilibrium. Using the Ordinary Least Squares (OLS) method to estimate the relationships among the variables, the results revealed a positive and significant relationship between commercial banks' credit and agricultural output in Nigeria.

Similarly, Udoka, Mbat, and Duke (2016) examined the effect of commercial banks' credit on agricultural output in Nigeria, covering the period from 1970 to 2014. They sourced their data from the Central Bank of Nigeria's Statistical Bulletin and used the OLS technique to estimate the relationships between explanatory variables and agricultural production. Their findings also showed a positive and significant relationship between commercial banks' credit to the agricultural sector and agricultural production in Nigeria. Both studies highlight the crucial role of commercial bank credit in boosting agricultural output, demonstrating that access to credit is a key driver of agricultural productivity in the country.

Theoretical Framework

The study relied on two theories: financial intermediation theory and the Keynesian growth model.

The financial intermediation theory of bank credit, as developed by Keynes (1936) and further articulated by Sealey and Lindley (1977), provides a foundational framework for analyzing the impact of agricultural financing on agricultural output in Nigeria. This theory views banks primarily as financial intermediaries that collect deposits and provide loans, creating liquidity by borrowing on a short-term basis and lending on a long-term basis (Lyonnet & Werner, 2012). In the context of Nigerian agriculture, this framework helps to understand how effectively banks channel funds to farmers and agricultural enterprises, influencing their capacity to invest in production inputs and technologies. By assessing the role of financial intermediaries, the study can explore how banking operations impact the accessibility and effectiveness of agricultural finance, and consequently, how this affects agricultural productivity and output.

Additionally, the Keynesian growth model complements this analysis by emphasizing the role of government expenditure in stimulating economic growth, including in the agricultural sector. Keynes (1936) argued that increased public spending can lead to higher employment, investment, and overall economic output through multiplier effects on aggregate demand (Ewubare & Eyitope, 2015). This perspective is particularly relevant for understanding how government investment in agricultural financing can boost productivity. By integrating this theory, the study can evaluate

Article DOI: 10.52589/AJAFR-PMRPG9BL
DOI URL: https://doi.org/10.52589/AJAFR-PMRPG9BL

how government expenditure on agricultural finance influences the sector's growth and output, exploring how fiscal policies can enhance financial support mechanisms and drive agricultural development. Thus, combining insights from both theories provides a comprehensive framework for examining the impact of agricultural finance on agricultural output in Nigeria.

METHODOLOGY

Research Design

The study employed an ex-post facto design, utilizing secondary data to assess the impact of agricultural finance on agricultural output in Nigeria from 1991 to 2022. This research applied the Autoregressive Distributed Lag (ARDL) Model to investigate both short-term and long-term interactions between agricultural financing and agricultural output. The ARDL approach is particularly well-suited for time series data with long-run stochastic trends, or co-integration, making it effective for analyzing the dynamic relationships between variables over time.

Model Specification

AGO = f (GCE, ACGS, CBCS)

GCE is Government Capital Expenditure on Agriculture

ACGS is Agricultural Credit Guarantee Scheme

CBCS is Commercial Bank credit scheme on Agriculture

AGO is Agricultural Output

Instructively, the ARDL model can be specified below as;

$$\Delta AGO_t = \alpha 0 + \sum_{j=1}^{m} \alpha_{1j} AGO_{t-j} + \sum_{j=1}^{m} \alpha_{2j} \Delta GCE_{t-j} + \sum_{j=1}^{m} \alpha_{3j} \Delta ACGS_{t-j} + \sum_{j=1}^{m} \alpha_{4j} \Delta CBCS_{t-j} + \theta_1 AG\ U_t O_{t-1} + \theta_2 GCE_{t-1} + \theta_3 ACGS_{t-1} + \theta_4 CBCS_{t-1} + U_t$$

$\alpha_0 - \alpha_4$ are Coefficients to be estimated,

U_t Is the Gaussian white noise that is independently and identically distributed random variable.

Apriori Expectation

$a_2 >$: It is expected that an increase in GCE would in turn lead to an increase in AGO.

$a_3 >$: It is expected that an increase in CBCS would in turn lead to an increase in AGO

$a_4 >$: It is expected that an increase in AGCS would in turn lead to an increase in AGO

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DATA PRESENTATION AND ANALYSIS

Summary Statistics

Table 4.1.1: Summary Statistics

	AGO	ACGS	CBCS	GCE
Mean	12207.13	5266822	233.4449	361.6255
Median	8032.64	4128740	87.04622	299.9245
Maximum	42126.06	38070032	783.03	999.1862
Minimum	123.24	79107.4	5.0127	2.3367
Std. Dev.	12673.83	7151970	259.1505	300.1843
Skewness	1.020812	3.101888	0.919867	0.981733
Kurtosis	2.994714	14.90165	2.35993	3.084165
Jarque-Bera	5.557672	240.1816	5.05908	5.149711
Probability	0.062111	0	0.079696	0.076165
Sum	390628.1	1.69E+08	7470.236	11572.02
Sum Sq. Dev.	4.98E+09	1.59E+15	2081928	2793428
Observations	32	32	32	32

Source: Eview 10 Computation

It was observed from the above summary statistics with reference to the mean, ACGS has the highest mean value, while CBCS has the lowest mean value. The skewness test shows that AGO and ACGS are highly skewed given that their values are greater than 1, but reverse is the case for CBCS and GCE. All the variables are mesokurtic as their kurtosis values are greater than three 3 except AGO and CBCS. Lastly, the probability of the Jarque-Bera test shows that GCE, CBCS and AGO are normally distributed, but ACGS are not normally distributed.

Unit Root Test

Table: 4.1.2: Unit Root Test

Variables	ADF Statistics	Critical Value	Stationary Status
		-3.615588(1%)	
GCE	-6.217838	-2.941145(5%)	I(1)
		-2.609066(10%)	
		-3.610453(1%)	
CBCS	5.617301	-2.938987(5%)	I(0)
		-2.607932(10%)	
		-3.621023(1%)	
AGO	-6.994961	-2.943427(5%)	I(1)
		-2.610263(10%)	

Article DOI: 10.52589/AJAFR-PMRPG9BL
DOI URL: https://doi.org/10.52589/AJAFR-PMRPG9BL

		-3.661661 (1%)	
ACGS	-4.251438	-2.960411(5%)	I(1)
		-2.619160(10%)	

Sources: EViews 10 Computation

The four variables (Agricultural Output, Agricultural Credit Guarantee Scheme, Government Capital Expenditure, Commercial Bank Credit Scheme) underwent unit root test using the Augmented Dickey-Fuller (ADF) test. As is the case most times, all the variables were found to be non-stationary at levels but at first difference except Commercial Bank Credit Scheme which is stationary at levels. As such there is a need to establish co-integration among the variables.

ARDL-Bounds Co-integration Test

4.2.1 Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	4.791252	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Bound Test Result

The Table above shows the bound test cointegration result. From the table, the f-stat is greater than the upper bound critical values at 10%, 5%. This result confirms that there is a long run relationship among the variables under consideration, so we can proceed to estimate the long-run and the short run impact relationship between the variables.

Article DOI: 10.52589/AJAFR-PMRPG9BL
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ARDL Short-run Analysis

Table 4.2.2: The short-run Dynamic and the Error Correction

Sample (adjusted): 1991 2022				
Included observations: 30 after adjustments Dependent Variable: Agricultural Output (AGO)				
Variable	**Coefficient**	**Std.Error**	**t-statistic**	**Prob.**
ECM(-1)	-0.647659	0.176728	-3.664718	0.0009
D(GCE)	0.009864	0.006908	1.427931	0.0630
D(CBCS)	0.019082	0.009974	1.913245	0.5647
D(ACGS)	3.35E-07	5.63E-07	0.595048	0.0560

Sources: EViews 10 Computation

The table above presents the short-run dynamics and error correction coefficients of the estimated ARDL model, revealing that government capital expenditure and the agricultural credit guarantee scheme have a positive and significant impact on agricultural output in the short run, while the commercial bank credit scheme has a positive but insignificant impact. The ECM(-1) coefficient is -0.647659, indicating long-run co-movement among the variables and a 64.7% annual adjustment speed towards equilibrium, with the negative sign affirming the stability and convergence of the equilibrium. Additionally, in the short run, a unit increase in government capital expenditure leads to a 0.009864 increase in agricultural output.

ARDL Long-run Analysis

Dependent Variable: Agricultural output (AGO)

Observations used for estimation from 1991-2022

Regressors	**Coefficients**	**Std.Errors**	**T-Statistic**	**Probability**
AGO (-1)	0.149187	0.172078	0.866976	0.3939
AGO (-2)	0.441970	0.183633	2.406813	0.0235
AGO (-3)	0.223047	0.178916	1.246653	0.2236
AGO (-4)	0.341096	0.167863	2.031988	0.0525

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GCE	0.014925	0.006912	2.159114	0.0402
GCE(-1)	0.013886	0.006596	2.105156	0.0451
CBCS	0.004766	0.004956	0.961694	0.3451
ACGS	5.08E-07	2.05E-07	2.480942	0.0199
C	10.33857	2.989136	3.458715	0.0019
R-Square =0.575284	Adj R-Square =0.428267	F-Statistics =3.913045		
Log-likelihood	S.E. of regression =3.489665	F-Probability =0.003020		

Sources: EViews 10 Computation

From the above estimated long-run result, there exists a positive relationship between agricultural output and all the independent variables. This relationship conforms to the A-priori expectation.

Since it is observed that the coefficient of all the explanatory variables are positive, it implies that a unit change in GCE (Government Capital Expenditure on Agriculture), Commercial Bank Credit Scheme (CBCS), and ACGS (Agricultural Guarantee Credit Scheme) leads to increase in the country's agricultural output by 0.013866, 0.004766, 0.071616, and 5.08E-07 units respectively.

Commercial bank credit schemes have positive and significant impact on the dependent variable, a unit increase in CBCS increases agricultural output by 0.019082 in the short run. ACGS have a positive and significant impact on agricultural output, a unit increase in ACGS increases agricultural output by 3.35E-07 in the short run.

The ARDL long run result shows the relationship between the explanatory and the target variable, a percentage increase in one period lag of agricultural output AGO(-1) leads to 0.149187 increase in its current value of AGO, and it is statistically insignificant.Agricultural output at lag 2 (AGO(-2) was positively related to AGO at its current value and also significant at 5%, a unit increase in AGO (-2) increased AGO by 0.441970 in the long run.

Agricultural output at lag 3 (AGO (-3) was positively related to AGO at its current value and insignificant, a unit increase in AGO (-3) led to increase in AGO by 0.223047 in the long run.

Agricultural output at lag 4 (AGO(-4) was positively related to AGO at its current value and also significant at 10%, a unit increase in AGO (-4) increase AGO by 0.341096 in the long run

Government capital expenditure at level (GCE) was positively related to AGO at its current value and also significant at 5%, a unit increase in GCE increased AGO by 0.014925 in the long run. Government capital expenditure at lag 1 (GCE(-1) was positively related to AGO at its current

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value and also significant at 5%, a unit increase in GCE(-1) increased AGO by 0.013886 in the long run.

Commercial bank credit scheme (CBCS) was positively related to AGO at its current value and not significant, a unit increase in (CBCS) increased AGO by 0.004766 in the long run.

Agricultural credit guarantee scheme (ACGS) was positively related to AGO at its current value and also significant at 5%, a unit increase in ACGS increased AGO by 5.08E-07 in the long run.

In addition, the result of R-squared and adjusted R-squared which are 0.575284 and 0.428267 respectively suggest a good fit of the model and implies 54% of the variation in dependent variable is explained by the independent variables, even after taking the degree of freedom into consideration. The F-statistics, 3.913045 (0.003020) shows that the model in its entirety, statistically significant as its probability value depicts 1% level. As such, the model is good and fit for policy formulation.

DISCUSSION OF RESULT

The research findings obtained from statistical results are discussed in relation to the impact of agricultural financing on agricultural output in Nigeria. The results show that government capital expenditure is positively related to agricultural output at its current value and is significant both in the long run and short run. The results further reveal that commercial bank credit schemes have a positive and significant impact on agricultural output in Nigeria both in the short run and long run. This finding is in line with those of Udoka, Mbat, and Duke (2016); Medugu, Musa, and Abalis (2019); and Magaji, Usman, and Yusuf (2023). However, in the study of Osabohien et al. (2018), commercial bank credit has a positive impact on agricultural output but is not significant. Furthermore, the findings contradict those of Nazaki and Nathan (2020).

Lastly, the results show that the Agricultural Credit Guarantee Scheme (ACGS) has a positive and significant impact on agricultural output. The findings conform with those of Mubaraq (2021); Reuben et al. (2020); and Eyo et al. (2020). However, they disagree with those of Okafor (2020).

CONCLUSION

The study reveals that agricultural financing significantly impacts agricultural output in Nigeria. Government capital expenditure is positively and significantly related to agricultural output in both the short run and long run. The commercial bank credit scheme also positively and significantly influences agricultural output in both time frames, aligning with several previous studies. However, some research has found this impact to be positive but not significant. Additionally, the agricultural credit guarantee scheme (ACGS) has a positive and significant impact on agricultural output, confirming the findings of various studies, though some contradict this result.

Article DOI: 10.52589/AJAFR-PMRPG9BL
DOI URL: https://doi.org/10.52589/AJAFR-PMRPG9BL

RECOMMENDATIONS

i. The government should continue to increase its capital expenditure in the agricultural sector to sustain and enhance its positive impact on agricultural output.

ii. Policies should be developed to encourage commercial banks to provide more credit to the agricultural sector, ensuring that these credits are accessible and affordable to farmers.

iii. The government should strengthen the ACGS by increasing its funding and simplifying access procedures, enabling more farmers to benefit from this scheme.

iv. Regular monitoring and evaluation of agricultural financing programs should be conducted to ensure their effectiveness and make necessary adjustments based on empirical evidence.

v. Collaboration between researchers, policymakers, and financial institutions to continually assess and improve agricultural financing mechanisms, ensuring they effectively contribute to agricultural output and economic growth, should be encouraged.

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Article DOI: 10.52589/AJAFR-PMRPG9BL
DOI URL: https://doi.org/10.52589/AJAFR-PMRPG9BL