



IMPACT OF THE USAGE OF FINANCIAL SERVICES ON AGRICULTURAL PRODUCTIVITY IN NIGERIA: A TIME SERIES ANALYSIS

ABSTRACT

This paper assessed the impact of the usage of financial services on agricultural productivity in Nigeria using annual time series data spanning the period of 41 years, from 1982 to 2022. Basically, agricultural credit guarantee scheme fund, deposits of rural bank branches, private sector credit to agricultural sector and loans of rural branches of deposit money banks, were considered as proxies for usage of financial services which in itself a measure of financial inclusion. The study controls for fertilizer consumption as working capital. Unit root tests conducted revealed that only loans of rural branches of deposit money banks is stationary at level, all other series are stationary at first difference. The study therefore employed Autoregressive Distributed Lag (ARDL) bounds testing to see both the long run and short run impact of the usage of financial services on agricultural productivity. The results revealed that usage of financial services proxied by agricultural credit guarantee scheme fund, private sector credit to agricultural sector and fertilizer consumption; all have significant positive impacts on agricultural productivity both in the short run and long run. Only deposit of rural bank branches that does not exhibit any impact on agricultural productivity. The study therefore recommends policies to enhance penetration of more banks in the rural areas as well as agricultural loan advances to increase productivity.

Keywords: ARDL, Agricultural productivity, Financial Inclusion, Usage of Financial Services,

1. INTRODUCTION

Nigeria is endowed with huge expanse of fertile land, rivers, streams, lakes, forests and grasslands, as well as a large active population that can sustain highly productive and profitable agricultural sector which can ensure self-sufficiency in food and raw materials for the industrial sector as well as provide gainful employment for the teeming population and generate foreign exchange for the economy (CBN, 2016). Unfortunately agricultural contribution to economic growth has been declining since the advent of oil. The low yield of agricultural production is compounded by the nature of agricultural practices in Nigeria smallholder farmers who produce at subsistence level with limited farming skills, lack of access to financial services, poor access to modern inputs and technology which are all crucial to the growth of agriculture.

Muhammad Ibrahim Abdullahi
Department of Economics,
Bayero University, Kano-Nigeria
shamsu797@yahoo.com

Maryam Ibrahim Musa
Department of Economics,
Bayero University, Kano-Nigeria

***Corresponding author:**
Muhammad Ibrahim Abdullahi
Department of Economics,
Bayero University, Kano-Nigeria
shamsu797@yahoo.com

It is in this context that the significance of financial inclusion becomes paramount in covering farmers' annual, medium term and long-term needs.

Financial inclusion has become an area of interest for most policymakers, academics and stakeholders globally. This growing interest in financial inclusion shows an increasing understanding of the transformative power it has in terms of economic and social development. It has emanated from the government, officials of finance and the banking industry as a whole (Sarma & Pais, 2011; Shahul, 2014). Analysis of the access to and usage of financial services by adults and enterprises shows that African countries lag behind other developing economies in both aspects (AFDB, 2013). Large number of bankable adult populations in Africa seems to have no access to financial services (World Bank, 2013). For instance, nearly two billion adults in the world are reported to have been financially excluded (Global Findex, 2017). In Africa, a whopping 370 million people still remain unbaked and underserved out of total population of 590 million (Global Findex, 2017). This gives apparent irritating contemplation that majority of African adults in many African countries appears to be financially excluded and perhaps use informal method to save and borrow.

In Nigeria, the financial sector has recorded significant growth and reorganization over years in terms of number of banks, finance companies, development finance organizations, total assets, amount of deposits, loan advances, and other indicators of financial development (CBN, 2016). However, banks in particular have continued to seek for better penetrations in providing access to financial services and thereby bridging the gap that constrains the growth of the agricultural sector (Terfa, 2018). Notwithstanding, the Nigerian Government in 2012 launched the Nigerian National Financial Inclusion Strategy (NFIS) with the sole aim of reducing the millions of people excluded from formal financial services from 46.3% to 20% to deepen financial sector by the year 2020 (NFIS, 2012).

In spite of the policy initiative, the EFINA (2020) survey revealed that only 64% of adults Nigerians were financially included by the end of 2020, which means that 36% of Nigerians adults, that is about 38 million adults remained financially excluded. Although there has been growth, it however fell below the NFIS target which aimed at 80% coverage of Nigerian adults within formal financial system. This piece of information has been corroborated by the CBN (2020) when the apex bank published that the financial inclusion rate had slightly increased from 63.2% in 2018 to 64.1% in 2020, even though the bank cited the adverse effect of Covid-19 as the cause of the marginal performance. Recently, the 2023 Access to Finance survey conducted by EFInA indicated that financial inclusion rate had increased to 74% in Nigeria with some 28.8 million adults still excluded.

Inadequate financing is generally recognized as one of the major constraints not only in expanding production but also, in modernizing agriculture in Nigeria. In the second quarter of 2019 for instance, agriculture received only 4.2% of commercial bank lending, while manufacturing received 15.3%, oil and gas 22% and services broadly received 36.5% (National Bureau of Statistics, NBS, 2019). This suggests that agriculture is largely excluded from, or marginally included in formal financial sector. This is supported by recent statistics which show that farmers are the largest group of financially excluded persons in Nigeria, as 37.6% of farmers are financially excluded (EFINA, 2018). Even when the credit is available through bank loans and other agencies, access becomes difficult. Obtaining such loans/credit by farmers may linger on until the farming season is over. Irrigation farming is however not popular in Nigeria due to land tenure system and inadequate finance

available to the poor farmers. Thus, agriculture in Nigeria is majorly rain-fed. This leads to loan/credit access one of the limiting constraint to agricultural production (Ugbor, Ambrose & Augustine, 2018).

Previous researches on the impact of financial inclusion on agricultural output have indicated varying results. Babajide (2020) and Nomfundo (2019) have found positive effect of usage and access of financial services on agriculture productivity in Nigeria. In contrast, Agbenyo, Jiang and Antony (2019) found that usage of financial services has an inverse relationship with agricultural growth. However, Okuma *et.al* (2019) revealed that financial inclusion does not have significant effect on agricultural sector in Nigeria. Again, Olainiya (2017) found that access to finance, but not usage, has insignificant impact on agricultural growth both in the short and long run. This lack of consensus among previous researchers is what motivated this research.

For the purpose of presentation, the paper is divided into five different sections. The second section reviews literature relevant to the paper, which is followed by the methodology used for the purpose of analysis in section three. Section four presents and discusses the findings, while the last section concludes the paper.

2. LITERATURE REVIEW

Financial inclusion is an area of interest for most policy makers, academics and stakeholders globally. This growing interest in financial inclusion shows an increasing understanding of the transformative power it has in terms of economic and social development. It has emanated from the government, officials of finance and the banking industry as a whole (Sarma & Pais, 2011; Shahul, 2014). This reflects mounting acknowledgment that financial inclusion plays an important role in eradicating poverty and backing up sustainable and inclusive development (World Bank, 2014). According to Enhancing Financial Innovation and Access (EFInA, 2013) financial inclusion is the provision of a broad range of high quality financial products, such as savings, credit, insurance, payments and pensions, which are relevant, appropriate and affordable for the entire adult population, and especially the low income segment, or simply an economic state where individuals and firms are not denied access to basic financial services based on motivations other than efficiency criteria (Massara & Mialou, 2014).

The core indicators will be operationally defined as: availability, accessibility and usage of formal financial services (Sarma, 2012). Availability of financial services is measured by the number of bank outlets or branches and number of functional ATMs per 100,000 adult; believing that an inclusive financial system should have banking services that are easily available to the users (Sarma, 2012). Accordingly, Sarma believed that number of bank employees per customer can also be used as financial service. On the other hand, accessibility of financial services is measured by banking penetration (i.e. the proportion of adult having bank account with official financial institutions). The proportion of deposit accounts is also a proxy for bankable adults because an inclusive financial system should penetrate widely amongst its users to increase the size of the banked population.

Meanwhile, usage of financial services is measured by the volume of credit and deposits or saving by adult population as percentage of GDP within the formal financial system. The major focus of this paper is the usage of financial services or patronage since it is seen as the final indicator of financial inclusion as sometimes availability of the services alone might not result in the patronage.

The Nigerian Government in 2012 launched the Nigerian National Financial Inclusion Strategy (NFIS) with the sole aim of increasing the number of adults that are financially included from 53.7% to 80% by the year 2020 (NFIS, 2012). By capturing Nigerians without access to formal financial services into financial inclusion net, the potentials of accumulating and mobilizing bulk of deposits or savings outside the banking system will be achieved, which will form part of investible funds that will promote productive activity as well as inclusive growth. Since then, some policy prescriptions were made and priority actions were taken to ensure the realization of such targets. These actions include expansion of digital financial services (DFS), harmonization of know your customer (KYC) requirements for opening bank accounts, improvement in cashless payment channels, among others (CBN, 2018). In spite of the policy initiatives, the EFINA (2020) survey revealed that only 64% of adults Nigerians were financially included by the end of 2020, which means that 36% of Nigerians adults, that is about 38 million adults remain financially excluded. Although there has been growth, it however fell below the NFIS target which aimed at 80% coverage of Nigerian adults within formal financial system.

The effects of financial inclusion on agriculture draw from the role finance plays in affecting poverty and inequality. Availability of finance leads to increased agricultural productivity and higher incomes for the farmer. As a result of this, hunger of the poor is reduced, and they are able to escape poverty traps and withstand periodic hock (Nathan, 2015). With financial inclusion, rural dwellers are offered a diverse array of financial services which helps them in money management and alternative investment outlets. Financial inclusion can affect agriculture in three distinct ways (Nathan, 2015).

Firstly, finance can boost agricultural productivity. Provision of credit facilitates the purchase of inputs and hiring of labour and machines, and this helps to keep the crop cycle going even after harvesting. The seasonal nature of agriculture means that farmers often have to wait several months to be able to plant during the rainy season. Smallholder farmers would have already consumed all the proceeds from the previous harvest and would have no money to buy inputs, or even if they had, they would not have sufficient funds to purchase machinery, fertilizers or seeds. Financial inclusion can help in mitigating these types of problems, as financial products are available in the form of credit or even savings products.

Secondly, finance facilitates diversification of livelihoods and increase in income of farmers. Access to credit can facilitate investment in storage facilities, which will help in keeping produce fresh during transportation. Thus, farmers can get better prices for their products by transporting them to the markets with best prices rather than having to dispose them quickly because of the perishable nature of the products. Also, better storage facilities mean that farmers do not have to sell during harvest when prices are low, but they can wait until when prices rise, thereby increasing their incomes. Availability of credit also provides funds for farmers to add value to products through processing. Improvements in raw farm produce through processing add value, and thus the farmers can get better prices for their products.

Thirdly, financial inclusion helps in promoting resilience and avoiding poverty traps. It has been found that the poor value savings more than credit. Savings facilitate investment which is devoid of interest payments, and so the farmers can be more innovative without the fear or burden of interest payments. Also, savings serve as a buffer against shocks either during unfavourable climatic conditions or during the off-harvest periods.

Financial inclusion in this regard through the provision of insurance against agricultural risk, such as weather, crop yields and livestock mortality would go a long way in avoiding poverty traps and promoting resilience.

More than 90% of agricultural outputs are accounted by financially excluded smallholder farmers with less than 2 hectares under production (NM partners, 2019) which is verifiable as the bulk of financially excluded population in Nigeria comes from the rural areas and the northern part of the country (EFINA, 2018) where most of the agricultural produce comes from.

2.1 EMPIRICAL LITERATURE

Literature is awash with studies on the impact of formal financial products and services on agricultural output in Nigeria. However, most of these studies focus on the role of availability and accessibility of the institutions and services. Seldom, usage of the services is considered. Some of these studies are reviewed.

Ajayi, Nogeri and Akolo (2017) assessed the impact of agricultural financing policy and deposit money bank loan on agricultural sector productivity from 1981-2015 using FMOL to evaluate the impact of deposit money bank credit to agricultural sector, agricultural credit guarantee scheme fund and lending rate on Agricultural share GDP within the period. The result revealed that deposit money bank loans (CBF) and agricultural financing policy proxied by Agricultural Credit Guarantee Scheme Fund (ACGSF) have significant positive impact on agricultural productivity in Nigeria, while lending rate (LR) showed negative impact on agricultural productivity.

Oluwafemi and Ode-Menka (2018) examined the impact of credit on agricultural production in Nigeria from 1978-2016. Agricultural sector's output was subjected to the effects of deposit money, bank credit to agricultural sector, agricultural credit guarantee scheme funds, government expenditure on agriculture and trade openness. Using Johansen Co-integration and Multivariate Ordinary least squares regression, the paper found absence of long-run relationship between deposit money bank credits and agricultural sector output. However, other macroeconomic variables in the model have shown significant influence on agricultural productivity.

Okuma *et al* (2019) studied the causality between financial inclusion and agriculture sector output using Engle-Granger co-integration test. Error correction model and granger Causality test were used to examine the impact of prime lending rate, deposit rate, agricultural guarantee scheme fund, demand deposit from rural areas, as well as bank loan to small scale enterprises as percentage of total loan, all on agricultural output. The ECM revealed that financial inclusion does not have significant effect on agriculture sector in Nigeria. The study indicated more support for independent causal relationship running from financial development to agricultural sector output. The study concludes that financial inclusion has not helped growth of agriculture output in the country.

Babajide (2020) studied the effect of financial inclusion on agricultural production in Nigeria using Panel data. The study integrated survey on agriculture (LMSM-ISA) and panel data estimations to investigate the effects of number of households with bank account, households borrowings from financial institutions, households savings in financial institutions, households consumption, households size, households religion, households location, households remittance, households' head age, education level, gender, occupation, quantity of fertilizer used, quantity of herbicide used as well as quantity of pesticide used on agricultural

output per hectare. The empirical result indicated that irrespective of how financial inclusion is measured has exerted positive effect on agricultural productivity in Nigeria.

In the same vein, Umaru and Eshiozemhe (2022) investigated the asymmetric effects of financial inclusion on agricultural productivity in Nigeria. Specifically, the paper assessed the effects of volumes of ATM usage, POS, mobile banking (e-banking) and demand deposit cheques, on agricultural output in Nigeria using quarterly data spanning the period of 2010Q1 and 2021Q4. Non-linear Autoregressive Distributed Lagged (NARDL) model and Stepwise Least Squares (STEPLS) were employed for the estimations. Findings of the study revealed that the use of ATM and POS significantly and positively affect agricultural output in the country.

Also, Adegbite and Macheche (2022) used cross-sectional survey to assess the impact of multidimensional financial inclusion on the livelihoods of smallholder farmers using a survey data on 2,300 rural smallholder farmers in Nigeria. Propensity score matching was employed by the paper and the results indicated that financial inclusion reduced the sole dependence of rural smallholder farmers on farm income by 37.58% but increased their engagement in both farm and non-farm income activities by 32.45%. Thus, the study partly recommends for efforts to increase the financial inclusion of rural smallholder farmers. Such action according to the paper, will promote sustainable rural livelihoods and inclusive economic development.

Oloyo *et al* (2024) examined the relationship between financial inclusion and agricultural output in Nigeria. Specifically, the study sought to ascertain the effect of commercial bank loans on agricultural sector, deposit of rural branches, loans by rural branches of commercial banks and number of commercial banks branches in rural areas, on agricultural output in Nigeria. Using secondary data the study adopted ordinary least square (OLS) regression technique as its method of analysis. Findings of the study revealed that commercial bank loans on agricultural sector and deposit of rural branches of commercial banks all had a positive effect on agricultural output. On the other hand, loans by rural branches of the banks and number of commercial banks branches in rural areas had negative effects on agricultural output in Nigeria. Thus, the study recommends increasing loans and advances to agricultural sector as well as establishing more branches in rural areas to enhance financial inclusion.

In a subnational study, Ashoro *et al* (2024) assessed the impact of financial inclusion on agricultural sector in Delta State, Nigeria, where agriculture is a major source of livelihood to many inhabitants. The paper opined that many financial interventions in Nigeria had helped in developing agricultural sector, including agent banking and mobile money, Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL), ACGSF and Microfinance banks. The impacts were discernable in improved food security, poverty reduction, women's empowerment, market access and value chain integration, risk mitigation, access to agricultural inputs and improved agricultural productivity in the State.

The literature reviewed is by no means exhausted. However, very few considered usage, in form of volume of deposits and credits particularly to rural population, as determinants of agricultural output, which this study intends to investigate.

2.2 THEORETICAL FRAMEWORK

This study is anchored by the Endogenous Growth theory which addresses the short comings of the neo-classical model where the essentials determinants of growth are made to be endogenous in the model. The

new model makes the rate of technological change to be endogenous and can be influenced by government actions and policies. Proponents of the endogenous growth are of the views that government policy and economic behavior must be able to affect the growth rate in the long run (Froyen, 2009). Romer (1986) initiated the endogenous growth theory which was improved by the contribution of Lucas (1988) and Robelo (1991), in his study titled “Long-Run Policy Analysis and Long- Run Growth”. The simplest endogenous model is the AK model which eliminates diminishing returns to capital which was characteristic of Neo-classical theory (Hussein & Thirwall, 2000). The AK model is stated as follows $Y=AK$, where Y = output, A = a positive constant that reflects the level of the technology and K = capital (to include finances in broader sense).

The model asserted that the growth in output depends on total productivity, improved financial intermediation and the rate of savings. Therefore, it is not disputable that growth rate of an economy, and by extension agricultural output, is an increasing function of financial inclusion particularly level of savings and capital formation. Hence, government policies have a great influence, on growth rate.

3. METHODOLOGY

This research employed quantitative method of the ex-post facto type of research design, utilizing secondary time series data of Nigeria from 1982 to 2022. The variables considered include; Agricultural productivity index (AGDP), commercial bank deposit (CBD), private sector credit to agricultural sector (PCA), agricultural credit guarantee scheme fund (ACGSF), deposit of rural bank branches (DRB), loan of rural bank branches (LRB), lending interest rate (PLR) and fertilizer consumption (FT). most of the data is sourced from the CBN.

Prior to establishing long run relationship among the variables, their time series properties are investigated using stationarity tests of both Augmented Dickey-Fuller and Phillips-Perron types as:

The Augmented Dickey-Fuller ADF test

$$\Delta y_t = a_0 + \delta y_{t-1} + \sum_{i=1}^k \beta_i \Delta y_{t-i} + \varepsilon_t \tag{1}$$

Where ε_t represent Error Term, and $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$, $\Delta y_{t-2} = (y_{t-2} - y_{t-3})$ etc

The Phillips-Perron (PP) test

$$\Delta y_t = \pi y_{t-1} + \beta_i D_{t-i} + \varepsilon_t \tag{2}$$

Where ε_t is a $I(0)$ with zero mean and D_{t-i} is a deterministic trend component.

The model used was adopted from the study of Okaro (2016) with some modifications to address the objective. The model showed that agricultural productivity is a function of agricultural credit guarantee scheme fund, deposit of rural bank branches, private sector credit to agricultural sector and fertilizer consumption as shown in equation 3.

$$AGP=f(ACGSF, DRB, PCA, LRB, FT) \tag{3}$$

Where:

AGP= Agricultural productivity (proxy by Agriculture sector share of GDP)

ACGSF= Agricultural Credit Guarantee Scheme Fund

DRB= Deposit of Rural Bank Branches

PCA=Private sector credit to agricultural sector

LRB=Loans of rural branches of deposit money banks

FT= Fertilizer consumption

Econometrically, the above model can be written as follows:

$$AGP_t = \alpha_1 + \alpha_2ACGSF_t + \alpha_3DRB_t + \alpha_4PCA_t + \alpha_5LRB_t + \alpha_6FT_t + \varepsilon_t \tag{4}$$

Where: $\alpha_1 - \alpha_6$ = Parameters to be estimated, t = time trend, ε = error term, others as in equation.

On a priori expectation, $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5,$ and $\alpha_6 > 0$

ARDL model was applied to estimate the parameters of the model. This technique has the ability to estimate co-integrating relationship among variables even though they are integrated at different orders; and it also allows for uneven lag orders. ARDL would only be possible if the time series are integrated of order I(0) or I(1), but not I(2) (Pesaran, Shin & Smith 2001). The model is specified as:

$$\begin{aligned} \Delta AGP_t = & \phi_0 + \sum_{i=1}^n \phi_{1i} \Delta AGP_{t-i} + \sum_{i=1}^n \phi_{2i} \Delta ACGSF_{t-i} + \sum_{i=0}^n \phi_{3i} \Delta DRB_{t-i} + \sum_{i=0}^n \phi_{4i} \Delta PCA_{t-i} \\ & + \sum_{i=0}^n \phi_{5i} \Delta LRB_{t-i} + \sum_{i=0}^n \phi_{6i} \Delta FT_{t-i} + Y_1AGP_{t-i} + Y_2ACGSF_{t-i} + Y_3DRB_{t-i} \\ & + Y_4PCA_{t-i} + Y_5LRB_{t-i} + Y_6FT_{t-i} + ECT_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

Equation 5 specifies both the short run and long run parameters to be estimated, including the error correction term ECT which is expected to be negative and less than one in magnitude to ensure convergence to long run equilibrium path in case of any short run disturbance. The closer the value of the ECT is to unity the higher the speed of the adjustment process.

Akaike Information Criteria (AIC) is used in the selection for the lag-length as:

$$AIC \ln (\hat{\sigma}^2)+2k/T \tag{6}$$

Other post-estimation tests are also carried out to ensure the stability of the model, which serial correlation, heteroskedasticity, normality and stability tests.

3.1 MEASUREMENT OF VARIABLES

Private sector credit to agricultural sector: This is measured by outstanding loans of commercial banks to agriculture sector. The data is sourced from CBN Statistical Bulletin (various issues).

Agricultural credit guarantee scheme fund measured by value of total loans guaranteed. The data is sourced from CBN Statistical Bulletin (various issues).

Deposit of rural branches of deposit money banks: This variable is operationally defined as the ratio of total deposit of rural branches of deposit money banks in Nigeria. These deposits capture the level of financial service availability and usage by citizenry in Nigeria, bearing in mind that greater proportion of farmers are the rural dwellers. The total deposits are in millions of naira and as a matter of fact, logarithm was taken on them to normalize the naira values with other values in ratio or percentage. The data is sourced from CBN Statistical Bulletin (various issues).

Loans of rural branches of deposit money banks: The loans are defined in this study as total loan advanced by deposit money bank rural branches to individual citizens in the rural areas. The loans are in absolute naira values, hence the reason for logging them as earlier explained above. The data is sourced from CBN Statistical Bulletin (various issues).

Fertilizer consumption: This is measured by the total number of metric tons of fertilizer consumption in Nigeria. The data is sourced from WDI (2023).

4. RESULTS AND DISCUSSIONS

This section presents the results obtained from the analysis of data conducted. The unit root test of the variables was performed using both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) techniques. The outcomes are reported in Table 1.

Table 1: Summary of Augmented Dickey-Fuller Unit Root Test

Variables	Test Statistics at Level	5% Critical Value at Level	P-Value (5%)	Test Statistics at First Diff.	5% Critical Value at First Diff.	P Value (5%)	Order of Integration
Augmented Dickey-Fuller Unit Root Test							
logAGP	-1.868572	-3.533083	0.6510	-5.880091	-3.536601	0.0001	I(1)
logACGSF	-0.884398	-3.533083	0.9475	-5.546786	-3.536601	0.0003	I(1)
logDRB	-2.357243	-3.536601	0.3946	-4.598432	-3.536601	0.0039	I(1)
logPCA	-2.524419	-3.533083	0.3153	-6.987212	-3.536601	0.0000	I(1)
logLRB	-3.694587	-3.536601	0.0353	-5.745882	-3.544284	0.0002	I(0)
logFT	-1.541079	-3.533083	0.7971	-7.250387	-3.536601	0.0000	I(1)
Phillips-Perron Unit Root Test							
logAGP	-1.945216	-3.533083	0.6115	-5.878654	-3.536601	0.0001	I(1)
logACGSF	-0.971148	-3.533083	0.9362	-5.546786	-3.536601	0.0003	I(1)
logDRB	-1.983452	-3.533083	0.5914	-4.620565	-3.536601	0.0037	I(1)

logPCA	-2.443088	-3.533083	0.3529	-8.365947	-3.536601	0.0000	I(1)
logLRB	-3.772255	-3.533083	0.0293	-16.89135	-3.536601	0.0000	I(0)
logFT	-1.453110	-3.533083	0.8281	-8.533006	-3.536601	0.0000	I(1)

Source: Authors' Computation, 2023 using EViews 10

The results showed that all the variables are not stationary at level at 5 percent with the exception of loan to rural bank branches. As such, the variables are considered fit for the use of ARDL model.

ARDL Bounds Test

The study applies the ARDL Bounds test to cointegration approach for the analysis, and Table 2 presents the findings.

Table 2: ARDL Bounds Test to Cointegration

F-Statistic	K	5% critical Bound Test value	
		Lower Bound	Upper Bound
3.850977	5	2.62	3.79

Source: Author's Computation, 2023

The results presented above revealed that the F- statistic value of 3.85 is higher than both the lower and upper bound critical values at 5 percent level of significance, suggesting that there is long run relationship among the variables.

ARDL Short-Run Estimates

In order to analyze the data, the study first chooses an optimal lag using the Akaike Information Criterion (AIC), and then it chooses the ARDL (2, 1, 0, 0, 0, 1) and presents the outcomes in Table 3.

Table 3: ARDL Short-Run Estimates

Dependent Variable=D(logAGP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(logAGP(-1))	0.180698	0.179360	1.007460	0.3227
D(logACGSF)	0.097505*	0.040006	2.437241	0.0217
D(logDRB)	0.004939	0.005302	0.931462	0.3599
D(logPCA)	0.063396*	0.029610	2.141033	0.0415
D(logLRB)	-0.011635	0.012346	-0.942466	0.3543
D(logFT)	0.001881*	0.000800	2.350637	0.0325
ECT(-1)	-0.577068**	0.172949	-3.336640	0.0025

R-squared=0.93, Prob (F-statistic)= 0.0000

Source: Authors' Computation, 2023

The short run results revealed that the coefficient of the lag dependent variable (AGP(-1)) is insignificant, implying previous information on agricultural productivity has insignificant influence on the current level of agricultural productivity. The results also revealed that agricultural credit guarantee scheme fund has positive impact on of agricultural productivity in the short run. The coefficient revealed that a unit increase in private sector credit to agricultural sector and fertilizer consumption will lead to 0.063396 percent and 0.001881 percent increase in agricultural productivity, respectively.

Contrarily, deposit of rural bank branches and loans of rural branches of deposit money banks have no impact on agricultural productivity in the short-run. The coefficient of the Error Correction Term (ECT) displayed a significant negative sign of -0.577068, supporting the existence of long-term cointegration among the variables. The coefficient of the Error Correction Term predicts that 57.8 percent of the long-term equilibrium will be adjusted each year. The coefficient of determination and overall goodness/fit of the model are all good.

ARDL Long-Run Estimates

The study estimates the long run ARDL model and presented the results in Table 4.

Table 4: ARDL Long-Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
logACGSF	0.249495**	0.029833	8.363082	0.0000
logDRB	0.008559	0.009362	0.914220	0.3687
logPCA	0.109859**	0.036662	2.996527	0.0058
logLRB	-0.020163	0.021333	-0.945139	0.3530
logFT	0.008300**	0.002435	3.408585	0.0021
C	2.130647	0.135500	15.724329	0.0000

Source: Authors’ Computation, 2023

Findings showed that agricultural credit guarantee scheme funds, private sector credit to agricultural sector and fertilizer consumption have long run positive impacts on agricultural productivity at 5 percent level. According to the coefficients, the output elasticity of agricultural credit guarantee scheme fund, private sector credit to agricultural sector and fertilizer consumption were 0.249495 percent, 0.109859 percent and 0.008300 percent increase in agricultural productivity, respectively. However, deposit of rural bank branches and Loans of rural branches of deposit money banks have not shown any impact on agricultural productivity in the long run.

Diagnostic Test Results

Table 5 shows the results of the diagnostic test for the ARDL estimates.

Table 5: Diagnostic Test for Third Objective

Test	P-Values
Breusch-Godfrey Serial Correlation LM	0.0665
Heteroskedasticity :Breusch-Pagan-Godfrey	0.0586

Source: Authors’ Computation, 2023.

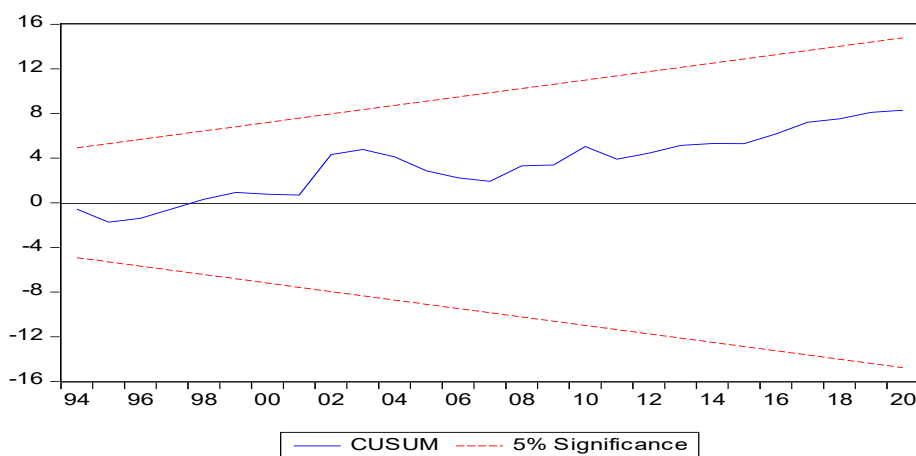


Figure 1: CUSUM Plot of the ARDL Model

According to the findings of the Breusch-Godfrey Serial Correlation LM test and the Breusch-Pagan-Godfrey heteroscedasticity test, the model does not have issues with serial correlation or heteroscedasticity because the observed R squares probability values are greater than 5%. Further evidence that the model's parameters are stable may be seen in Figure 1, where the CUSUM plot is below the 5% critical bound.

4.2 Discussions of the Results

The estimated ARDL short run and long model revealed that agricultural credit guarantee scheme fund has significant positive impact on of agricultural productivity. According to the coefficient, the degree of responsiveness of agricultural output to agricultural credit guarantee scheme funds is 0.097505 and 0.249495 significant increase in agricultural productivity in the short run and long run, respectively. This result is consistent with the a’p priori expectation and the findings of Obilor (2013), Oluwafemi & Ode-Menka (2018) and Olainyi (2017) in Nigeria but contradicts the work of Okuma et.al (2019).

Theoretically, private sector credit to agricultural sector and fertilizer consumption should accelerate agricultural productivity. The results of the short run and long run model revealed that private sector credit to agricultural sector and fertilizer consumption have significant positive impact on agricultural productivity which is in line with the a’p priori expectation of the study.

Deposit of Rural Bank Branches is also anticipated to impact positively on agricultural productivity. The results of the short run and long run model presented in Table 3 and 4 however, contradict the a’p priori claim because deposit of rural bank branches has no impact on agricultural productivity during the period under study.

5. CONCLUSION AND RECOMMENDATIONS

This study assesses the impact of financial inclusion, measured in terms of the usage of financial services, on agricultural productivity in Nigeria over the period 1982 to 2022, using the Autoregressive Distributed-Lag (ARDL) Model. Based on the findings, the study concludes that two indicators of the usage of financial services, which are the agricultural credit guarantee scheme fund and private sector loans to the agricultural sector, as well as fertilizer consumption, all contribute significantly toward improving the productivity of the agricultural sector in Nigeria. However, deposit of rural bank branches and loans to those branches in the rural areas do not seem to impact on agricultural productivity in Nigeria.

Based on the conclusion the following recommendations were proffered:

1. Government at all levels should implement measures to strengthen its ability to increase the number of loans and advances accessible to farmers from commercial banks with flexible lending rate. Farmers information should also be properly captured by the government as this will aid banks in information collecting. Due to the preponderance of small-scale farmers dispersed across the nation without a formal identity or registration, the cost of information collection is frequently high beyond what banks can afford.
2. Central and commercial banks should establish a panel examining committee to make sure that the money released to farmers are rigorously used for their purpose without any potential diversion. The government should stop subsidizing fuel and instead subsidize credit rates for the agriculture sector.

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