**Assessing the Effects of Financial Inclusion on Agricultural Production in Nigeria: Insights and Implications (1999-2022)**

**ABSTRACT**

The research examined the effect of financial inclusion on agricultural production in Nigeria from 1991 to 2022. Specifically, the study determined the effects of commercial bank loans and advances to the agricultural sector, deposits from rural branches of commercial banks, Agricultural Credit Guarantee Scheme Fund and interest rates on agricultural output in Nigeria. Annual secondary data were sourced from Central Bank of Nigeria Statistical Bulletin and Index Mundi Database. The data was analysed using the Autoregressive Distributed Lag Error Correction Model. The result showed that in the long run and short run, the independent variables agricultural credit guarantee scheme fund, commercial banks loans and advances to agricultural sector and interest rate had significant effect on agricultural output (PV < 0.05), whereas deposits of rural branches of commercial banks did not have significant effect on agricultural output (PV > 0.05) both in the long and short runs. The study recommended that loans from agricultural credit guarantee scheme funds be used for the agricultural purposes that they are aimed at so as to reduce the negative effect it had on agriculture within the study period.

**Keywords:** Agricultural output, Agricultural Credit Guarantee Scheme Fund, Autoregressive Distributed Lag Error Correction Model, Financial inclusion, interest rate.

**Introduction**

Agriculture has historically been the backbone of Nigeria's economy, preceding the discovery of crude oil. In a related avowal, Tuaneh and Wiri (2019) asserted that agriculture was the mainstay of the Nigerian economy until the discovery of oil in Nigeria in 1956 and its export in 1958. Also, Tuanane and Okidim (2019) emphasised that Agriculture has the inert potentials of; expanding the productive capacities of the agro-allied industries. This could be achieved through the provision of industrial raw materials, generation of foreign earnings by increasing the export base of the economy, and provision of employment for a larger percentage of its citizenry.

Over 70% of Nigeria's population residing in rural areas engage in agriculture for both commercial and subsistence purposes. Smallholder agriculture is a key source of income for many (Obe-Nwaka, Okidim, and Agbagwa, 2020). According to Umaru and Inusa (2022), agricultural output is crucial for emerging economies, as issues like food insecurity, high food imports, and rising food prices remain pressing challenges. These concerns underscore the need to increase agricultural sector output.

Ojo et al. (2022) define agriculture as encompassing various forms of farming, including land cultivation, fishing, livestock, poultry, and forestry. Agriculture in Nigeria has the potential to expand the country's productive and export base through job creation, food security, industrial input supply, and overall economic growth. However, despite its importance, the sector faces several challenges. These include limited access to financial services and exclusion from the formal financial system, which negatively impacts yields and overall performance (Emaziye, 2015, as cited in Ashoro et al., 2024). For example, in 2019, agriculture received only 4.2% of commercial bank financing in the second quarter, while manufacturing, oil and gas, and services received 15.3%, 22%, and 36.5%, respectively (National Bureau of Statistics, 2019). This highlights the exclusion of agriculture from formal financing.

Financial inclusion is crucial for unlocking the socioeconomic potential of underserved communities and fostering inclusive development (Alliance for Financial Inclusion, 2019a). The MAYA Declaration of 2011 for sustainable financial inclusion has urged developing economies to reduce the number of people without access to formal financial services. El-Said et al. (2020) define financial inclusion as the ability of individuals to access and use financial products and services. Oladimeji and Adegbite (2019) describe it as ensuring ease of access, availability, and use of formal financial systems for all members of an economy. Ashoro et al. (2024) emphasize that financial inclusion is a vital driver of economic development and poverty reduction, as it brings rural communities closer to financial services, allowing them to access financing for agricultural and other needs.

Fowowe (2020) noted that agriculture contributed 63.8% to Nigeria's GDP in 1960, but this dropped significantly to 23.8%, 20.3%, and 21.4% in 2010, 2014, and 2018, respectively. This decline is largely attributed to the discovery of oil and Nigeria's increasing reliance on it as a primary source of revenue, leading to a loss of self-sufficiency in food production. Many contemporary farmers are financially excluded and rely on rudimentary tools, which results in low productivity and perpetuates poverty. It is concerning that sectoral distribution of commercial bank loans and advances shows that agriculture received only 8%, 1.96%, 1.67%, 3.26%, 5.15%, 5.98%, and 6.16% of bank loans in 2000, 2006, 2010, 2016, 2020, 2021, and 2022, respectively (CBN Bulletin, 2022). However, to fully appreciate the significance of the contribution of small holder agriculture in achieving SDG 2, it is essential to include rural smallholder farmers in the formal financial system.

**Objective of the study**

The primary objective of this study is to determine the effects of financial inclusion on agricultural production in Nigeria. Specifically, the study aims to:

1. investigate the effects of commercial bank loans and advances to the agricultural sector on agricultural output in Nigeria;
2. analyze the influence of deposits from rural branches of commercial banks on agricultural output in Nigeria;
3. examine the effects of the Agricultural Credit Guarantee Scheme Fund on agricultural output in Nigeria and
4. assess the effects of interest rates on agricultural output in Nigeria.

**Literature Review:**

Financial inclusion is defined as "access to and usage of formal financial services to enhance the well-being of individuals within a country" (Demirgüç-Kunt *et al*., 2015; Ozili, 2020a & b). Nwanne's study (2015, as cited in Okuma et al., 2019) described financial inclusion as a state in which all individuals in a nation have full access to the appropriate financial products and services necessary for effective money management. This means that financial services should be available to those who need and can use them. In a similar vein, Sarma and Pias (2018) defined financial inclusion as the availability of various financial services, including savings accounts, insurance, loans, and payment and remittance processing.

Etea and Obodoechina (2019) described the agricultural sector as encompassing activities related to crop production and livestock farming for human consumption. Yilson *et al*. (2021) provided a more detailed definition of agriculture, describing it as the intentional act by individuals, groups, organizations, or governments to alter a portion of the earth’s surface for the cultivation of crops, livestock, forestry, or fisheries, with the aim of personal sustenance or economic benefit. In Nigeria, the agricultural sector plays a crucial role in expanding the country's productive, consumption, and export capacities.

Umaru and Inusa (2022) investigated the asymmetric effect of financial inclusion on agricultural output in Nigeria. They used variables such as the volume of automated teller machines, point of sale systems, mobile banking, and cheque transactions. Data was sourced from the Nigerian Inter-Bank Settlement System (NIBSS) and the Central Bank of Nigeria's 2021 statistical bulletin. The study employed the non-linear Autoregressive Distributed Lag (NARDL) model and Stepwise Least Squares (STEPLS) method for estimation. The results indicated that financial inclusion had a positive and significant impact on agricultural output in Nigeria over the period under review.

Fowowe (2020) conducted an empirical study on the effects of financial inclusion on agricultural productivity in Nigeria. Using the Living Standards Measurement Study–Integrated Surveys on Agriculture (LSMS-ISA) methodology, the study utilized both time series and cross-sectional data through panel data estimation techniques. The findings revealed that financial inclusion had a positive and statistically significant effect on agricultural productivity in the country.

Okuma et al. (2019) explored the causality between financial inclusion and Nigeria's agricultural sector output. They employed an ex-post facto research design and used annual time series data obtained from the Central Bank of Nigeria's statistical bulletin. Their analysis incorporated Unit Root Tests, the Engle–Granger Co-integration Test, the Error Correction Model (ECM), and Granger Causality Tests. Financial inclusion was proxied by variables such as prime lending rate, deposit rate, the Agricultural Credit Guarantee Scheme Fund, the demand for deposits in rural areas, and the proportion of bank loans to small-scale enterprises. The study found that financial inclusion explained 41% of the variations in agricultural output. However, the F-statistics co-efficient of 0.070531 suggested that the explanatory variables had an insignificant effect on agricultural output, and the Granger Causality Test provided further evidence that no causal relationship existed between financial inclusion and agricultural sector output.

Tuaneh and Okidim (2019) used the Autoregressive distributed lag model in their study on Agricultural Performance amidst Macroeconomic Instability in Nigeria.

**Materials and methods**

The quasi-experimental design was used in the study since the study requires the use of secondary data to determine the relationship between the independent and dependent variables. Time series data spanning 32 years were gathered from CBN Statistical Bulletin between 1991 and 2022.

**Stationarity Test**

In order not to provide spurious results, the data used for the study were subjected to stationarity test utilizing Augmented Dickey Fuller (ADF) test.

**Cointegration Test**

Once stationarity is established, cointegration test was conducted in order to test for long run relation among the variables.

**Error Correction Model (ECM)**

The association between financial inclusion variables and agricultural output were determined using ECM.

**Model Specification**

In this research, the independent variables (financial inclusion variables) were agricultural guarantee scheme fund (ACGSF), Commercial bank loans to agricultural sector (CBLA), deposit of rural branches of commercial banks (DRBCB), and interest rate (INTR) while the dependent variable will be the value of agricultural output. The model is given as:

∆AOt=α0+∑α1∆AOt-i+∑α2∆ACGSFt-i+∑α3∆CBLAt-i +∑α3∆DRBCBt-i +∑α3∆INTRt-i + δECTt-1+Ut

Where:

AO = Agricultural Output (% GDP)

ACGSF = Agricultural Guarantee Scheme Fund (N million)

CBLA = Commercial bank loans to agricultural sector (N billion)

DRBCB = Deposit of rural branches of commercial banks (N billion)

INTR = Interest rate (%)

Ut = error term

Δ = first difference operator

βs= vector long run multipliers

αs= vector of short-term coefficients

ECT = component of the error correction

δ = Component of error correction

**Results and Discussion:**

**Descriptive Statistics**

**Table 1: Descriptive statistics of the variables used**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Statistics | **AO** | **ACGSF** | **CBLAG** | **DRBCB** | **INTR** |
|  Mean |  24.53458 |  4121650. |  567.6458 |  169.7425 |  17.68833 |
|  Median |  23.96500 |  1617380. |  222.0000 |  28.21500 |  16.87000 |
|  Maximum |  37.35000 |  12456251 |  4808.000 |  988.5900 |  24.85000 |
|  Minimum |  20.24000 |  35642.00 |  60.00000 |  8.940000 |  15.14000 |
|  Std. Dev. |  4.088910 |  4381157. |  955.0363 |  269.6290 |  2.113315 |
|  Skewness |  1.759071 |  0.527157 |  3.843603 |  1.789260 |  1.921462 |
|  Kurtosis |  6.002159 |  1.639548 |  17.66051 |  5.148822 |  6.757455 |
|  |  |  |  |  |  |
|  Jarque-Bera |  21.39028 |  2.962410 |  274.0238 |  17.42324 |  28.88654 |
|  Probability |  0.000023 |  0.227364 |  0.000000 |  0.000165 |  0.000001 |
|  Sum |  588.8300 |  98919604 |  13623.50 |  4073.820 |  424.5200 |
|  Sum Sq. Dev. |  384.5412 |  4.41E+14 |  20978172 |  1672095. |  102.7203 |
|  Observations |  32 |  32 |  32 |  32 |  32 |

**Source: Author’s Computation from E-views 10.**

The average values for agricultural output, the Agricultural Credit Guarantee Scheme Fund, commercial bank loans to the agricultural sector, deposits of rural branches of commercial banks, and interest rates over the 32-year period considered in this study were 24.53, 4,121,650, 567.64, 169.74, and 17.68, respectively. These means represent the typical values of the variables during the specified time frame. The descriptive analysis revealed that all the variables exhibited low standard deviations, indicating that the data points were closely clustered around the mean.

**Unit root test**

To ensure reliable results, a unit root test was performed using the Augmented Dickey-Fuller (ADF) test. The test was carried out at both levels and differences to determine the order of integration. The results of the unit root test are presented in Table 2.

**Table 2: Unit Root Test Results**

|  |  |
| --- | --- |
| **Variables** | **Augmented Dickey-Fuller** |
|  | **Level** | **1st difference** | **Remarks** |
| AO | -2.158 (0.225) | -4.3701 (0.002) | 1(1) |
| ACGSF | --1.790956(0.3752) | -3.691 (0.012) | 1(1) |
| CBLAG |  -13.733(0.000) |  | 1(0) |
| DRBCB | -2.8854 ( 0.062) | -6.531(0.000) | 1(1) |
| INTR | -3.053010 (0.0447) |  | 1(0) |

**Source: Author’s Computation from E-views 10.**

The results of the unit root test indicate that the variables were stationary at different levels. Commercial bank loans to the agricultural sector and interest rates were found to be stationary at level, meaning they were integrated of order zero, I(0). On the other hand, agricultural output and deposits from rural branches of commercial banks were non-stationary at level but became stationary after the first difference, indicating they were integrated of order one, I(1). Given that the variables were stationary at different levels, the Johansen cointegration test would not be appropriate. Therefore, the Auto-Regressive Distributed Lag (ARDL)-Bounds Cointegration Test was employed to assess the presence of a long-run relationship among the variables.

**ARDL- Bounds Cointegration Test**

The study carried out Auto-regressive Distributed Lag-Bounds test to establish whether there was an existing long run relationship between the Agricultural Productivity and financial inclusion variables.

**Table 3: ARDL-Bonds Cointegration Test**

|  |  |
| --- | --- |
| (Dependent variable: AO) F(ACGSF, CBLAG, DRBCB, INTR) | **F-Statistics** 8.498150 |
| **Critical Values**

|  |
| --- |
| K=4; n=22  |
| 10%  |
| 5%  |

 | **Lower Bound 1(0)**2.22.56 | **Upper Bound 1(1)**3.093.49 |

**Source: Author’s Computation from E-views 10.**

As presented in Table 3, the results of the cointegration test revealed the presence of a long-run cointegrating relationship among the variables. The F-Statistic value of 8.498 was higher than the upper critical values of 2.56 and 3.49 at the 5% significance level (Keji, 2018). As a result, the study rejected the null hypothesis of no long-run relationship. Therefore, it was concluded that a long-run relationship exists among the variables under investigation.

**Autoregressive Distributed Lag Error Correction Model result of Financial Inclusion and Agricultural output Result**

**Table 4: ARDL Error Correction Model result of Financial Inclusion and Agricultural output**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Regressor** | **Coefficient** | **Standard error** | **T-Statistic** | **Probability** |
| **Long-Run Result** |
| AO (-1)\* | -1.237 | 0.216 | -5.737 | 0.000 |
| ACGSF | 0.000 | 0.000 | -3.650 | 0.005 |
| CBLAG | 0.007 | 0.002 | 2.900 | 0.018 |
| DRBCB | -0.002 | 0.002 | -1.457 | 0.179 |
| INTR | 1.199 | 0.225 | 5.328 | 0.001 |
| C | 4.590 | 4.271 | 1.075 | 0.311 |
| **Short-Run Result** |
| D(AO (-1)) | 0.365 | 0.098 | 3.731 | 0.005 |
| D(CBLAGR) | -0.019 | 0.005 | -3.694 | 0.005 |
| D(CBLAGR (-1)) | 0.002 | 0.000 | 4.621 | 0.001 |
| D(DRBCB) | -0.001 | 0.001 | -1.630 | 0.138 |
| D(ACGSF) | 0.000 | 0.000 | -3.367 | 0.008 |
| D(INTR) | 0.895 | 0.179 | 4.989 | 0.001 |
| D(INTR(-1)) | -0.684 | 0.252 | -2.712 | 0.024 |
| ECM(-1)\* | -1.237 | 0.139 | -8.906 | 0.000 |
| R-squared | 0.917399 |     Mean dependent var | 0.111818 |
| Adjusted R-squared | 0.876098 |     S.D. dependent var | 3.454915 |
| S.E. of regression | 1.216119 |     Akaike info criterion | 3.504493 |
| Sum squared resid | 20.70523 |     Schwarz criterion | 3.901236 |
| Log likelihood | -30.54943 |     Hannan-Quinn criter. | 3.597954 |
| Durbin-Watson stat | 1.592060 |  |  |  |

**Source: Author’s Computation from E-views 10.**

Table 4 shows that both the long-run and short-run effects of the Agricultural Credit Guarantee Scheme Fund on agricultural output were negative and significant. Specifically, the estimated coefficients were -5.95E-07 in the long run and -2.99E-07 in the short run. This indicates that an increase in the Agricultural Credit Guarantee Scheme Fund would lead to a decrease in agricultural output, which contradicts the a’priori expectation. This suggests that policies aimed at increasing funding for the agricultural sector should be carefully designed and implemented to ensure they have a positive impact on agricultural output. These results align with the findings of Jam, Tsegba, and Aondoakaa (2023), who also reported a negative effect of the Agricultural Credit Guarantee Scheme Fund on output in Nigeria's crop and fishery sectors.

In contrast, both the long-run and short-run effects of commercial bank loans to the agricultural sector on agricultural output were positive and significant, with coefficients of 0.006885 and 0.001566, respectively. This indicates that an increase in commercial bank loans to the agricultural sector would result in higher agricultural output in the long run. This outcome supports the findings of Oloyo, Uloghobui, Okenyi, and Yesufu (2024), who observed a positive relationship between commercial bank loans and agricultural output in Nigeria.

Interest rate also had a positive and significant effect on agricultural output over the review period, suggesting that an increase in interest rates would lead to an increase in agricultural output in the long run. This positive relationship contradicts the a’priori expectation. These results are consistent with the findings of Arikpo and Adebisi (2017), who also identified a positive relationship between interest rates and the agricultural sector. Tuaneh (2018) also found a positive relation between exchange rate and macroeconomic variable like the implicit price deflator. However, in the short run, interest rate had a positive effect on agricultural output in the current period, but a negative effect in the first lag. The coefficient for the current period's interest rate was 0.894, while the first lag had a coefficient of -0.683, implying that an increase in interest rate would reduce agricultural output in the short run.

The error correction term (ECT) was correctly signed with a negative value, indicating that previous errors were corrected in the subsequent period. The ECT was significant (P = 0.0000 < 0.05) for agricultural output, with a coefficient of -1.236, which implies a speed of adjustment of 12.3% towards long-run equilibrium.

Additionally, the R-Square, which measures the goodness of fit, was 0.876, meaning that 87% of the changes in agricultural output (AO) were explained by the independent variables, with the remaining 13% accounted for by the error term in the model.

### Conclusion:

The primary objective of this study was to assess the impact of financial inclusion on agricultural production in Nigeria between 1999 and 2022. The financial inclusion variables considered were the Agricultural Credit Guarantee Scheme Fund, commercial bank loans to the agricultural sector, deposits from rural branches of commercial banks, and interest rates. The findings indicated the following:

1. **Agricultural Credit Guarantee Scheme Fund**: had a negative and significant effect on agricultural output in both the long and short run.
2. **Commercial Bank Loans**: These had a positive and significant effect on agricultural output during the review period.
3. **Deposits of Rural Branches**: The effect was negative but not statistically significant.
4. **Interest Rates**: Interest rates had a positive effect on agricultural output in the long run, while they had a negative and significant effect in the short run.

### Recommendations:

1. **Commercial Banks**: Banks should continue increasing their loans and advances to the agricultural sector to sustain the positive effect on agricultural output.
2. **Deposit Drive in Rural Areas**: Banks should improve their deposit collection efforts in rural areas, simplifying account opening procedures to increase deposits. This will have a positive impact on agricultural output.
3. **Agricultural Credit Guarantee Scheme Funds**: Funds from the agricultural credit guarantee scheme should be used specifically for their intended purposes to mitigate the negative impact they currently have on agricultural output in Nigeria.

**Disclaimer (Artificial intelligence)**

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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