

Statistical Analysis of the Effects of Agricultural Loans on Agricultural Productivity

Hassan, F. A, Afolabi, N. O., Ayinde, Y. O.

Department of Statistics, Ogun State Institute of Technology, Igbesa, Ogun State

Abstract: Agriculture constitutes one of the most important sectors of the Nigerian economy. The sector is particularly important in terms of its contributions to employment generation, gross domestic product (GDP), and export revenue earnings. Before the country shifted its focus to oil exports in the 1970s, Nigeria's agrarian economy contributed 40% of the GDP and employed about 70% of the working population. With all this aforementioned agricultural contribution, it is true to say that agriculture, by every standard, is a business venture that requires a lot of finance. Since independence in 1960, successive government has been making efforts to address the problems of difficulty to access credit by the rural poor farmers. In recognition of the vital role of small-scale farmers in wealth creation, the government of Nigeria has experimented with various financing initiatives, like the establishment of institutions, programmes, and schemes aimed at providing for the financial needs of rural farmers. Despite government efforts, the Nigerian agricultural sector has been growing at a very low rate, and its contribution to the economy is reducing geometrically compared to its financing capacity. The data for this research was collected from the CBN office in Lagos State on the contributions of co-operative society crop farmers, farmer's contributions in thousands, and single-life-stock farmers to the growth rate. The data covered a period of seven years, from January 2015 to December 2021. The R-programming package was used for the analysis. The descriptive statistics of the variables of the research work were shown in the analysis; both skewness and kurtosis showed values of zero and three, respectively, but for the inferential analysis, regression, ANOVA, auto-correlation, and coefficient of determination were used. The plots of all the variables of interest showed upward trends and fluctuation modes over the periods of interest. The growth rate (GR) maintained steady growth from the starting year before the excessive increment in 2020 up to 2021. The aggregate loans from crop farmers (CF) maintained an increment between 2020 and 2021 but were a bit lower in 2020. The aggregate loans from single-life-stock farmers (SLSF) and co-operative societies (CS) fluctuated but drastically fell from 2018 to 2020. The farmer's contribution (CONT.) increased the growth rate. Their respective contributions are represented by the below linear equation: $GR = -228.587 + 2.028CONT + 0.017CS + 0.454SLSF + 2.185CF$. For the first test, we have $F = 8.963$, $r = 0.801$, $R^2 = 0.642$, and a significance value of 0.030. We therefore concluded that there is a very strong relationship between the CBN guidelines and agricultural productivity. Likewise, we inferred that there is a significant relationship between the growth rate and all other considered independent variables (i.e., CONT, CS, SLSF, and CF). with all the above information. We

therefore recommend that loans be given to real farmers at the appropriate time. And more effort to induce the youth into small and medium-scale farming to avoid famine.

Key words: Growth rate, Agricultural loan, Agricultural productivity, Revenue earning, CBN-guidelines, credit, Intermediation.



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Introduction

Agriculture constitutes one of the most important sectors of the Nigerian economy. The sector is particularly important in terms of its employment generation, contribution to gross domestic product (GDP), and export revenue earnings. Nigeria is described as an agrarian economy; before the country shifted focus to oil exports in the 1970s, agriculture contributed 40% of the gross domestic product (GDP) and employed about 70% of the working population (FMARD, 2012). Despite Nigeria's rich agricultural resource endowment, however, the agricultural sector has grown at a very low rate. In the pre- pre- and post-independence eras (1930–1965), the Nigerian economy was situated on, agriculture, which employed about 70–80% of the country's labour force (Eze, 2010) and contributed 60% of the nation's GDP and foreign exchange earnings (CBN, 1985). In the oil boom era (1966–1977), the oil sector became prominent as an important source of national revenue, contributing 57.6% to the GDP in 1977 and up to 99.7% in 1972. Agriculture, on the other hand, contributed only 12% to the GDP in 1970, which culminated in a rising a rising food import, bill, resulting in a persistent huge deficit in the balance of payments over the years (Ugwu, 2007).

In the post--oil boom era (1977–2002), the price of crude oil started fluctuating, and there has been growing concern about revitalizing the agricultural sector as well as diversifying the economy. During this period, only less than 50% of the country's cultivable agricultural land is under cultivation (Manyong, Ikpi, Olayemi, Yusuf, Ommona, and Idachaba, 2003). Even then, small-holder and traditional farmers who use rudimentary production techniques, with resultantly low yields, cultivate most of this land. Small-holder farmers are constrained by many problems, including poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, land and environmental degradation, and degradation, and inadequate research and extension services, among others.

The role of agricultural financing as a factor in improving agricultural production to facilitate economic growth and development cannot be overemphasized. According to Olomola (1997), the agricultural credit guarantee system is often considered an effective policy instrument for improving the production and distribution of agricultural commodities. Nnanna (2004) affirms that credit finance is more than just another resource such as labour, land, equipment, and raw materials since it can be used to acquire all others. Iheanacho, Chikaire, Ejiogu-Okereke, Osuagwu and Obi (2012) suggested that inadequate financing of the financing of the of the agricultural of the agricultural sector has caused a decline in agricultural production. If these claims are true, it raises doubts about the effectiveness the effectiveness of the agricultural finance institutions and programmes that are introduced from time to time to specially provide guaranteed credits to farmers to enhance agricultural production.

Among the established agencies to support agricultural financing to boost agricultural production and ensure food security is the Nigerian Agricultural Cooperative Bank (NACB), established in 1990 as an agricultural financing institution. In the year 2000, the Federal the Federal Government also established the Nigerian Agricultural Financing Institution to facilitate agricultural

production through the provision of affordable credit facilities to micro, small, and medium-scale farmers (Mustapha, 2006), now known as the Bank of Agriculture (BOA).

Despite the establishment of agricultural financing agencies over the years, the inability of the agricultural sector to expand as well as contribute meaningfully to the growth of the Nigerian economy has been huge due to inadequate agricultural credit (CBN, 2010). According to the CBN (2007), about 65% of Nigeria's economically active population lacks access to formal financial services, and much more recently, out of the 84.7 million adults, 46.3% were financially excluded while 53.7% were financially catered for. Hence, the continuous efforts by the government and researchers to address the issue are imperative. The situation raises the need for an inquiry into the impact of agricultural finances on agricultural production. It is therefore against this background that this research work seeks to examine the impact of agricultural financing on agricultural productivity in Nigeria using time series data from 2015 to 2022. The study, therefore, intends to investigate the causal relationship between agricultural financing and agricultural productivity in Nigeria, as well as the effect of agricultural financing on agricultural output in Nigeria.

Literature Review

Since independence in 1960, successive Nigerian governments have made efforts to address the problems of lack of access to credit for rural poor farmers. In recognition of the vital role of small-scale farmers in wealth creation, the government of Nigeria has experimented with various financing initiatives. The Federal Government of Nigeria established many institutions, programmes, and schemes aimed at meeting the financial needs of rural farmers. The major institutions established to provide credit facilities for agricultural growth and development in Nigeria were the defunct Nigerian Agricultural and Co-operative Bank (NACB), 1973; the River Basin Development Authority (RBDA), 1977; the Directorate of Food and Rural Infrastructure (DFRRI), 1986; and the Nigerian Agricultural Insurance Corporation (NAIC), 1987. The above institutions were complemented by the following programmes: the Agricultural Development Programme (ADP), 1975; Operation Feed the Nation (OFN), 1976; the Rural Banking Programme (1977); the Green Revolution, 1980; the defunct Family Economic Advancement Programme (FEAP), 1997; and the National Poverty Eradication Programme (NAPEP), 1999. The major agricultural financing schemes were the Agricultural Credit Guarantee Scheme Fund (ACGSF), 1978, and the Agricultural Credit Support Scheme (ACSS), 2006 (World Bank, 2009).

To enhance the provision of support services in all parts of the country, the government established the Agricultural Development Projects in all states of the Federation and the National Agricultural Land Development Authority. With the growth in the number of government agricultural development programmes, one expected meaningful growth in agricultural output, a positive change in farm sizes, and general development in the sector over time. Unfortunately, the index of real agricultural sector GDP shows the complete absence of any substantial growth. For example, the growth rate in real GDP of agriculture between 1981 and 2005 fluctuated between -13 and 65.13. The growth rate in real GDP agriculture was positive in 1982, between 1987 and 2003, and negative by 1983 and 1986, as well as in 2004 and 2005. On the other hand, the index of real GDP for agriculture fluctuated from 100 to 98.44 in 1986, from 136.35 in 1987 to 141.37 in 2000, increased steadily to 165.13 in 2003, and then dropped to 71.79 by 2005 (Eze, 2010).

In order to solve the problem of agricultural financing so as to boost agricultural production and ensure food security, especially in rural areas, the Federal Government of Nigeria established the Nigerian Agricultural and Co-operative Bank (NACB) on November 24, 1972, as an agricultural financing institution. In July 2001, the Nigerian government finally established the Nigerian Agricultural Co-operative and Rural Development Bank (NACRDB) as an agricultural financing institution to facilitate agricultural production through the provision of affordable credit facilities to micro, small, and medium-scale farmers. NACRDB, since its inception, has functioned for over ten (10) years in Nigeria as a rural financial intermediary with the primary objective of promoting

grass-roots self-reliant economic development through the provision of finance and banking services, among others. The capacity of the agricultural sector in Nigeria would be significantly enhanced through the provision of NACRDB low-interest credit facilities to enable farmers to start, expand, and modernize their farming activities, be self-reliant, self-employed, and generate adequate income and investment (Nwankwo, 2012). Most recently, the Micro Finance Bank in 2005 and many other presidential initiatives were established aimed at financing the production and export of certain commodities such as cassava, rice, cocoa, and oil palm. Furthermore, commercial banks in the country were mandated to extend credit to agriculture at a regulated rate of 9% per year.

Theoretically, Solow's theory of economic growth also provides a useful framework for analyzing growth drivers. According to Spence (2009), Solow's theory relates to the explanation of the sources (determinants) of growth on the supply (production) side of an economy. It starts with the idea of production functions, namely, that the quantity of the output (Q) in any sector is a function of the amounts and qualities of inputs or factors of production. These typically are land and natural resources (R), labour (L), and physical capital, such as buildings and machines (K).

$$Q = f(R, L, K)$$

Any residual is attributed to "technological change," that is, a shift in the production function due to factor outputs.

The theoretical studies have shown that a relationship exists between financial intermediation, agricultural production, and economic growth. For example, McKinnon (1973) and Shaw (1973), in their studies, strongly emphasized the role of financial intermediation in economic growth. In the same vein, Greenwood and Jovanovich (1990) observed that financial development can lead to rapid growth. Becivenga and Smith (1991) explained that the development of banks and efficient financial intermediation contribute to growth by channeling savings to increase agricultural production and reduce liquidity risks. They therefore conclude that financial intermediation leads to growth. Based on this assertion, this study seeks to examine the extent to which finance intermediation in the agricultural sector of the economy has influenced the sector and economic growth in Nigeria.

Anyanwokoro (1999) states that "financial system, means various financial institutions working together to provide the financial services required in an economy". He further stated that the Nigerian financial system comprises the banking system, the non-bank financial institutions, the regulatory authorities, and other financial market participants that play the role of financial intermediation in the Nigerian economy. The impact of agricultural financing on agricultural output in the Nigerian financial system can further be described as a family of rules and regulations within different categories of financial arrangements, institutions, agents, and mechanisms whereby they relate to each other within the financial sector and the rest of the world (Nwankwo, 2012).

Ahangar *et al.* (2013) examined the mobilization of domestic financial resources for agricultural productivity in India and observed that institutional credit has been conceived to play an important role in the agricultural development of India. The study reveals that the highest increase in loans issued was in the case of scheduled commercial banks, while the lowest was in the case of cooperatives. On the other hand, the total number of account holders in scheduled commercial banks has increased from 5,841 rupees to 30,538 rupees, whereas the amount of finance increased from 14,516 rupees to 271,670 rupees in the referred period. The total direct and indirect advances to agriculture outstanding by scheduled commercial banks have shown a gradual increase from 59,310 rupees to 583,343 rupees during the reference period. Awe (2013) examines the mobilization of domestic financial resources for agricultural productivity in Nigeria with a view to

identifying the contributions of the various sources of finance to agricultural productivity in Nigeria.

To achieve this objective, the paper employed a vector autoregressive model (VAR) to analyse time series data from 1980–2009. The study identified the various instruments and strategies used by the government for mobilizing resources for the agricultural sector in Nigeria, including subsidy and agricultural credit policies that were financed through the Nigerian Agricultural Cooperative Bank (NACB), check the correct name and abbreviation, and credit facilities from the Nigerian Bank for commerce and industries at the state level. The OLS (VAR) result revealed positive relationships between agricultural financing and agricultural productivity, and the variance decomposition measure measures the proportion of forecast error. Most governments have constantly emphasized that agricultural credit is highly important and necessary. All past federal governments have come up with their own version of support services. In this regard, the government of Nigeria has introduced schemes, programmes, and institutions aimed at boosting agricultural production among rural dwellers for economic development. These measures could not achieve the intended objectives because agriculture, being a labor-intensive and capital-intensive venture, requires adequate financing. The study is challenged by the problem of ascertaining agricultural financing in Nigeria and its implications for agricultural productivity.

However, it is equally acknowledged by Ijera (1985) that the finance to accomplish this is beyond the search of most farmers, which gives a clear justification for agriculture credit.

Materials and Methods

Study Area

The study covered the contribution of cooperative society, crop farmers in thousands, the single live-stock farmers and farmer's contribution into the growth rate of the agricultural productivity of CBN Lagos State.

Data and Study Population

Secondary data was obtained on the Agricultural contribution to the GDP as dependent variable (y_i), while data on cooperative society, crop farmers, single livestock farmers and farmer's contributions as independent variables (x_i) from CBN office Lagos State.

Hypotheses of the Research

Hypothesis one

H₀₁: There is no significant linear relationship between the central bank loan guidelines and agricultural output.

H₁₁: There is significant linear relationship between the central bank loan guidelines and agricultural output.

Hypothesis two

H₀₂: There is no significant relationship between agricultural loans and farming activities.

H₁₂: There is significant relationship between agricultural loans and farming activities.

Analysis of Variance

ANOVA (i.e Analysis of variance) is used to evaluate the difference in averages measured on a continuous scale among one or more characteristics defined by the categories. In this research, contributions of four different characteristics are considered in relation to agricultural productivity. They are (cooperative society, farmer's contribution, single livestock farmers and crop farmers).

Regression Analysis

The Multiple regression method of analysis is adopted here since the yearly GDP stands as dependent variable (y_i) while the farmer contribution, cooperative society, single live-stock farmers and crop farmers are the independent variables (i.e x_1, x_2, x_3 and x_4 respectively)

The model for the regression line of best fit is;

$$y_i = \beta_0 + \beta_1x_1 + \beta_2x_2 + \beta_3x_3 + \beta_4x_4 + e_{ij}$$

$$\text{Or } GR = \beta_0 + \beta_1CONT + \beta_2CS + \beta_3SLSF + \beta_4CF + e_{ij} \dots\dots\dots(i)$$

y_i = Growth rate

x_1 = Farmers contribution value to growth rate

x_2 = Cooperative society contribution to growth rate

x_3 = Single livestock farmer contribution to growth rate

x_4 = Crop farmer’s contribution to growth rate

e_{ij} = random error effects

A typical equations of the general linear regression model can be written as

$$y_i = \beta_0 + \beta_1x_{1i} + \beta_2x_{2i} + \dots + \beta_Tx_{mi} + U_i$$

$$Y = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_0 \end{bmatrix} \dots\dots\dots(ii) \quad X = \begin{bmatrix} x_{11} & x_{11} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & \vdots \\ \vdots & \vdots & \dots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \dots\dots\dots(iii) \quad B$$

$$= \begin{bmatrix} \beta_0 \\ \beta_1 \\ \vdots \\ \beta_T \end{bmatrix} \dots\dots\dots(iv)$$

For the parameters of the model to be estimable, the following assumptions are made

- (I) $E(U) = 0$
- (II) $E(U^2) = \sigma^2$
- (b) $E(U_iU_j) = 0 \quad (\forall i \neq j)$
- (III) X is a set of fixed constants for any sample
- (IV) X has full rank i.e $r(X) = k$

The mean of \hat{B}

$$\hat{b} = (X^T X)^{-1} X^T Y \dots\dots\dots(v) \text{ for all other apart from } B_0 = \hat{b}_0$$

$$\hat{b}_0 = \frac{1}{T} (\sum Y - \hat{b}_1 \sum X_1 - \hat{b}_2 \sum X_2 + \dots + \hat{b}_k \sum X_k) \dots\dots\dots(vi)$$

$$X_i X_j = \sum X_i X_j - \frac{x_i x_j}{T} \dots\dots\dots(vii)$$

Variance of \hat{b}

$$\text{Var}(\hat{b}) = \widehat{\sigma^2} (X^T X)^{-1} \dots\dots\dots(viii)$$

Error sum of square

$$\widehat{\sigma^2} = \widehat{s} = \frac{Y^T Y - b^T X^T Y}{T - K - 1} \dots\dots\dots(ix)$$

Co-efficient of determination (R²)

$$r^2 = \frac{\sum(y_i - \widehat{y})^2}{\sum(y - \bar{y})^2} \rightarrow \frac{\sum(y_i - \bar{y})^2 - \sum e_i^2}{\sum(y_i - \bar{y})^2} \dots\dots\dots(x)$$

Or

$$R^2 = 1 - \frac{\sum e_i^2}{\sum(y_i - \bar{y})^2}$$

Statistical Inference on b

Recall that $b = B + ((X^T X)^{-1} X^T U$, using $E(B) = \widehat{b}$. In carrying out Statistical Inference on b, we used (in addition to the earlier assumptions) to assume that the vector U is normally distributed with mean (0) and variance $\widehat{\sigma^2}$ i.e $U \cong (0, \sigma^2 I)$

Test for single coefficient (b_i)

Recall that $b = B + (X^T X)^{-1} X^T U \dots\dots\dots (xi)$

using $E(B) = \widehat{b}$. U is normally distributed \rightarrow b is normally distributed. Since $(X^T X)^{-1} X$ is a linear combination of U.

Recall that $E(b) = B$ and $Var(\widehat{b}) = \widehat{\sigma^2} (X^T X)^{-1}$

$$\therefore b \cong N[B, \widehat{\sigma^2} (X^T X)^{-1}]$$

$$\rightarrow \frac{b_i - B_i}{\sigma_{bi}} \dots\dots\dots (xii)$$

Where $\sigma_{bi} =$ *ith diagonal element of $\widehat{\sigma^2} (X^T X)^{-1}$*

$b_i =$ co-efficient of x_i in the diagonal regression hyper plane

Recall that we could only obtain the estimate s^2 of σ^2

\therefore in place of normal distribution in (1)above therefore we can only use the t – test

$$\frac{b_i - B_i}{s_{bi}} \cong t_{\alpha/2(T-K-1)} \dots\dots\dots (xiii)$$

Joint test for vector B

In testing for significance of the entire co-efficient B i.e $B_1=B_2=B_3=B_4=\dots\dots=B_K=0$, The test statistics is $(\frac{(b^T X^T Y^T)/(k+1)}{\frac{\sum e_i^2}{T-K-1}}) = F_{\alpha(K+1),(T-K-1)} \dots\dots\dots (xiv)$

The estimate s² of the error sum of square

$$\sigma^2 = s^2 = \frac{\sum e_i^2}{T-K-1} \dots\dots\dots(xv)$$

The Autocorrelation co-efficient method

Large autocorrelation co-efficient between the residual U_t may be an indication of autocorrelation. The Autocorrelation coefficient ρ can be linked to the product moment correlation co-efficient (r). Recall that the product moment correlation co-efficient between U_t is defined as

$$r = \frac{\sum_2^n U_t U_{t-1}}{\sum_2^n U^2_{t-1}} \dots\dots\dots (xvi)$$

On the other hand, the auto-correlation co-efficient (ρ) between U_t and U_{t-1} is defined as

$$\rho = \frac{\sum_2^n U_t U_{t-1}}{\sum_2^n U^2_{t-1}} \dots\dots\dots (xvii)$$

Observe that;

Interpretations

- (a) $-1 \leq \rho \leq 1$
- (b) Autocorrelation is perfect and positive when $\rho = 1$
- (c) Autocorrelation is perfect and negative when $\rho = -1$
- (d) Autocorrelation does not exist when $\rho = 0$
- (e) The closer ρ is to -1 or 1, the higher is the degree of auto correlation
- (f) The closer ρ is to zero, the smaller is the degree of autocorrelation

Durbin Watson Co-efficient

This is another method of electing autocorrelation. The method is valid only if the following conditions are satisfied:

- (i) The data is time series type
- (ii) Autocorrelation is of the first order
- (iii) There is a constant term in the regression equation
- (iv) The regression equation does not include lagged values of the dependent variables
- (v) The sample size is small

∴ Durbin Watson Statistics (d) is defined as $D = \frac{\sum_2^n (U_t - U_{t-1})^2}{\sum_2^n U^2_t} \dots\dots\dots (xviii)$

INTERPRETATIONS

- (i) If $\rho = 0$ or $d = 2$, there is no autocorrelation
- (ii) If $\rho = 1$ or $d = 0$, there is autocorrelation
- (iii) If $0 < \rho < 1$ or $0 < d < 2$, there is a level of positive autocorrelation
- (iv) If $\rho = -1$ or $d = 4$, there is a perfect and negative autocorrelation
- (v) if $-1 < \rho < 0$ or $2 < d < 4$, there is a level of negative autocorrelation

DATA ANALYSIS

Decision Rule of Hypothesis Test:

If Probability Value denoted as (sig. or p-value) is less than level of significance (α), the null hypothesis H_0 will be rejected and test will be significant but if otherwise, vice versa.

Decision Rule of Correlation:

- 1) If $0.5 \leq r < 1$, there will be a strong positive correlation.
- 2) If $0.0 \leq r < 0.5$, there will be a weak positive correlation.

- 3) If $-0.5 < r \leq 0.0$, there will be a weak negative correlation.
- 4) If $-1.0 < r \leq -0.5$, there will be a strong negative correlation.

Time Plot of Variables of Interest

The time plots of all the variables that are of interest in the research work are presented in the below figures 4.1 to 4.4. It shows that the variables considered have an upward trend and fluctuation mode over the period of interest in the study. This implies that the variables fluctuated over the period except one (the exchange rate) that maintained increment.

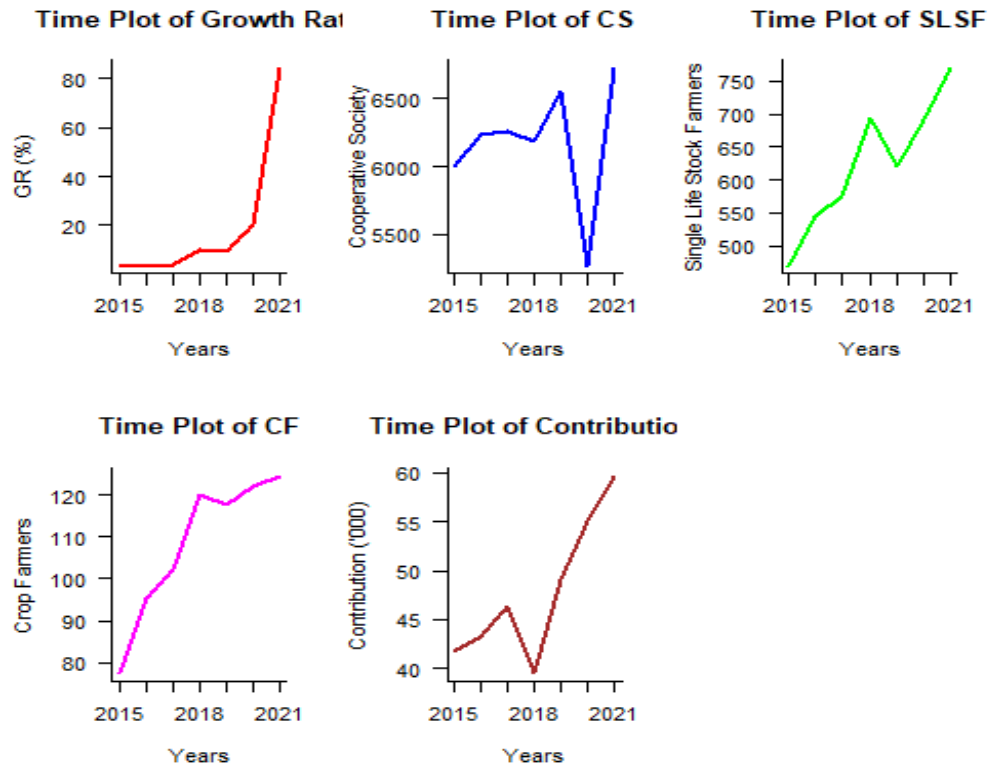


Figure 1: Time Plot of the Variables

From the figures above, it is shown that the GR (Growth Rate) maintained steady growth from the start years before the excessive increment in 2020 up-to 2021. The aggregate loans from crop farmers (CF) maintained increment from 2015 to 2021 but just reduced in the year 2020. The aggregate loans from single life stock farmers (SF) and cooperative society (CS) maintained fluctuation trend but drastically fell around year 2020 for 2018. The farm contribution in thousands (Cont) also fluctuated significantly from 2015 to 2021.

Descriptive Statistics of Variables

The summary of the descriptive statistics of the variables in this research work is presented in the table below, whereby skewness is an indicator of the asymmetry or deviation of the variables from a normal distribution with an expected value of zero, and kurtosis defines the degree of flattening or peakedness of a distribution with an expected value of three.

Table 1: Descriptive statistics of the Variables of Interest (2015 – 2021)

| Statistics | GR (%) | CS | SLSF | CF | CONT ('000) |
|------------|----------|----------|----------|----------|-------------|
| Mean | 19.47143 | 8515669. | 19.74410 | 18.53133 | 47.77 |
| Maximum | 84 | 6720 | 769 | 124.5 | 59.7 |
| Minimum | 3.6 | 5272 | 470 | 77.5 | 39.5 |

| | | | | | |
|-----------|----------|----------|----------|----------|-------|
| Std. Dev. | 29.02893 | 464.9222 | 102.5157 | 17.44724 | 7.352 |
| Skewness | 1.884 | -0.928 | -0.086 | -0.783 | 0.538 |
| Kurtosis | 4.798 | 3.212 | 1.929 | 2.250 | 1.959 |

The variables GR and CONT have a skewness greater than zero (Positively skewed) while CS, SLSF and CF possessed skewness lesser than zero (Negatively skewed), kurtosis value of only GR is greater than three (3) which shows the leptokurtic in nature of the data, while SLSF, CF and CONT are lesser than three (3) which is platykurtic and only CS possessed the condition of mesokurtic with the value of 3.

Regression Analysis

This section deals with multiple linear regression of four explanatory variables (independent) and one response variable (dependent). It gives the model diagnostic as well at 5% level of significance in terms of individual tests (t-tests) and overall test (F-test).

Multiple Linear Regression Analysis

Table 2 shown below contains multivariate regression results for the growth rate model. The results indicate that the coefficients of CONT, SLSF and CF together with constant are statistically significant, only that of CS is statistically insignificant.

Table 2: Multivariate Regression Model

| Dependent Variable: GR | | | | | |
|--|-------------|------------|-------------|---------|----------|
| $GR = \beta_0 + \beta_1 CONT + \beta_2 CS + \beta_3 SLSF + \beta_4 CF + \varepsilon$ | | | | | |
| Explanatory variables | Coefficient | Std. Error | t-Statistic | P-value | Remark |
| Intercept | -228.587 | 27.687 | -8.256 | 0.014 | Sig. |
| CONT | 2.028 | 0.340 | 5.959 | 0.027 | Sig. |
| CS | 0.017 | 0.004 | 4.198 | 0.052 | Not Sig. |
| SLSF | 0.454 | 0.061 | 7.454 | 0.018 | Sig. |
| CF | -2.185 | 0.333 | -6.560 | 0.022 | Sig. |

The coefficients of farmers' contribution (CONT) and single life stock farmers (SLSF) are found to be statistically significant at the 5 percent level, as indicated by their probability values of 0.027 and 0.018, which are rightly signed (positive). The coefficient of crop farmers (CF) is also found to be statistically significant at the 5 percent level, as indicated by its probability values of 0.022, but is lefty-signed (negative). Lastly, the coefficient of cooperative society (CS) is also found to be statistically insignificant at the 5 percent level, as indicated by its probability value of 0.052, which is rightly signed (positive).

This, implies that the increase in farmers' contribution (CONT) raises the growth rate (GR) by 2.028; 1.7% increase in cooperative society (CS) raises the growth rate; 45.4% increase in single life stock farmers (SLSF) raises the growth rate and the increase in crop farmers (CF) reduces the growth rate (GR) by 2.185.

Model Diagnostics

The F-statistics 60.444, which is a measure of the joint significance of the explanatory variables, is found to be statistically significant at 5 percent level as indicated by the corresponding probability value 0.016.

Table 3: Model Diagnostics

| | |
|--------------------|-------|
| R-squared | 0.996 |
| Adjusted R-squared | 0.992 |

| | |
|--------------------|--------|
| F-statistic | 60.444 |
| Prob (F-statistic) | 0.016 |
| Durbin- Watson | 1.878 |

The $R^2 = 0.996$ (99.6%) implies that 99.6 percent total variation in the GR is explained by the explanatory variables in the regression equation. Coincidentally, the goodness of fit of the regression remained high after adjusting for the degree of freedom as indicated by the adjusted R^2 (Adj. $R^2 = 0.992$ or 99.2%). After observing the Durbin-Watson statistic 1.878 to be higher than R^2 (0.996) indicating that the model is non-spurious (meaningful), so the need for a unit root test became unnecessary.

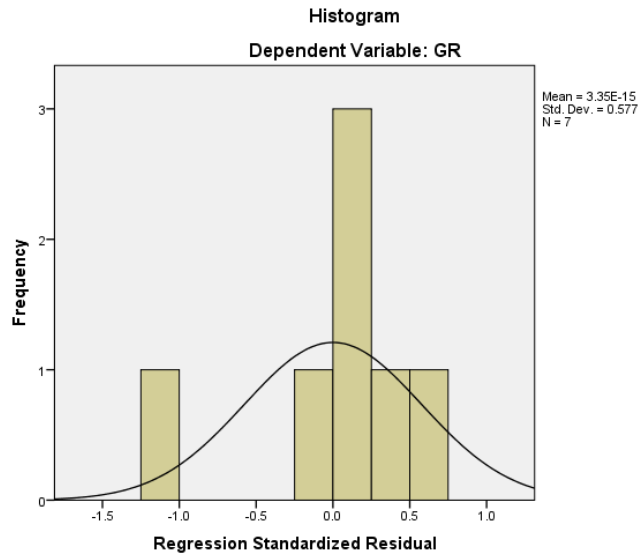


Figure 2: Histogram of Regression Analysis

Hypotheses Testing and Interpretations

1. Hypothesis One

H_0 : There is no significant linear relationship between the central bank guidelines and agricultural output.

H_1 : There is a significant linear relationship between the central bank guidelines and agricultural output.

$\alpha = 5\% = 0.05$

Table 4: Significance of Central Bank Guidelines and Agricultural Output

| Model | Sum of Squares | df | Mean Square | F | Sig. | r-value | R^2 |
|------------|----------------|----|-------------|-------|-------|---------|-------|
| Regression | 3245.521 | 1 | 3245.521 | 8.963 | 0.030 | 0.801 | 0.642 |
| Residual | 1810.553 | 5 | 362.111 | | | | |
| Total | 5056.074 | 6 | | | | | |

It is observed from the above table that the probability value is lesser than the level of significance i.e. $\text{sig.} < \alpha$ ($0.030 < 0.05$) which indicates that there is enough evidence to reject the null hypothesis leading to the conclusion of statistical significance and thereby conclude that there is significant linear relationship between the central bank guidelines and agricultural output.

The result implies that the central bank guidelines is significantly influenced by agricultural output with even positive relationship of 0.801 value and that the $R^2 = 0.642$ (64.2%) shows that 64 percent total variation in the central bank guidelines is explained by the agricultural output in the regression equation $Y_i = \beta_0 + \beta_1 X_i$.

2. Hypothesis Two

H_0 : There is no significant relationship between agricultural loans and farming activities.

H_1 : There is a significant relationship between agricultural loans and farming activities.

$\alpha = 5\% = 0.05$

Table 5: Significance of Agricultural Loans and Farming Activities.

| Model | df | SS | MS | F-value | Sig. | r-value | R^2 |
|------------|----|----------|----------|----------|----------|---------|-------|
| Regression | 1 | 3525.654 | 3525.654 | 11.51858 | 0.019379 | 0.835 | 0.697 |
| Residual | 5 | 1530.42 | 306.0841 | | | | |
| Total | 6 | 5056.074 | | | | | |

It is revealed from the above table that the probability value is lesser than the level of significance i.e. sig. $< \alpha$ ($0.019 < 0.05$) which indicates that there is enough evidence to reject the null hypothesis leading to the conclusion of statistically significance and thereby conclude that agricultural loans has a significant impact on farming activities at 5% level of significance.

The result implies that farming activities is significantly influenced by the agricultural loans with positive relationship of 0.835 value; also, the $R^2 = 0.697$ (69.7%) implies that 70 percent total variation in the farming activities is explained by the agricultural loans in the regression equation $Y_i = \beta_0 + \beta_1 X_i$

Correlation and its Significance

Correlation shows or gives the extent or degree of association that exist between one dependent (Y) and one or more independent variables (X's) in terms of positive or negative; weak or strong or perfect.

Table 6: Correlation Analysis of the Variables of Interest

| | | CONT | GR | CS | SLSF | CF |
|--|---------------------|-------|-------|------|--------|--------|
| CONT | Pearson Correlation | 1 | .801* | .052 | .663 | .601 |
| | Sig. (2-tailed) | | .030 | .911 | .105 | .154 |
| | N | 7 | 7 | 7 | 7 | 7 |
| GR | Pearson Correlation | .801* | 1 | .388 | .734 | .534 |
| | Sig. (2-tailed) | .030 | | .390 | .060 | .217 |
| | N | 7 | 7 | 7 | 7 | 7 |
| CS | Pearson Correlation | .052 | .388 | 1 | .125 | .085 |
| | Sig. (2-tailed) | .911 | .390 | | .790 | .856 |
| | N | 7 | 7 | 7 | 7 | 7 |
| SLSF | Pearson Correlation | .663 | .734 | .125 | 1 | .946** |
| | Sig. (2-tailed) | .105 | .060 | .790 | | .001 |
| | N | 7 | 7 | 7 | 7 | 7 |
| CF | Pearson Correlation | .601 | .534 | .085 | .946** | 1 |
| | Sig. (2-tailed) | .154 | .217 | .856 | .001 | |
| | N | 7 | 7 | 7 | 7 | 7 |
| *. Correlation is significant at the 0.05 level (2-tailed). | | | | | | |
| **. Correlation is significant at the 0.01 level (2-tailed). | | | | | | |

The table above indicated that significant relationship exists between the pair of all the variables of interest since they all possessed the p-values (sig.) that combined both lesser and greater than the level of significance (α) with the combination of relationship degree of weak positive (GR and CS) and strong positive (GR and CONT, SLSF, CF) at 5% level of significance.

Tests for Autocorrelation

The Durbin Watson test statistics will be used to test for the presence of autocorrelation. If d is less than 2 (Positive Autocorrelation) and if d is greater than 2 (Negative Autocorrelation).

Since the d (1.29) < 2 , the hypothesis is given thus because positive autocorrelation is to be tested from $d=2(1-\rho)$.

H_0 : There is no positive first order autocorrelation.

H_1 : There is a positive first order autocorrelation.

$\alpha = 5\% = 0.05$

Table 7: Analysis of Autocorrelation

| Model | Change Statistics | | | | | Durbin-Watson |
|---|-------------------|----------|-----|-----|---------------|---------------|
| | R Square Change | F Change | df1 | df2 | Sig. F Change | |
| 1 | .992 ^a | 60.444 | 4 | 2 | .016 | 1.878 |
| a. Predictors: (Constant), CF, CS, Cont, SLSF | | | | | | |
| b. Dependent Variable: GR | | | | | | |

Since the p -value $< \alpha$ ($0.016 < 0.05$), there is enough evidence to reject the null hypothesis and therefore concluded that there is a positive first order autocorrelation between the dependent variable (GR) and independent variables (CONT, CS, SLSF and CF).

SUMMARY:

The above table displays the statistics of the variables in the research work, revealing values of zero for skewness and three for kurtosis. The time plots of all the variables that are of interest in the research showed an upward trend and fluctuation mode over the period of interest in the study. This suggests that all the variables, including the exchange rate, fluctuated and maintained an increase. From the figure shown above, the GR (i.e., growth rate) maintained steady growth from the starting years before the excessive increment in 2020 up to 2021. The aggregate loans from crop farmers (CF), single-livestock farmers (SLSF), and cooperative societies (CS) maintained a fluctuating trend, but drastically fell in 2020 compared to 2018. The farmer's contribution in dollars (CONT.) also fluctuated significantly between 2015 and 2021. There was an increase in farmer's contribution in thousand (CONT.), which raised the growth rate (GR) by 2.028; a 1.7% increase in co-operative society (CS) raised the growth rate; a 45.4% increase in single life stock farmers (SLSF) raised the growth rate; and an increase in crop farmers (CF) reduced the growth rate by 2.185. The regression equation's explanatory variables explain 99.2% of the total variation in the GR, as indicated by the R^2 (adj.) = 0.992 (i.e., 99.2%)..

Interestingly, the regression equation's goodness of fit stayed high after adjusting for the degree of freedom, as shown by adjusted $R^2 = 0.992$, or 99.2%. This was confirmed by the Durbin-Watson statistic, 1.878, being higher than $R^2 = 0.996$, which means the model is not spurious (meaningful), so there was no need for a unit-root test.

CONCLUSION:

The research analysis revealed sufficient evidence to reject the null hypothesis, leading to the conclusion of a significant linear relationship between the CBN loan guidelines and agricultural

productivity. We also concluded that the growth rate and all other considered independent variables (i.e., CONT, CS, SLSF, and CF) have a positive linear relationship.

RECOMMENDATIONS:

- Loans should be given to farmers at the appropriate time, particularly the small-scale farmers who make-up the greater farmers population.
- More effort should be made to include the youth in to small and medium scale farming, if the large-scale farming is not feasible for now.
- Financial institutions should be more accessible to farmers most of whom are illiterate who can easily be intimidated by office-procedure with its characterized bureaucracy.
- Still penalty should be placed on lending guidelines, for defaulting financial institutions so as to ensure perfect disbursement of loans to agricultural sectors.
- More serious attention should be given to the issue of Nigeria agricultural insurance scheme to help most farmers out of problems of inadequate collateral
- Agreed very affordable interest rate be given to agriculture. This will enable farmers to obtain cheap loans to agricultural productivity

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