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EFFECTS OF COMMERCIAL BANKS' CREDIT ON AGRICULTURAL OUTPUT GROWTH IN NIGERIA (1980-2022)

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Abstract: The study investigates the influence of commercial bank loans on the growth of Nigeria's agricultural output from 1980 to 2020, utilizing annual time series data obtained from the Central Bank of Nigeria (CBN) and FAO Statistics (FAOSTAT). The data analysis involved descriptive statistics including average growth rates, means, standard deviation, coefficients of variation, and percentages. To assess the stationarity of the time series data, the Augmented Dickey-Fuller statistics were applied, while Johansen's method helped confirm co-integration among variables. The study employed the vector auto regression (VAR) method to explore the relationship between bank loans and agricultural output. Throughout the period, both agricultural output and commercial bank credit exhibited fluctuations, largely influenced by public spending trends. The VAR analysis revealed that public spending positively impacts agricultural output, while the interest rate on agricultural loans and bank lending to the agriculture sector show a one-year lag effect.
Collectively, the findings suggest that enhancing budgetary allocations and increasing commercial banks' lending to agriculture can significantly promote agricultural productivity in Nigeria.

Key words*: Agricultural output, Agricultural sector, Agricultural spending, Co-integration analysis, Vector auto regression, Nigeria*

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INTRODUCTION

Agriculture's contribution to human development cannot be overstated. It is the main occupation of the working population, particularly in agrarian countries; it is an essential part of the people's way of life, culture, and customs; and it includes providing the basic food needs of human populations [1].. The most important economic sector in Nigeria is agriculture. Most rural households in the nation rely on it for their livelihoods due to its economic activity [2]. According to [3], the sector is extremely advantageous to the economy because it creates jobs and food, contributes significantly to the GDP, supplies raw materials for related agricultural sectors, and produces agricultural export commodities that provide foreign exchange profits. Historically, commercial banks have been crucial to the financing of agriculture. Commercial banks are interested in lending money to their large client base while keeping in mind the three guiding principles of profitability, liquidity, and solvency. Nonetheless, a number of elements, including the current interest rate, deposit volume, amount of domestic and international investment, bank liquidity ratio, prestige, and public recognition, are taken into consideration when a commercial bank decides whether to make a loan [4]. The inability to obtain financing from commercial banks to enable them to take advantage of economic possibilities to raise their level of output and escape poverty is one of the factors contributing to the decline in the agricultural sector's share of GDP. For many years, rural residents and impoverished farmers have been hampered by credit constraints, which were once considered to be an essential component of a set of inputs required to increase agricultural output. The majority of farmers do not have access to formal loans, which has remained a barrier to their adoption of agricultural innovations and productivity gains.

Despite the significance of finance in agricultural output, there are several issues with both obtaining and repaying it. Institutional issues have not been sufficiently addressed, such as the lending requirements that restrict investors' access to credit facilities. Farmers' capacity to obtain the best possible loan is influenced by a wide range of socioeconomic conditions. These variables include the geography, the age of the farmers, the high interest rate that financial institutions demand, and the danger of loan default [5]. One of the biggest obstacles to the agriculture sector's contribution, according to [6], is funding. Since agricultural credit is a crucial component of agricultural modernization and the commercialization of the rural economy, policy concerns for agricultural productivity have been hampered by the shortage of credit supply and declining government spending on agriculture. Introducing simple and affordable finance is the fastest approach to increase agricultural output. Consequently, meeting the credit needs of the farming community has emerged as the top priority for every succeeding administration [7].

Farmers' access to credit for agricultural investment, which is crucial, is restricted, despite the fact that successive governments have launched and implemented a number of programs to address the issue of agricultural output not being able to meet the nation's demand for agricultural products because of credit shortages [8].

[9] state that it is well established that sufficient funding is necessary for every industry to develop successfully. In order for the economy's agriculture sector to grow, credit is crucial.

The agriculture industry is more reliant on credit than any other sector of the economy because of the seasonal fluctuations in farmer returns and the shift from subsistence to commercial farming [10].

Appropriate financial policies and supportive institutional financing for both commercial and subsistence farming have the potential to boost agricultural development, which will raise the sector's employment and foreign exchange earnings as well as the income of economic actors involved in agricultural activities [11].

The National Accelerated Food Production Program, which was established in 1972, the Agricultural Development Program, which was established in 1975, and Operation Feed the Nation, which was established in 1976, are just a few of the early agricultural policies that the government has established and implemented since the 1970s. Many of these policies were short-lived and failed to meet their goals. Inadequate funding has been found to be a significant barrier to the agricultural sector's growth in the majority of developing nations, including Nigeria [12]. The sector has been clearly characterized by the employment of antiquated and primitive tools as well as inadequate agricultural infrastructure, including inadequate transportation facilities. These terrible traits are thought to be caused by a lack of funding for the purchase of new and improved farming equipment, innovative farming techniques, and enhanced infrastructure. A system of sustainable agricultural financing schemes, programs, and institutions that can offer credit facilities to agricultural producers, processors, and marketers at all levels is what the government has been aiming for since the 1970s because it recognizes this limitation [13]. Despite the implementation of many policies and plans by the government and other institutions to expand the framework of sustainable growth, the agriculture sector continues to operate below ideal levels [14] and [15].

Therefore, from 1980 to 2022, the study looked at how Nigerian agricultural output growth was impacted by commercial banks' lending. The study's primary goal is to investigate how Nigerian agricultural output growth is impacted by commercial banks' loans between 1980 and 2022. The study specifically looks at the trends in government spending, agricultural output growth, and commercial bank credit to the agricultural sector. It also figures out how commercial bank credit affected Nigeria's agricultural output growth from 1980 to 2022.

MATERIAL AND METHODS

Study area

The study was conducted in Nigeria, one of Africa's largest nations, which is located entirely in the tropics along the Gulf of Guinea on the continent's western coast. Between latitudes 4° 16'N and 13° 52' N and longitudes 2° 49' E and 14° 37' E is where Nigeria is located. As of 2016, its estimated population was approximately 170 million, and its total land area was 923,768, 622 km2 (NPC, 2016). The climate is tropical, with high temperatures and humidity as well as distinct wet and dry seasons, notwithstanding the contrasts between the North and the South.

Rainfall overall declines northward from the shore. Rainfall in the extreme north ranges from 500 to 1000 mm per year, whereas in the south, below Latitude 8° N, it ranges from 1,500 to 4,000 mm. In Nigeria, food production is essentially dependent on rainfall. According to Oladimeji and Abdulsalam (2014), Nigeria's irrigated land as a percentage of its total agricultural area is projected to be at 2%, which is less than the average of just 6% for Africa, 37% for Asia, and 14% for Latin America.

Data collection

This study's data came from annual time series. The Central Bank of Nigeria (CBN) publications and the Food and Agriculture Organization (FAO) Statistics (FAOSTAT) were among the secondary sources from which the data sample was gathered. The study specifically gathered information on government spending, interest rates, agricultural credit, agricultural output, and commercial banks' lending to the agricultural sector interest rates expressed as percentages, agricultural credit expressed in billions of Naira, government spending expressed in billions of Naira, and agricultural output growth expressed as percentage changes are the study's independent variables. The study's dependent variable is agricultural output growth, which is defined as the annual increase in output from different agricultural sub-sectors valued in monetary terms.

Data analysis

Several analytical techniques were used in this study, depending on the previously mentioned goals of the study. These consist of average growth rate, means, standard deviation, coefficients of variation, and percentages. These were utilized to explain Nigerian government spending patterns, commercial bank lending to the agricultural sector, and trends in agricultural output growth. The stationarity of time series data was confirmed using Augmented Dickey-Fuller statistics. The co-integration of the model's variables was confirmed using Johansen's approach. The effects of commercial banks' loans on the increase of the agriculture sector's output between 1980 and 2020 were assessed using the Vector Auto Regression Model (VAR). Following, [16], the explicit model that will be used in this study is given as:

$$\ln Y_t=\alpha_1+\alpha_2\ln Y_{t-1}+\alpha_3\ln X_{2t-1}+\alpha_4\ln X_{3t-1}+\alpha_5\ln X_{4t-1}\ u_{t1} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where:
Y is the agricultural output growth
X_1 is the government expenditure in billions Naira
X_2 is agricultural credit in billions Naira
X_3 is the commercial banks; lending to agricultural sector in billion Naira
X_4 is the interest rate in the economy measured in percentage.
Ln is the logarithm operator
U_{ts} are stochastic random errors
$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6,$ and λ_1 are parameters to be estimated

The statistical tools (means, standard deviation, coefficients of variation, percentages and average growth rate, Augmented Dickey-Fuller statistics, Johansen's co-integration method, and Error Correction Model) used in this study are justified based on the fact that the study utilised time series data and these tools have been proved in the literature to yield robust estimates from time series data which can be used for policy formulation and forecasting.

RESULTS AND DISCUSSION

Trend in agricultural output in Nigeria (tonnes) (1980-2020)

Table 1 presents a comprehensive overview of Nigeria's agricultural production trends from 1980 to 2022, highlighting a consistent increase in agricultural output throughout this period. The average annual agricultural production was recorded at 8032.01 tons. Notably, the annual percentage change in output was marked by substantial fluctuations, varying between a high of 154.71 percent and a low of 34.03 percent, culminating in an average change of 639.71 percent. Additionally, the coefficient of variation for the entire study period stood at an average of 67.99 percent, illustrating a considerable degree of volatility in agricultural production, with variations ranging from 10.18 percent to 36.23 percent.

Table 1. Trend in agricultural output (tonnes) in Nigeria (1980-2022)

Sub period	Average annual output growth (tonnes)	Annual percentage change	Coefficients of Variation (%)
1980-1989	2697.74	40.669	36.23
1990-1999	3989.92	35.758	10.18
2000-2009	8960.88	154.71	28.47
2010-2022	15711.54	34.03	10.88
All period	8032.01	639.71	67.99

Source: CBN and FAOSTAT, 2024.

Trend in commercial banks' (₦ billions) credit to agriculture in Nigeria (1980-2022)

Table 2 shows the trend of commercial bank lending to the agricultural sector from 1980 to 2022, highlighting an average lending of 133.91 billion annually across the study period. Notably, there was a consistent increase in lending, with an annual change averaging 127.06 percent. This growth varied significantly within sub-periods: it recorded a low of 29.59 percent from 2010 to 2022, while reaching a high of 77.50 percent during 1980-1989. Additionally, the coefficient of variation indicates substantial fluctuation in commercial bank credit within the agricultural sector, ranging from 30.07 percent in the recent sub-period (2010-2022) to a striking 69.29 percent in the earlier one (1980-1989), with an overall average of 138.35 percent throughout the study duration.

Table 2. Trend in commercial banks' (₦ billions) credit to agriculture in Nigeria (1980-2022)

Sub periods	Average commercial banks' (₦ billions)	Annual percentage change	Coefficients of Variation (%)
1980-1989	1.59	77.50	67.29
1990-1999	18.95	63.81	61.11
2000-2009	77.61	23.99	49.35
2010-2022	409.90	29.59	30.07
All period	133.91	127.06	138.34

Source: CBN and FAOSTAT, 2024.

Trends in public expenditure in Nigeria (1980-2022).

Table 3 shows public spending trends over the study period, showcasing a significant increase in average annual public expenditure across different periods. From 1980 to 1989, the average annual public spending was recorded at 17.34 million USD, which escalated dramatically in subsequent decades. In the periods of 1990-1999, 2000-2009, and 2010-2022, public spending rose to 302.08 million USD, 1829.42 million USD, and peaked at 9276.47 million USD, respectively. Notably, the average public spending across the entire study period amounted to 2856.33 million USD.

The data reveals substantial growth rates within each sub-period: 291.51 percent for 1980-1989, 93.64 percent for 1990-1999, 79.70 percent for 2000-2009, and 77.18 percent for 2010-2022, highlighting a trend of increasing expenditure. The overall average annual growth rate for public spending during the study was notably high at 99.94 percent. Furthermore, the coefficients of variation for public spending indicated considerable variability, ranging from 169.99 percent to 170.64 percent, with an average of 61.42 percent throughout the studied period, underscoring the stability of public funding growth. Overall, the findings conclude that public spending has generally increased at an accelerating rate, reflecting ongoing investment trends over the decades.

Table 3. Trend in public expenditure in Nigeria (1980-2022)

Sub-periods	Average public expenditure (‘000 USD) per annum	Annual Percent growth	Coefficients of variation (%)
1980-89	17.34	291.51	169.99
1990-99	302.08	93.64	111.47
2000-09	1829.42	79.70	192.33
2010-2022	9276.47	77.18	170.64
All Period	2856.33	99.94	61.42

Source: Computed from CBN and FAOSTAT, 2024

Unit root test

The analysis presented in Tables 4 and 5 explores the results of unit tests on the variables of a model using the Augmented Dickey-Fuller (ADF) technique. In time series analysis, it is crucial to evaluate whether the variables are stationary or contain a unit root. This examination operates under the premise that non-stationary data cannot be utilized in regression analysis due to the potential for false or spurious results. The ADF test assesses both original and first difference values of the model's variables.

According to the methodology of ADF, if the absolute values of ADF statistics fall below the critical values at the 1%, 5%, and 10% significance levels, the null hypothesis—which posits the presence of a unit root cannot be rejected. Conversely, should the ADF statistics exceed these critical thresholds, especially at the 5% level, it indicates that the null hypothesis can be rejected; thus, the time series data is confirmed as stationary and suitable for regression analysis.

The results presented in Table 4 affirm that the absolute values of the ADF statistics for the original values of the variables are all lower than the critical values, indicating the presence of a unit root, thereby rendering these original values unsuitable for regression analysis.

In contrast, Table 5 displays results from the first difference values, where the absolute values of the ADF statistics rise above the critical values at the 5% level, signifying the absence of a unit root. As a result, the first difference values of the variables are deemed appropriate for statistical regression analysis.

Table 4. Result of ADF unit root for variables of the model (original values)

Variables	Test statistics (ADF)	1% critical value	5% critical value	10% critical value	Decision
Y	-0.341	-3.655	-2.961	2.613	Non-stationary
X_1	-1.700	-3.655	-2.961	2.613	Non-stationary
X_2	-1.706	-3.655	-2.961	2.613	Non-stationary
X_3	-1.784	-3.655	-2.961	2.613	Non-stationary
X_4	-2.132	3.668	-2.966	2.616	Non-stationary

Source: Author Computation 2024.

Table 5. Result of ADF Unit root test for variables of the model (first difference values)

Variables	Test statistics (ADF)	1% critical value	5% critical value	10% critical value	Decision
Y	-3.190	-3.622	-2.964	-2.614	I(1)
X_1	-6.230	-3.622	-2.964	-2.614	I(1)
X_2	-4.529	-3.622	-2.964	-2.614	I(1)
X_3	-4.405	-3.622	-2.964	-2.614	I(1)
X_4	-5.267	-3.622	-2.964	-2.614	I(1)

Source: Author Computation 2024.

Lag length selection

In the context of developing a vector auto regression (VAR) or vector error correction (VEC) model, determining an appropriate lag length is crucial. Several criteria are typically utilized to ascertain this lag length, including the Akaike Information Criterion (AIC), the Han-Quick Criterion (HIC), and the Schwarz Bayesian Information Criterion (SBIC). According to the results shown in Table 6, which evaluate lag length selection based on the Final Prediction Error (FPE), AIC, HIC, and SBIC criteria, the analysis indicates that a lag length of 4 is optimal for both VAR and VEC models. This selection enhances the model's accuracy and reliability in capturing the data's temporal dependencies.

Table 6. Selection-order criteria for lag length of the variables of the model

Lag	LL	LR	Df	P	FPE	AIC	HOIC	SBIC
0	-1182.98				5.3e+21	64.2152	64.2919	64.4329
1	-1013.11	339.75	25	0.000	2.1e+18	56.3841	56.8446	57.6903
2	-975.569	75.074	25	0.000	1.2e+18	55.7064	56.5507	58.1011
3	-901.289	148.56	25	0.000	1.0e+17	53.0426	54.2706	56.5257
4	-805.342	191.89*	25	0.000	3.5e+15*	49.2077*	50.8194*	53.7792*

Endogenous: Y, $\ln X_1$, $\ln X_2$, $\ln X_3$, $\ln X_4$; Exogenous: _cons
Source: Author Computation 2024.

Co-integration test

The co-integration test plays a crucial role in time series analysis by identifying long-term relationships among the variables within a model. When establishing a Vector Error Correction Model (VECM), which accounts for both short-term and long-term relationships, it is essential that a long-term relationship exists among the variables. Conversely, if no long-term co-integration is found, a Vector Auto Regression Model (VAR), which focuses exclusively on short-term relationships, is appropriate. This study employs the Johansen co-integration procedures to determine the number of co-integration equations at a 5% significance level, assessing whether the trace statistic falls below the critical value. The study's findings, presented in Table 7, indicate that there are no co-integrating equations present, signifying an absence of long-term correlation among the model's variables. Thus, the VAR model is employed to analyze the short-term associations between these variables.

Table 7. Result of Johansen tests for co-integration among variables of the model

Rank	Panus	LL	Eigen value	Trace statistics	5% critical value
0	42	125.487		60.591	94.15*
1	53	153.390	0.774	51.505	68.52
2	62	163.331	0.416	31.623	47.21
3	69	169.219	0.273	19.848	29.68
4	74	174.398	0.244	9.490	15.41
5	77	177.554	0.157	3.178	3.76
6	78	179.143	0.082		

Source: Author Computation 2024.

Results of short run vector auto regression model (VAR) regression analysis

The analysis of the short-run VAR model yields several significant findings as presented in Table 8. The model's explanatory power is quantified by an R^2 coefficient of 0.671, indicating that the model accounts for 67.10 percent of the variability in the data. The Chi-square value, recorded at 60.733, is statistically significant at the 1% level, confirming that the model demonstrates a good fit. Key results reveal that government expenditure on agriculture and the credit extended by commercial banks to the agricultural sector, both lagged by one year, have positive influences on the agricultural output for the current year. Specifically, these relationships are statistically significant at the 1% level for government expenditure and at the 10% level for commercial banks' credit. Additionally, when evaluating the impact of interest rates, it is found that the coefficient for agricultural loans whose rates are delayed by two years is also positive and reaches statistical significance at the 5% level. This suggests that the current agricultural output is positively affected by loan interest rates from the agricultural loans two years prior. In conclusion, the findings indicate that the current agricultural output is positively correlated with past government expenditure, past commercial bank credit to agriculture, and the loan interest rates over the previous two years, highlighting the importance of these factors in agricultural performance in the short run.

Table 8. Short run vector error correction model regression analysis results

Variables	Coefficient	Stand. error	z value	p-value
LnX_1				
L1	83.625	22.689	3.69	0.001*
L2	-0.735	0.674	-1.09	0.275
Ln X_2				
L1	-32.033	32.964	-0.97	0.338
L2	-0.088	0.352	-0.25	0.804
Ln X_3				
L1	53.5547	34.225	1.56	0.127***
L2	-0.924	9.842	-0.09	0.926
Ln X_4				
L1	78.28184	62.497	1.25	0.219
L2	0.437	0.204	2.14	0.040**
Constant	2445.032	1144.167	2.14	0.040

R^2=0.671, Chi Square= 60.733 P=0.000*
*mean significant at 1% level
**mean significant at 1% level
***mean significant at 5% level
Source: Author Computation 2024

CONCLUSIONS

It is concluded from the findings of the study that government expenditure, commercial bank credits to agricultural sectors, and interest rates on agricultural credit are significant positive determinants of agricultural output growth in the economy, particularly in the short run. To enhance this growth, recommendations are made for increased budgetary allocations specifically aimed at agricultural expenditure, which would help stimulate agricultural output growth. Moreover, it is suggested that commercial banks should provide more favorable credit allocations to the agricultural sectors, offering agribusiness-friendly interest rates to support the farmers and boost overall productivity.

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EFEKTI KREDITA KOMERCIJALNIH BANAKA NA RAST POLJOPRIVREDNE PROIZVODNJE U NIGERIJI (1980–2022)

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Apstrakt: Rad istražuje uticaj kredita komercijalnih banaka na rast poljoprivredne proizvodnje u Nigeriji za period od 1980 do 2020 godine, koristeći godišnje vremenske serije podataka dobijene od Central Bank of Nigeria (CBN) i FAO, Odeljenje za statistiku (FAOSTAT).

Analiza podataka obuhvatila je primenu deskriptivne statistike, uključujući prosečne stope rasta, aritmetičke sredine, standardne devijacije, koeficijente varijacije i procente učešća. Za testiranje stacionarnosti (promena ili ne) vremenskih serija primenjen je Augmentir Dickey-Fuller test, dok je Johansen metoda korišćena za potvrdu kointegracije među varijablama.
U radu je primenjen model vektorske autoregresije (VAR) radi ispitivanja odnosa između bankarskih kredita i poljoprivredne proizvodnje.
Tokom posmatranog perioda, poljoprivredna proizvodnja i krediti komercijalnih banaka pokazivali su oscilacije, koje su u velikoj meri bile pod uticajem trendova javne potrošnje. Rezultati VAR analize ukazuju da javna potrošnja ima pozitivan uticaj na poljoprivrednu proizvodnju, dok kamatne stope na poljoprivredne kredite i bankarsko kreditiranje poljoprivrednog sektora ispoljavaju efekat sa vremenskim zaostatkom od jedne godine.
Sveukupno, rezultati istraživanja, ukazuju da povećanje budžetskih izdvajanja i intenziviranje kreditiranja poljoprivrede od strane komercijalnih banaka mogu značajno doprineti unapređenju poljoprivredne produktivnosti u Nigeriji.

Ključne reči: *poljoprivredna proizvodnja, poljoprivredni sektor, javna potrošnja u poljoprivredi, kointegraciona analiza, vektorska autoregresija, Nigerija.*

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