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Analysis of the Threshold Effect of Government Expenditure and Commercial Bank Credit on Agricultural Output in Nigeria

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Abstract
This study empirically investigated the threshold effect of government expenditure and commercial bank credit on agricultural performance in Nigeria spanning 1986 to 2021. The study used the Threshold Autoregression (TAR) analysis to carry out the analysis. The result of the TAR regression established a threshold value of ₦390.01 billion for government agricultural expenditure. The TAR regression established a linear relationship between government expenditure and agricultural performance in Nigeria, thus, a positive threshold effect of 2% and 22% below and above the threshold value respectively was established by the TAR regression. Similarly, an asymmetric inverted U-shaped relationship exists between commercial bank credit to the agricultural sector and the performance of the agricultural sector in Nigeria. It found a threshold value of commercial bank credit to the agricultural sector at ₦610.15 billion; stating that below this threshold, commercial bank credit to the agricultural sector has a positive and significant effect of 51% on the performance of the agricultural sector in Nigeria. However, above this threshold, commercial bank credit adversely affect the performance of the agricultural sector, reducing the sector's performance by 6%. Based on these findings, this study recommends that commercial bank credit to the agricultural sector should be kept within the established threshold level. Furthermore, to maximize the performance of the agricultural sector, the study recommends the allocation of additional funds to the agricultural sector by the government.
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1. INTRODUCTION

In Africa, the agricultural sector has a massive economic and social footprint. Smallholder farmers make up more than 60% of the population in sub-Saharan Africa, and agriculture accounts for around 23% of the region's gross domestic product (GDP) (Goedde et al., 2019). Yet, the continent's full agricultural potential according to Venture Africa (2022) is still unrealized.

Realizing the continent's full agricultural potential will require massive investment. In particular, Sub-Saharan Africa alone will require eight times more fertilizer, six times better-improved seed, at least $8 billion in basic storage investments (excluding cold-chain investments for horticulture or animal products), and up to $65 billion in irrigation (Goedde et al., 2019). Additionally, significant investment will be required in basic infrastructure, including ports, roads, and energy, as well as changes to legislation and regional trade patterns. Consequently, investments from both the public and private sectors are considered essential to agricultural productivity.

A sub-Saharan Africa agricultural productivity potential analysis across 44 countries showed that nine countries make up 60% of the total potential, with three countries- Nigeria, Ethiopia, and Tanzania, comprising half of that (Goedde et al., 2019). Nigeria's enormous size and market potential make it a unique case among these three. Nigeria is Africa's most populous country with a population of over 217 million inhabitants (Worldometer, 2022), and it has a land area of 92.4 million hectares (International Fund for Agricultural Development, 2022). Data from the World Bank (2022a), showed that Nigeria's agricultural sector remains the largest sector in the country contributing 20.8%, 21.2%, 21.9%, 24.1%, and 23.3% of GDP between 2017 and

2021 respectively. Furthermore, the Food and Agricultural Organization (FAO) reported that more than 70% of Nigerians engage in agriculture, primarily for subsistence (FAO, 2022a).

Consequently, investments in Nigeria's agricultural sector according to Abubakar (2020) are considered critical to promoting economic growth and the reduction of poverty. This is because GDP growth originating in agriculture is much more effective in reducing poverty than growth in other sectors (Chichaibelu, et al., 2021). Onuegbu et al. (2022) equally maintained that agricultural GDP development is more effective generally in developing nations, stating that hunger is more prevalent in countries where investment in agricultural expenditure per worker is lower. Additionally, there is a growing consensus that more investment is needed in smallholder farmers because they producemost of the food and are among the most undernourished people (World Bank, 2022b). Therefore, making such investments would be the single best way to end hunger and improve food security.

The foregoing proves that improving the productivity of the agricultural sector through massive investment is a means to national development. Also, reiterating Nigeria's huge agricultural potential, Ayodeji (2022) noted that Nigeria is endowed with enormous agricultural potential, but requires increased investment from both the government and the private sectors to unlock the enormous opportunities.

Consequently, over the years, the Nigerian government in addition to its annual budgetary agricultural expenditure has implemented several funding interventions such as the Agricultural Credit Guarantee Scheme Fund (ACGSF), Interest Drawback (IDP), Commercial Agricultural Credit Scheme (CACS), Agricultural Credit Support Scheme (ACSS), Anchor Borrowers' Programme, the Nigerian Incentive-Based Risk Sharing system for Agricultural Lending (NIRSAL), Cassava Bread Development Fund and National Programme for Food Security Fund among others.

Going by credit financing and government expenditure on agriculture in Nigeria, In terms of government expenditure, the budget allocation fluctuated each year. In 2000 the government capital expenditure on agriculture increased from ₦111.51 bill to ₦259.76 billion in 2001 and dropped to ₦97.98 billion in 2003. There was further increase in government expenditure on agriculture from ₦167.72 billion in 2004 to about ₦506.01billion in 2009 and dropped to ₦320 billion in 2012. There was an increase from ₦320billion in 2012 to ₦505.77billion in 2013, respectively. 2014 to 2016 experienced a continuous decrease from ₦393.45billion to ₦278.95billion (CBN, 2021). Given government efforts to diversify the economy and restore agricultural contribution to the economy of Nigeria, government expenditure on agricultural sector increased from ₦278.95billion in 2016 to all time high of ₦1.10trillion in 2021. Similarly, commercial bank credit to agricultural sector has been on consistent increase over the years. In 2010, commercial bank credit to agricultural sector stood at ₦128.41 billion. It rose consistently to ₦449.31billion, ₦528.24billion, ₦772.38billion and ₦1457.82trillion in 2015, 2018 and 2021 respectively (CBN, 2021).

These interventions are intended to boost agriculture in order to produce an abundance of commodity crops for export on the global market as well as meet domestic demand. However, agricultural productivity in the country has not fared so well. For instance, Nigeria's total agricultural imports from 2016 towere19 was N3.35 trillion, which is four times the country's total agricultural export of N803 billion over the same period (FAO, 2022b). Additionally, the FAO (2022b) reported that only 57% of the 6.7 million metric tons of rice consumed in Nigeria each year is produced locally, leaving a deficit of 3 million metric tons importation. This is true even though rice production in Nigeria increased from 3.7 million metric tons in 2017 to 4.0 million metric tons in 2018. Also, Nigeria's agricultural trade deficit widened by N689.7 billion in 2019 alone compared to N549.3 billion in 2018 (FAO, 2022b). In addition, Okojie (2022) stated that the agricultural sector is also plug with several number of issues, including a poor system of land tenure, a lack of irrigation farming, climate change, and land degradation, poor technology adoption, high production costs and inefficient input distribution, significant post-harvest losses, and difficult market access.

Funding the agricultural sector is critical, there is much to learn about how much funding from the public and private sectors will b necessary for optimum agricultural performance. As a consequence, this study assesses the threshold effects of government expenditure and commercial bank credit on agricultural performance in Nigeria. This study is divided into five sections. In addition to section one, is section two which is literature review, section three is the methodology, section four is the presentation and discussion of findings and section five is the conclusion and policy recommendations.

2. LITERATURE REVIEW

2.1 Conceptual Literature

The Classification of the Function of Government (COFOG) definitions, created by the Organization for Economic Co-operation and Development (OECD), defines government's expenditure in any purpose for which funds are spent. These according to Curtis and Adama (2013) includes administration of agricultural affairs and services; conservation, reclamation or expansion of arable land; agrarian reform and land settlement; supervision and regulation of the agricultural industry; construction or operation of flood control, irrigation and drainage

systems, including grants, loans or subsidies for such works. The COFOG's definition of government agricultural expenditure has a significant gap because it excludes research and development in the field of agriculture. On the other hand, the Food and Agricultural Organization's (FAO) Monitoring and Analyzing Food and Agricultural Policies (MAFAP) definition of government agricultural expenditure includes all rural spending. The definition according to Curtis and Adama (2013) comprises all expenditures related to agriculture, be they agriculture-specific or agriculture-supportive more generally.

According to Obeta (2016), agricultural credit refers to money borrowed by people, farms, and other entities for use in growing, storing, processing, and selling crops and livestock products. Similar to this, ClassHall (2022) stated that agricultural credit includes all loans and advances given to borrowers to finance and service production activities related to agriculture, fisheries, and forestry as well as for the processing, marketing, storage, and distribution of products obtained from those activities. Also, Chen (2021) refers to agricultural credit as one of the various financial instruments used to finance agricultural activities. Loans, notes, bills of exchange, and banker's acceptances are some examples of these instruments. This kind of finance is specially tailored to the unique financial requirements of farmers and enables them to acquire equipment, plant, harvest, market, and carry out other tasks required to maintain their farms.

In addition, the Food and Agricultural Organization (2022) defines agricultural credit as the total amount of loans and advances granted by the banking industry to farmers, rural households, agricultural cooperatives, or any other businesses with an agricultural focus. This study adopts this definition as operational definition on.

Agricultural Performance

Preckel et al. (2013) define agriculture performance in terms of productivity, and it is seen as the measurement of agricultural outputs to inputs ratio. They stated that while crop yield, or the weight of each product, is typically recorded, estimating the total agricultural output is challenging since different products vary. As a result, the market value of the finished product is typically used to gauge agricultural production. A variety of inputs, including labor, land, and capital, can be used to compare this productivity.

Similarly, the Australian Government's Department of Forestry and Fishery (2022) defines agricultural performance as the amount of output produced from a certain amount of inputs. Long-term productivity growth is a reflection of advances in farming technology and production efficiency. Farm productivity improvement helps farmers produce more output with fewer inputs, which boosts profitability and competitiveness.

This study adopts the Organization for Economic Co-operation and Development's (OECD) (2022) definition which sees agricultural performance in terms of agricultural final output. It defines it as the value of agricultural items generated during the accounting period that are available for export or consumption before processing.

2.1 Theoretical Framework

Theories explaining the positive impact of credit markets on output growth abound in the literature. Schumpeter (1911) argued that the financial system stimulates output growth due to its role in the allocation of savings, encouragement of innovation and funding of productive investments. McKinnon (1973) and Shaw (1973) in their independent studies concluded that financial development has positive effect on output growth. Levine (1991) and St. Paul (1992) suggested that financial markets aids in the diversification of firms' portfolio, reduce risks and stimulate output growth. Fractional reserve theory of banking suggest that bank can create credit money out of nothing whenever it executes bank loan contracts or purchases assets. Banks do not solely lend out deposits that have been provided to the bank. Instead, the bank creates bank deposits as a consequence of bank lending. There is also the monetary circuit theory (MCT) which holds that money is endogenously created by the banking sectors rather than exogenously by the government (Graziani, 1989). This theory emphasized on whether the credit is used for productive or unproductive activities.

Since the emphasis of this study is on how government and commercial banks mediate in improving the performance of agricultural sector in Nigeria, this study is anchored on the financial intermediation theory of bank credit which emanates from the writings of early Bankers including Mises (1912) and much later popularized by great economists such as Keynes (1936), Gurley and Shaw (1955) and Stein (2014). The theory holds that banks are merely financial intermediaries, not different from other non-bank financial institutions as they gather deposits and lend them out. In other word, banks create liquidity by borrowing on short term basis and lending in long term long basis, meaning that banks borrow from depositors with short maturities and lend to borrowers at longer maturities (Dewatripont, Rochet, & Tirole, 2010). Similarly, Keynes (1936) has further posited on the importance and the role of government in stimulating economic activities by increasing government expenditure.

The financial intermediation theory confers two important benefits that makes it relevant to this study. First, it supports the idea that borrowers undertakes to borrow fund simply because they do not have sufficient fund for investment. Thus, farmers need more fund to invest in agriculture. As famers' income are augmented by credit, it will raise the level of investment in agricultural sector as well as farmers' savings thereby increasing the

efficiency in the allocation of financial funds in the system. Secondly, this theory expresses a proportional relationship between agricultural financing and agricultural output. As such, when there is sustainable increase in agricultural output, there will be a relative increase in food security.

2.3 Empirical Literatures

Reviewing some related threshold literatures, Mubaraq (2021) who assessed government expenditure using the Agricultural credit guarantee scheme fund (ACGSF) and agricultural performance in Nigeria. The study evaluated the thresholds of ACGSF on agricultural performance in Nigeria between 1981 and 2019. The study used a Threshold Autoregression (TAR) model on the variables of real agricultural GDP, value of agricultural loans guaranteed under the ACGSF, inflation, commercial banks' credit to agricultural sector, and interest rate. The study's findings revealed a U-shaped relationship between real agricultural GDP and ACGSF, despite being insignificant. ACGSF also significantly increases real agricultural GDP at the thresholds of ₦5,951,809 and ₦1,060,389.

Similarly, Angaha and Atong (2020) evaluated agricultural financing and economic growth in Nigeria using threshold autoregressive (TAR) model between 1990-2017. The study used the Threshold Autoregression, and the Error Correction Model (ECM) to carry out its empirical analysis. Variables used in the study were GDP, credit to agriculture, budget allocation to agriculture, and interest rates. The study revealed that Nigeria's agricultural financing is not strong enough to produce greater economic benefits because its findings revealed that Nigeria has not yet reached a healthy threshold as revealed in all GDP regimes.

Using Nonlinear Autoregressive Distributed Lag (NARDL) estimation technique to model the agricultural sector credit and output relationship in Nigeria, Olorunsola et al. (2017) used a quarterly time series dataset (1992Q1 to 2015Q4), comprising of real agriculture output growth and private sector credit to agriculture. The findings indicate that there is no evidence of asymmetry in the short run between the positive and negative effects of credit on production growth in the agricultural sector, but there are different equilibrium connections in the long run. With a lag of four quarters of the projection horizon, the dynamic adjustments demonstrate that the influence of the favorable increases in credit to agriculture is primarily what drives the cumulative agricultural output growth.

Assessing the relationship between government expenditure and agricultural performance, Apata (2021) examined agricultural productivity returns between 1981 and 2018 using public finance data from the agricultural and non-agricultural sectors at the national level in Nigeria. The impact of public spending on agricultural growth-drivers like health care, farm feeder roads, and education on agricultural productivity was also looked at. Three-stage simultaneous equations and descriptive statistics were used to analyze the data. Results of a descriptive statistics analysis showed that between 1981 and 2018, the average percentage of Nigeria's agricultural public spending as a percentage of all public spending was 4.88 percent. Less than 25% of this budget was used for capital or development projects in agriculture. The access to moderate farm feeder roads variable was 0.045, the access to education variable was 0.071, and the access to health care facilities (within 15–30 minutes' walk to health facility) variable was 0.013, according to elasticity results computed from the 3-stage simultaneous equation. All of these factors were 1% significant. These findings indicate that a 1% increase in funding for health care, farm feeder roads, and educational institutions will increase agricultural productivity per person by 0.043. Consequently, the findings showed that the estimated benefit-cost ratio was 4.3:1. Therefore, a 4.3% increase in public spending on health care, farm feeder roads, and education would result in 1% increase in agricultural output.

Similarly, using annual time series data from 1985 to 2019, Salisu and Haladu (2021) looked into the relationship between agricultural output, government spending, and economic growth in Nigeria. The study used both the Gregory-Hansen test of cointegration and the ARDL model on the variables of GDP, agricultural output, government expenditure, and interest rate. The Gregory-Hansen test with structural break established that the used variables have a cointegration relationship. According to the ARDL model with break, while government spending has a positive and statistically significant effect on GDP in the short run, agricultural output has a negative and statistically insignificant impact. The long-term outcome demonstrates that while government spending also has a positive impact on Nigeria's GDP, agricultural output has a stronger influence.

In a study in Mali, Maiga et al. (2021) analyzed the effects of government spending on agricultural growth using data from 2000 to 2019. The study used the ARDL model on the variables of agricultural value added per worker, expenditure on agriculture, expenditure on education, expenditure on health, number of jobs in the agricultural sector, fertiliser consumption. The findings of this study demonstrate that, with the exception of agricultural expenditures that have negative effects, public spending has positive and notable effects on agricultural growth. Similar negative effects are also seen in the rate of agricultural employment and fertilizer usage.

Alabi and Abu (2020) in a Nigeria based study analysed the impact of agricultural public expenditure on agricultural productivity in Nigeria between 1981-2014. The study used the Error Correction Model (ECM) on a

key dataset comprising of agricultural productivity, agricultural public expenditure (capital and recurrent), investment, and labour to carry out its empirical analysis. According to the study's findings, agricultural public capital expenditure has a positive impact on agricultural productivity, which manifests over time even though recurrent and total agricultural public expenditure do not. The study also suggested that public capital spending in agriculture can support private agricultural investment.

Also, Abubakar et al. (2020) examined the impact of state government expenditure on agricultural growth in Kogi state, covering the period of 2000-2018. The study used the Vector Autoregressive (VAR) model on a dataset of crop production, state government capital expenditure, and the state government recurrent expenditure. The VAR model's outcome showed that in Kogi State, there is no significant relationship between government capital spending and agricultural growth. Similar to this, the study found that in Kogi State, there is equally no significant relationship between recurrent expenses and agricultural growth.

Ebenezer et al. (2019) examined the impact of government expenditure on agricultural productivity in South Africa using annual time series data spanning 1983 to 2016. The study used the ARDL model on the variables of agricultural productivity, agricultural sector government expenditure, and urbanization. The results showed that there is a relationship between government spending on agriculture and agricultural productivity over the long term, with a positive significant effect only to be anticipated over that time. In an era of climate change and a highly commercialized agricultural system, the finding emphasizes the indispensable function of South Africa's government funding of the agricultural sector.

In addition, Agri et al. (2019) examined the impact of government expenditure on agricultural productivity in Nigeria within spanning 1981 to 2018. To carry out the analysis, the study used the ECM technique on the variables of agricultural output, government expenditure on agriculture, government expenditure on health, government expenditure on infrastructure, and food imports. According to the study, there is a significant and positive correlation between government spending on infrastructure, health care, and agriculture in Nigeria. Even though the results indicated that government spending on agriculture has a favorable and significant impact on agricultural productivity, the coefficient of 18.34 percent is insufficient given how important the agricultural sector is to the Nigerian economy.

Assessing the impact of bank credit on the performance of the agricultural sector, Onuegbu et al. (2022) examined the effect of commercial bank credit on agricultural output in Nigeria spanning 1980-2013. The study used the ordinary least square technique to carry out its analysis. Variables used in the study were agricultural output, bank credit to the agricultural sector, government spending on the agricultural sector, the ACGS, and interest rate. The study demonstrates that while interest rates have a detrimental and insignificant impact on agricultural output, bank credit, government spending on the agricultural sector, and the ACGSF have positive and significant effects. As a result, the study draws the conclusion that deposit money bank credit has a favorable impact on agricultural output in Nigeria and has increased agricultural production in Nigeria over the course of the study.

Ngong et al. (2022) investigated the impact of bank credit on agricultural productivity in the Central African Economic and Monetary Community (CEMAC) between 1990 and 2019. The study used the Autoregressive Distributed Lag (ARDL) model on a dataset comprising of agricultural value added to GDP which proxied agricultural productivity, while domestic credit to the private sector by banks, broad money supply, land, inflation, physical capital, and labour supply were used as explanatory variables. The results of the co-integration test indicated that the variables were co-integrated over the long term. The results show that land and physical capital, as well as domestic bank credit to the private sector, have a positive impact on agricultural productivity. The general availability of money, the rate of inflation, and labor have a negative impact on agricultural productivity.

Golley and Samuel (2021) assessed the relationship between loan assessment and food security in Nigeria covering the period of 1993-2019. The study used the OLS technique on the variables of food security, loan assessment, food availability, food assessment, food utilization, and food absorption. The study's conclusions showed a strong positive correlation between loan assessment and food security in Nigeria. The study came to the conclusion that commercial bank credit has a significant impact on the agricultural industry because it increased food production in the nation by enhancing access to, availability of, and utilization of food.

Moving to Uganda, Nakazi and Sunday (2020) examined the impact of the commercial banks' credit on agricultural sector growth. Using quarterly time series data over the sample period of 2008Q3 -2018Q4, the study applied the Autoregressive Distributed Lag (ARDL) approach to carry out its empirical analysis. Variables used for the study were agricultural sector GDP, commercial bank credit to agriculture sector, commercial bank agriculture credit that specifically goes to production, commercial bank agriculture credit that specifically goes to processing and marketing, inflation, percentage change in the price, and percentage rate at which money is lent out to farmers. The study discovered that credit has a significant long-term beneficial effect on agricultural output. It equally found that credit to production has a much greater impact on agriculture output than credit to processing and marketing. The study found that bank credit does not immediately affect agricultural output in the

short term. The study offers proof that the GDP of Uganda's agricultural sector is significantly influenced by the agricultural credit provided by commercial banks.

Analysis of these recent related literatures revealed the existence of several compelling extant literatures. However, none have conducted a comparative threshold effect analysis that combines both government expenditure commitments in the agricultural sector and credit availability from the private sector (with particular reference to commercial banks credit) on the agricultural sector in Nigeria. While the studies by Mubaraq (2021) Angaha and Atong (2020) came close, they however fell short in the comparative analysis. Consequently, this study uniquely uses the TAR regression to analysis the threshold effects of government expenditure and commercial bank credit on agricultural performance in Nigeria.

3. METHODOLOGY

3.1 Types and Sources of Data

Secondary data was used in this study. It used annual time series data spanning 1986 to 2021. The base year coincided with the period of the structural adjustment era in Nigeria culminating in government's diversification efforts that saw a focus on the agricultural sector, while the terminal year was influenced by the availability of recent data. The data for agricultural productivity, government agricultural expenditure, and commercial bank credit to the agricultural sector were gotten from the 2021 annual CBN statistical bulletin, while the data for employment in agriculture was gotten from the 2022 World Bank database.

3.2 Model Specification.

Following the study's theoretical framework, the study adapted the works of Alabi and Abu (2020) and that of Olorunsola et al. (2017) to model the threshold effect of government expenditure and commercial bank credit to the agricultural sector respectively, on the performance of the agricultural sector in Nigeria. For the first model, the study adapted the model of Alabi and Abu's (2020) who employed an error correction model (ECM). This study employed the TAR model and used the variables of agriculture output growth, agricultural public expenditure, and labour. For the second model, the study adapted the model of Olorunsola et al. (2017) who employed the NARDL to analyze agricultural output and private sector credit and used the variables of agriculture output growth, commercial bank credit to the agricultural sector, and labour with emphasis on TAR.

Model 1: *Government Agricultural Expenditure Threshold Model*

Functional model:

AGP=f(GAE, LAB) - - - 1

Econometrics model

$$AGP_t = \alpha_0 + \alpha_1 GAE_t + \alpha_2 LAB_t + \varepsilon_t \quad - \quad - \quad - \quad 2$$

Model 2: *Commercial Bank Credit Threshold Model*

Functional model:

AGP=f(CBC, LAB) - - - 3

Econometrics model

$$AGP_t = \alpha_0 + \alpha_1 CBC_t + \alpha_2 LAB_t + \varepsilon_t \quad - \quad - \quad - \quad 4$$

where, α_0 are the intercepts, α_1 and α_2 are the coefficients of the variables, ε_t represents the error term; *AGP* represents agricultural productivity (proxied by the agricultural output contribution to *GDP*), *GAE* stands for government agricultural expenditure (proxied by total government agricultural expenditure in line with the FAO's MAFAP definition), *CBC* represents commercial banks credit to the agricultural sector, while *LAB* represents labour (employment in agriculture as % of total employment).

Equations 2 and 4 are traditional linear agricultural growth model, but the models are altered into the two regime threshold autoregressive (TAR) model of Hansen (2000). The model is written as follows:

TAR Model for Government Agricultural Expenditure.

$$\left.\begin{aligned} AGP_t &= c + \alpha GAE_t + \beta LAB_t + \varepsilon_t \ \ if \ \ q_t \le AGP \\ AGP_t &= c + \alpha GAE_t + \beta LAB_t + \varepsilon_t \ \ if \ \ q_t > AGP \end{aligned}\right\} \quad - \quad - \quad - \quad 5$$

where, c is the constant, q is the observable threshold variable and *AGP* is threshold value of government agricultural expenditure.

The two regime equation 5 can also be written in a compact form as:

$$AGP_t = \left|c + \alpha GAE_t + \beta LAB_t\right| GAE\,(q_t \le AGP) + \left|c + \alpha GAE_t + \beta LAB_t\right| GAE\,(q_t > AGP) + \varepsilon_t \quad - - - \quad 6$$

TAR Model for Commercial Bank's Credit to the Agricultural Sector.

$$\left.\begin{aligned} AGP_t &= c + \alpha CBC_t + \beta LAB_t + \varepsilon_t \ \ if \ \ q_t \le AGP \\ AGP_t &= c + \alpha CBC_t + \beta LAB_t + \varepsilon_t \ \ if \ \ q_t > AGP \end{aligned}\right\} \quad - \quad - \quad - \quad 7$$

where, c is the constant, q is the observable threshold variable and AGP is threshold value of commercial bank credit to the agricultural sector.

The two regime in equation 7 can also be written in a compact form as:

$$AGP_t = \left|c + \alpha CBC_t + \beta LAB_t\right| CBC(q_t \le AGP) + \left|c + \alpha CBC_t + \beta LAB_t\right| CBC(q_t > AGP) + \varepsilon_t \quad - -$$

- 8

The threshold values can be found by estimating Equations 3.7 and 3.8 through finding the minimum error sum of squared in a re-order threshold variable. The threshold variable can be set by the exogenous variables out of the theoretical model. In this study, government agricultural expenditure and commercial bank credit to the agricultural sector are used as the threshold variables. The threshold value is determined by using the Bai-Perron tests of L + 1 versus L sequential at 5% level of significance. The Bai-Perron tests allows one threshold value of government agricultural expenditure and commercial bank credit to the agricultural sector to be selected out of five maximum number of thresholds and, therefore, the study period is divided into two regimes.

3.3 Method of Analysis

To determine the threshold effect of government expenditure and commercial bank credit on agricultural performance in Nigeria, the study used the Threshold Autoregression (TAR) model of Hansen (1996, 2000). Regression models in the threshold class have predictors and outcomes that are related in a threshold-dependent manner. Threshold regression models offer a straightforward but elegant and understandable technique to represent specific sorts of nonlinear interactions between an outcome and a predictor by introducing a threshold parameter, often known as the change point (Fong et al., 2017).

4. RESULTS AND DISCUSSION OF FINDINGS

4.1 Descriptive Statistics

The results of the descriptive statistics are presented on Table 1.

Table 1:

Descriptive Statistics Result

	AGP	***GAE***	***CBC***	***LAB***
Mean	451.620	362.650	254.112	43.596
Maximum	906.870	1174.737	1457.820	50.570
Minimum	160.410	2.793	5.010	34.970
Skewness	0.163	1.061	1.918	-0.226
Kurtosis	1.622	3.817	6.466	1.534
Jarque-Bera	2.589	6.680	34.530	3.039
Probability	0.274	0.035	0.000	0.219
Observations	31	31	31	31

Source: *Author's computation using E-views 10.*

Given the mean values of each data-sets, evidence of significant variations were observed as shown in the difference between the minimum and maximum values of the data-set. Samples from a normal distribution have an expected skewness of 0, consequently, only the skewness of *AGP* and *LAB* were normally distributed. Similarly, since the values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution, only *AGP* and *LAB* had normal kurtosis. In addition, the Jarque-Bera test represents a goodness-of-fit test which confirms whether sample data have the skewness and kurtosis matching a normal distribution. Using a probability value of 5%, the Jarque-Bera statistics equally confirms that only the Skewness and Kurtosis of *AGP* and *LAB* were normally distributed. However, individual statistical analysis does not invalidate further analysis. Also, Halvorsen (2015) added that, linear regression by itself does not necessarily need the gaussian assumption, because the estimators can be calculated (by linear least squares) without any need of such assumption, and makes perfect sense without it.

4.3 Threshold Effect of Government Expenditure on Agricultural Performance in Nigeria

The result of the TAR regression of the threshold effect of government expenditure on agricultural performance in Nigeria is presented on Table 2.

Table 2:
Government Agricultural Expenditure Threshold Regression Point

Dependent Variable*: AGP*		
Threshold variable: *GAE*		
Variable	*Regime 1* *GAE < 390.0169*	*Regime 2* *390.0169 <= GAE*
GAE	0.016524 (0.104028) [0.8751]	0.216099 (0.059179) [0.0012]***
LAB	-39.28044 (3.267084) [0.0000]***	19.88980 (4.695495) [0.0003]***
C	2145.184 (167.1660) [0.0000]***	1304.880 (207.0537) [0.000]***
Observations	18	13
R-squared	0.976743	
Adjusted R-squared	0.972092	
Durbin-Watson stat.	1.441835	
F-statistic	209.9889	
Prob(F-statistic)	[0.000000]***	

Notes: ( ) are standard errors; [ ] are probabilities values; and (3) ***, ** and * are 1%, 5% and 10% significance levels respectively.
Source: *Author's computation using E-views 10.*

The empirical result in Table 2 shows that the threshold value of government expenditure on agricultural is ₦390.01 billion. When government expenditure to the agricultural sector is small (below this threshold level), its expenditure has positive but insignificant effect on the performance of the agricultural sector in Nigeria. Specifically, a one unit increase in government expenditure on agricultural leads to 0.02 unit increase in agricultural performance. This result confirms that while government expenditure to the agricultural sector is beneficial, low expenditure levels can have insignificant effect on the performance of the sector.

However, when government expenditure on agricultural is high (above the threshold level of (N390.01 billion), government expenditure on agricultural equally has a positive, but in this case, significant effect on the performance of the agricultural sector in Nigeria. This implies that a one unit increase in government expenditure on agriculture above this threshold increases the performance of the agricultural sector in Nigeria by 0.22 unit. This result points to the fact that sufficient public sector funding for the agricultural sector would lead to a significant performance of the sector. This is consonance with the study of Olorunsola et al. (2017) that found no evidence of asymmetry between funding and production growth in Nigeria's agricultural sector. The study's finding of a positive effect between government's agricultural expenditure and agricultural performance is corroborated by the findings of the studies by Apata (2021), and that of Agri et al. (2019)

Labour had a negative and significant effect on agricultural performance in the first regime while in the second regime, the effect is positive and equally significant. This shows that in the first regime, incentive to innovate and apply better agricultural inputs and machineries to boost and aid farm practices among farmers was largely absent, leading to inefficient allocation of the meager funds with traditional farm practices, leading to an adverse effect on the performance of the agricultural sector. This shows that agricultural labour without appropriate training in efficient farm practices, can adversely affect agricultural performance.

The result of the R-squared statistics shows that 98% of the variance in agricultural performance is explained by the explanatory variables and the null hypothesis stipulating zero identity for all slope coefficients is rejected since the F-statistic is significant at the 1% level. Therefore, the result presented in the Table 2 passes the test associated with goodness of fit.

Table 3:
Breusch-Godfrey Serial Correlation LM Test Result

F-statistic	1.135490	Prob. F(2,17)	0.3445
Obs*R-squared	3.653181	Prob. Chi-Square(2)	0.1610

Source: *Author's computation using E-views 10.*

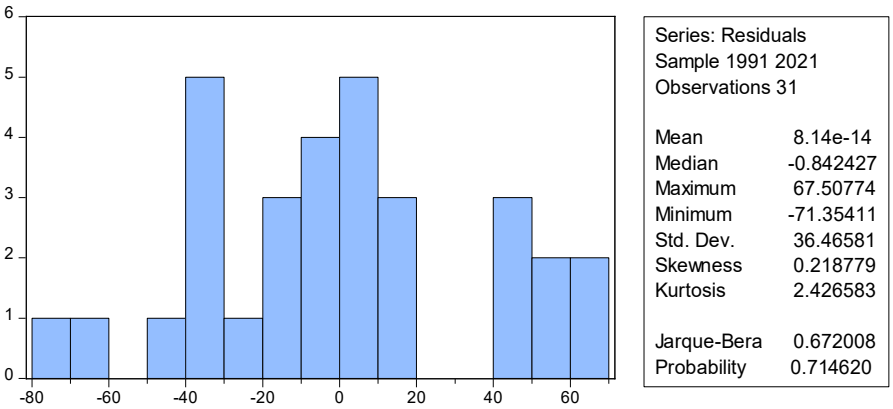

Figure 1: *Jarque-Bera Normality Test*
Source: *Author's computation using E-views 10.*

The study conducts a post-estimation tests for the TAR regression. The post-estimation tests conducted are the Breusch-Godfrey serial correlation LM test and the Jarque-Bera statistics to test for normality in in the model. The result of serial correlation test on Table 3 confirms that there is no serial correlation in the residual of the TAR regression estimate. Furthermore, the result of the Jarque-Bera test statistics on Figure 1 used to test the normality of the residual accepted the null hypothesis of normality since the probability value is greater than 0.05. This indicates that the errors are normally distributed, and inference can be drawn from the model.

4.4 Threshold Effect of Commercial Bank Credit on Agricultural Performance in Nigeria

The result of the TAR regression of the threshold effect of commercial bank credit on agricultural performance in Nigeria is presented on Table 4.

Table 4:
Commercial Bank Credit Threshold Regression Point

Dependent Variable*: AGP*		
Threshold variable: *CBC*		
Variable	*Regime 1* CBC < 610.14999	*Regime 2* 610.14999 <= CBC
CBC	0.511688 (0.124406) [0.0004]	-0.058018 (0.068263) [0.4034]
LAB	56.18561 (4.290681) [0.0000]***	-29.25550 (99.65816) [0.7715]
C	2993.076 (209.6370) [0.0000]***	1899.050 (3525.362) [0.5949]
Observations	27	4
R-squared	0.974080	
Adjusted R-squared	0.968896	
Durbin-Watson stat.	2.089563	
F-statistic	187.9032	
Prob(F-statistic)	[0.000000]***	

Notes: ( ) are standard errors; [ ] are probabilities values; and (3) ***, ** and * are 1%, 5% and 10% significance levels respectively.
Author's computation using E-views 10.

Similarly, the empirical result on Table 4 shows that the threshold value of commercial bank credit to the agricultural sector is N610.15 billion. When commercial bank credit to the agricultural sector is below this threshold level, commercial bank credit to the agricultural sector has a positive and significant effect on the performance of the agricultural sector in Nigeria. Specifically, a unit increase in commercial bank credit to the agricultural sector leads to 0.51 unit increase in agricultural performance. This result confirms that appropriate credit utilization can increase the amount of profitable investment in the agricultural sector. Appropriate credit is essential for removing the financial barriers that farmers have when investing in farm activities, boosting production, through the adoption of scientific and technological innovation. Similarly, the positive and significant effect of the labour input within this threshold is a pointer to the complementarity of appropriate

credit and labour quality in Nigeria's largely traditional agricultural sector. This is so because labour constitutes an important input in increasing production in traditional agriculture.

However, when commercial bank credit to the agricultural sector is high (above the threshold level of N610.15 billion), commercial bank credit to the agricultural sector has a negative and significant effect on the performance of the agricultural sector in Nigeria. This implies that above this threshold, commercial bank credit to the agricultural sector would adversely affect the performance of the agricultural sector reducing the sector's performance by 0.06 unit. This result point to the fact that more credit is not always better and it tends to harm the performance of the agricultural sector. When there is a large commercial bank credit expansion to the agricultural sector in the economy, credit may flow to farm borrowers with poor credit quality. Reduced borrower quality exposes the commercial bank's credit facility to the agricultural sector to increased default risks, which may be realized only after a substantial deterioration on the output level of these farmers. The negative effect of the labour input above the threshold is a pointer to this fact. In simple terms credit above the threshold level leads to debt, interest charges, and poor farm output. While a similar asymmetric relationship between commercial bank credit to the agricultural sector and the performance of the agricultural was reported by Mubaraq (2021), it however differed from Mubaraq's (2021) finding of a U-shaped relationship, stating that too much commercial bank credit beyond the threshold level is detrimental to agricultural output.

The result of the R-squared statistics shows that 97% of the variance in agricultural performance is explained by the explanatory variables and the null hypothesis stipulating zero identity for all slope coefficients is rejected since the F-statistic is significant at the 1% level. Therefore, the result presented on the Table 4 passes the test associated with goodness of fit.

Table 5:

Breusch-Godfrey Serial Correlation LM Test Result

F-statistic	1.730799	Prob. F(2,23)	0.1994
Obs*R-squared	4.055293	Prob. Chi-Square(2)	0.1316

Author's computation using E-views 10.

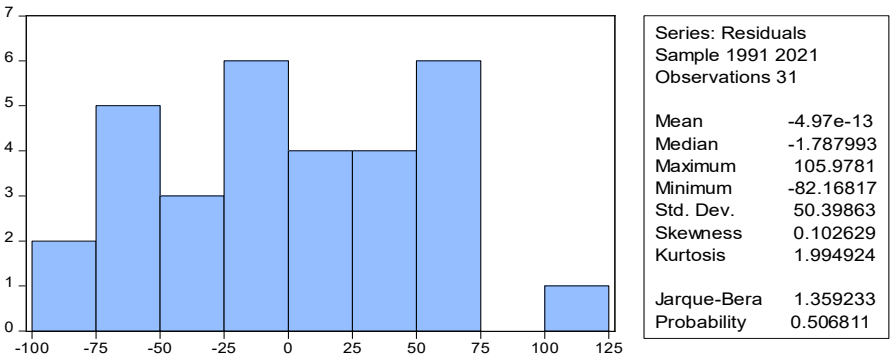

Figure 2: *Jarque-Bera Normality Test*

The study equally conducted post-estimation tests for the TAR regression. The post-estimation tests conducted are the Breusch-Godfrey serial correlation LM test and the Jarque-Bera statistics to test for normality in the model. The result of the serial correlation test on Table 5 confirms that there is no serial correlation in the residual of the TAR regression estimate. Furthermore, the result of the Jarque-Bera test statistics on Figure 2 used to test the normality of the residual accepts the null hypothesis of normality since the probability value is greater than 0.05. This indicates that the errors are normally distributed, and inference can be drawn from the model.

5. CONCLUSION AND POLICY RECOMMENDATION

5.1 Conclusion

This study empirically investigated the threshold effect of government expenditure and commercial bank credit on agricultural performance in Nigeria spanning 1986 to 2021. The result of the TAR regression established a threshold value N390.01 billion for government expenditure on agricultural. It concluded that that when government expenditure to the agricultural sector is small (below this threshold level), its expenditure has positive but insignificant effect on the performance of the agricultural sector in the country. It increases agricultural performance by just 0.02 unit. However, when government expenditure on agriculture is high (above the threshold level), its expenditure equally has a positive, but much more significant effect on the performance of the agricultural sector in Nigeria. It increases agricultural performance by 0.22 unit.

Also, the study concluded that an asymmetric inverted U-shaped relationship exist between commercial bank credit to the agricultural sector and the performance of the agricultural sector in Nigeria. It concluded that

the threshold value of commercial bank credit to the agricultural sector is N610.15 billion; stating that below this threshold, commercial bank credit to the agricultural sector has a positive and significant effect of 0.51 unit on the performance of the agricultural sector in Nigeria. However, above this threshold, commercial bank credit to the agricultural sector would adversely affect the performance of the agricultural sector, reducing the sector's performance by 0.06 unit. It concludes that more credit is not always better- that it tends to harm the performance of the agricultural sector, stating that when there is a large commercial bank credit expansion to the agricultural sector in the economy, credit flows to farm borrowers with poor credit quality.

5.2 Policy Recommendation

Based on the findings of this study, this study recommends that commercial bank credit should be kept within the established threshold levels. Furthermore, to maximize the performance of the agricultural sector, the study recommends the allocation of additional funds to the agricultural sector by the government. Along this line, targeted extensive support must be provided to poor farmers by the ministry of agriculture to improve their competitiveness; access to markets for fair and competitive prices should be encouraged; and, adequate monitoring and evaluation mechanisms should be put in place to ensure that expended monies reach the intended beneficiaries and achieves the desired impact.

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