Non-Tax Incentives and Agricultural Output in Nigeria

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Abstract

This study investigates the impact of non-taxl incentives on agricultural sector output in Nigeria from 1981 to 2019, using Autoregressive Distributed Lag (ARDL) Model/Bounds test technique. The findings of this study show that non-tax incentives have a significant positive impact on agricultural sector output growth in the long-run; however, the effect was negative and statistically insignificant in the short run. On the other hand, government expenditure on agriculture was negative and significant on agricultural sector output growth in the short-run, while its long-run impact was also negative but not significant. Therefore, the study recommends targeted expansion of non-tax incentives to the entire agricultural value chain with appropriate monitoring and evaluation to boost output in the sector.

I.   Introduction

In recent years, the quest for diversified, sustainable and inclusive economic growth has become the overriding goal of most developing nations, including Nigeria. The attainment of this goal is essentially a precondition for reversing the perennial problems of poverty, inequality, unemployment, weak infrastructure, low productivity, over dependence on oil, and other vulnerabilities that currently characterise the Nigerian economy. Given the nation's endowment in natural and human resources, Nigeria can potentially rank among the top 10 leading economies by 2050, with a projected Gross Domestic Product (GDP) of $6.4 trillion (PricewaterhouseCoopers, 2016). Increasing productivity across various sectors of the economy is critical for realising such a robust growth, and lifting 30 million people out of extreme poverty, (World Bank, 2019a). It, therefore, becomes imperative for government and policymakers to pay more attention to other key sectors of the economy, besides oil, that hold enormous potential for boosting productivity, employment and well-being of Nigerians.

Over the years, countries across the globe have subscribed to fiscal incentives as tools for stimulating and accelerating economic growth. In Nigeria, the government has relied on applying tax and non-tax incentives to influence desirable outcomes across potentially promising sectors of the economy. Tax-based incentives have taken the form of tax reliefs, tax credits, tax holidays, unrestricted capital

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allowances, investment and reinvestment allowances, reduction in tariffs, and waivers of duty payments on imported agro-allied equipment and machinery, amongst others. On the other hand, non-tax incentives in the form of agricultural credit guarantee funds, subsidies, grants, insurance facilities, or waivers will induce investments in critical sectors like agriculture. The agricultural sector is no doubt, one of the key drivers of the Nigerian economy, accounting for over a quarter of the nation's GDP; 36.0 per cent of employment; 88.0 per cent of non-oil exports earnings; and a major source of food and raw materials for agro-allied industry (PricewaterhouseCoopers, 2018 and World Bank, 2019b).

Although there exist a plethora of studies on the impact of fiscal incentives on investment and economic performance (Rapu et al., 2013; James, 2013;; Fowowe, 2013; Ele et al., 2014; Amuka & Ezeudeka, 2017). There is no consensus on the impact of non-tax fiscal incentives on the performance of the agricultural sector in Nigeria (Iganiga & Unemhilin, 2011; Oyakhilomen et al., 2013; Ewubare & Eyitope, 2015; Okoh, 2015; Ironkwe & Promise, 2016; Ojiya et al., 2019). This study contributes to the extant literature on the impact of non-tax incentives in two ways. First, it accounts for the long- and short-run dynamics of non-tax incentives in determining agricultural output in Nigeria. This provides further insights into the effectiveness of non-tax incentives. Second, the study differs as it demonstrates that non-tax incentives can be proxied by Agricultural Credit Guarantee Scheme Fund (ACGSF) for empirical analysis. This represents a plausible way to circumvent the difficulty of measuring non-tax incentives quantitatively. Therefore, the objective of this paper is to determine the long- and short-run impact of non-tax incentives on agricultural sector output in Nigeria from 1981 to 2019, using the Autoregressive Distributed Lag (ARDL) model/bounds testing approach.

Following this introduction, section 2 reviews the theoretical and empirical literature. Section 3 covers an overview of the Nigerian agricultural sector and fiscal incentives, while section 4 presents the research methodology, variables, model specifications, and estimation techniques. Section 5 focuses on empirical analysis, presentation, and discussion of results. Finally, the summary, policy recommendations and conclusions are contained in section 6.

II.   Literature Review and Theoretical Framework

II.1   Theoretical Literature

The theoretical underpinnings of the study are predicated on the Neo-Classical Investment Theory founded by Jorgensen (1963) and the Credit Rationing Hypothesis by Stiglitz and Weiss (1981). The neo-classical investment theory proposes that investment decisions depend mainly upon the cost of capital. The profit-maximising motive of the firm drives investment decisions. Given this motive, businesses naturally continue to accumulate capital if the marginal cost of doing so

is less than the marginal benefit until the marginal cost and benefit are at equilibrium. The theory, therefore, suggests that aside from the real rate of interest and depreciation, tax incentives, including corporate tax and investment tax breaks, also affect the rental cost of capital. On this basis, the governments offer investment tax credits to firms to encourage investment. In an investment tax credit scheme, firms are allowed a certain rebate, say, and 10.0 per cent of their investment expenditure, on the tax payable. Such incentives reduce the rental cost of capital. The real rental cost of capital, r can be expressed as follows:

$$r = i - \pi + d - k_c$$

Where; d = depreciation rate, Π = expected inflation rate, i = nominal interest k_c = percent tax rebate on investment expenditure per year

II.2   Empirical Literature

Several studies in the literature have investigated the impact of fiscal incentives on the economy through various channels by adopting several econometric techniques. This section examines some of these studies and their findings to identify possible gaps in the extant literature.

Ogunsanya et al. (2017) investigate the impact of Agricultural output on economic growth in Nigeria from 1981 to 2014. The Ordinary Least Square (OLS) regression method was used to analyse the data. The results revealed a positive and significant relationship between gross domestic product (GDP) and agricultural output in Nigeria. The agricultural sector was estimated to contribute 2.247 per cent to the variation in the GDP.

Ironkwe and Promise (2016) empirically examine the impact of tax incentives on economic development in Nigeria with evidence from the years 2004 to 2014. Spearman's Rank Correlation Coefficient statistical tool was employed in testing the hypothesis. The findings revealed that sufficient tax incentives enhance industrial growth and the economy. Iganiga and Unemhilin (2011), Ebere and Osundina (2014) as well as Ewubare and Eyitope (2015) examine the effects of government spending on the agricultural sector in Nigeria and found that increased funding of the agricultural sector led to an increase in output.

Oyakhilomen, et al. (2013) examine the relationship between budgetary allocation to agriculture and economic growth in Nigeria from an econometric perspective. The results show that the connection between budgetary allocation to agriculture and economic growth in Nigeria is positive but insignificant in the long-run.

In OECD countries, tax incentives had distortionary effects on the agricultural sector (Hill, 2005; Hill & Blandford, 2007). However, in the South African Development Community (SADC), Nathan-MSI Group (2004) finds that non-tax incentives matter for investment flows into agriculture and other sectors of the economy. The study also suggests that fiscal incentives decisions should be country-specific since the impacts of tax incentives are often exaggerated.

Utilising the ACGSF as a proxy for non-tax incentives, some studies report that ACGSF hurts agricultural output in Nigeria (see Anetor et al., 2016; Adetiloye, 2012). Other studies reveal that ACGSF significantly boosts agricultural output (see Usman et al., 2017). The empirical literature also indicates a positive and significant threshold effect of ACGSF on agricultural production (see Sulaimon, 2021).

From the strand of the empirical literature on fiscal incentives above, it is clear previous studies focus more on the impact of tax incentives rather than the impact of non-tax incentives on agricultural productivity in Nigeria. This study further demonstrates the use of ACGSF as a proxy for non-tax incentives, indicating a significant departure from previous studies. In addition, the study employs an appropriate method for estimating both the short- and long-run impact of non-tax incentives on agricultural output in Nigeria, thereby bridging a gap in the literature by using extended data points.

III.   Overview of Fiscal Incentives and Agricultural Sector Performance

The Nigerian agricultural sector enjoys several fiscal incentives deployed to enhance its performance in terms of output, income, and job creation. Some of these incentives include enhanced capital allowance for companies engaged in wholly agricultural activities; and the ACGSF, which provides guarantees on the payment of interest and principal in respect of loans granted by any bank for certain agricultural purposes up to 75 .0 per cent. In addition, exemption from minimum Corporate Income Tax for a company carrying on agricultural trade from payment of minimum tax; indefinite carry forward of losses for companies engaged in agricultural trade or business; income tax relief for three years. Other incentives are zero import duty for import of agricultural equipment and agro-processing equipment; increased tariff with an additional levy on any commodity that Nigeria produces to promote domestic production and local contents; exemption of interest from tax on loans granted to agricultural activities; and value-added tax (VAT)

In terms of performance, agriculture remains one of the key sectors of the Nigerian economy. The sector employs about two-thirds of the workforce while contributing nearly 21.0 per cent to GDP (FAO, 2020; CBN, 2018). The sector is endowed with an

arable landmass of 82 million hectares, out of which only 34 million hectares have been cultivated (FMARD, 2016). According to the FAO (2020), Nigeria is the largest producer of cassava in the world, with 50 Million metric tons annually from a cultivated area of 3.7 million hectares, which accounts for about 20.0 per cent of world production as well as Africa's highest consumer of rice, and one of its leading producers in the continent.

However, a major challenge is the sector's domination by smallholder farmers who concentrate mostly on crop production using crude farm tools. Crop production accounts for about 90.0 per cent of the sector, while fishery, livestock, and forestry account for about 10.0 per cent (CBN, 2018). The prevalence of smallholder farmers with the associated limited application of research and technological aids has seen huge post-harvest losses and waste estimated at USD10 billion in export opportunities from groundnuts, cocoa, palm oil, and cotton (FAO, 2020).

III.1   Trend Analysis of Selected Agricultural Sector Performance Indicators

Here we consider a graphical analysis of some selected determinants of the agricultural sector to identify possible co-movements during the study period. The selected variables are Agricultural output (AGRO); ACGSF; Commercial Banks Loans to the Agricultural Sector (CBLA); Government Expenditure on Agriculture (GEXA); and Agricultural Tractors and Machinery (MAG).

In Figures 1 to 4, we graphically analyse the possibility of symmetry between AGRO, and the expected outcome of various interventions or inputs to the agricultural sector vis-à-vis ACGSF; CBLA; GEXA; and MAG. Figure 1 portrays co-movement between AGRO and ACGSF. The agricultural output rose marginally from the 1980s to the late 1990s and sustained more than a marginal rise from the early 2000s until its peak in 2018 before declining. While ACGSF followed a similar pattern to AGRO, the increase in the fund was marginal until the spike in 2005 before maintaining an upward but volatile trajectory peaking in 2014, which ushered in a downward trend that culminated in 2018 before recovering in 2019. CBLA followed a similar trajectory, with significant agricultural injections around 2006 while spiking from 2016 to 2018 before declining marginally in 2019 (Figure 2). For GEXA, the trend portrays a slow rise in the 1980s, which spiked in 1999 and maintained the upward trajectory with a break in 2008 that ushered in a volatile period culminating in a decline in 2019 (Figure 3). MAG rose steadily and gradually following the review period (Figure 4). However, there is no evidence of a co-movement between rainfall and agricultural output (Figure 5).

The observation from the trend shows a rather weak or poor investment in agriculture from the 1980s to the late 1990s, which may be a result of several years of neglect. From the 2000s upward, investment in the sector improved following the

return to democracy. This can be seen from the spike and sustained increase in the sectoral output and increases in the other indicators during this period. It is important to note that democratic rule came with several innovative programmes that drove agricultural output, such as the litany of presidential initiatives (2000-2010) that focused on developing selected agricultural commodities; the Agricultural Transformation Agenda (ATA); Agriculture Promotion Policy and the several Agriculture targeted interventions by the CBN cited above. While these measures seem to spur the sectoral output as seen by the upward trajectory of AGRO. The dip in that trend in 2018 may not be unconnected to the security challenges observed within these periods, especially the herder-farmer clashes that continue to disrupt farming activities.

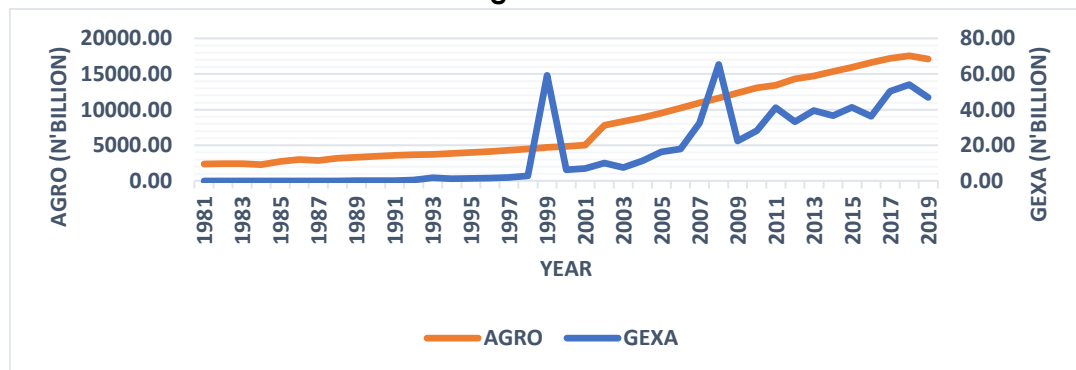**Figure 1: The Trend of Agricultural Output and ACGSF**
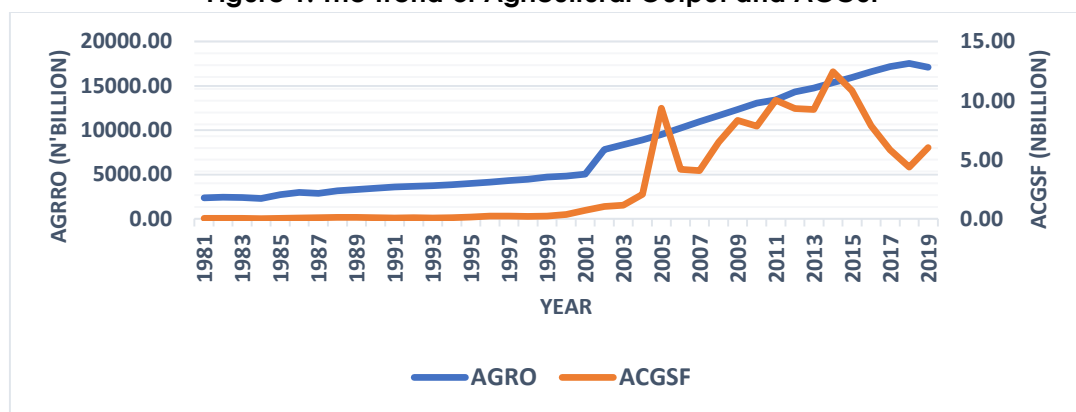
Source: CBN Statistical Bulletin.

Figure 2: The Trend of Agricultural Output and Commercial Bank Credit to the Agricultural Sector.
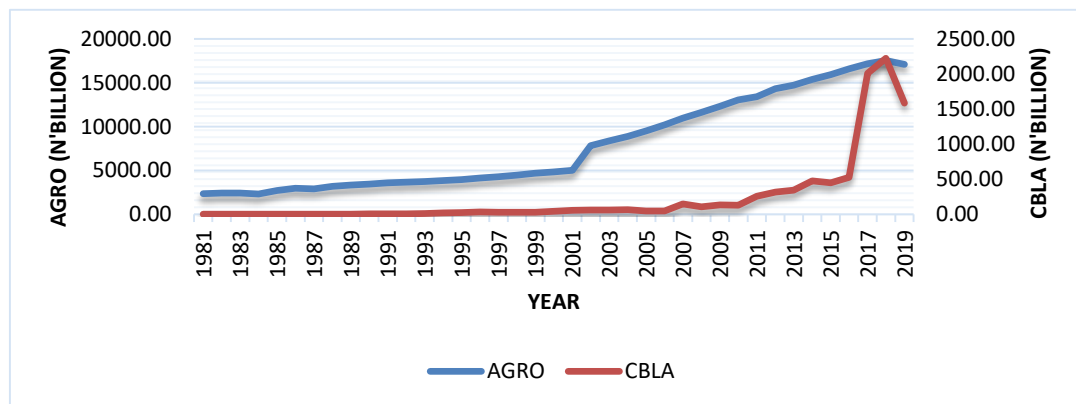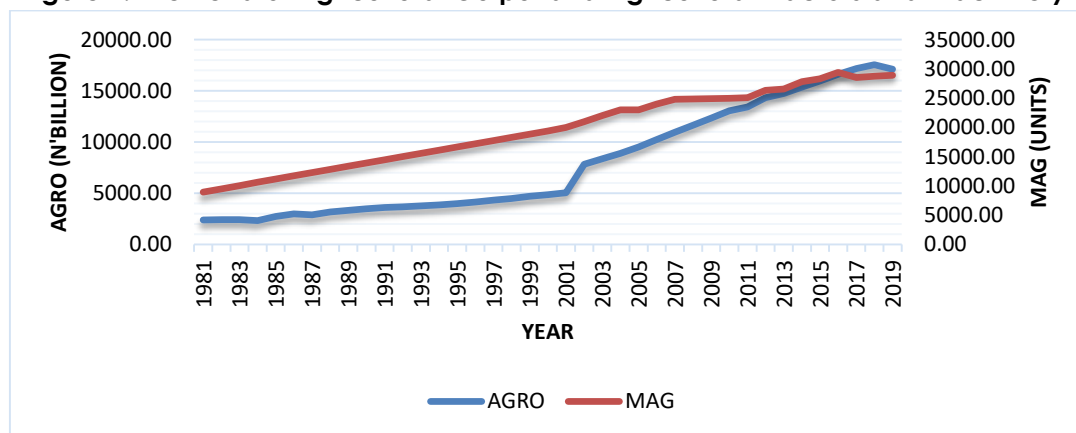

Source: CBN Statistical Bulletin.

Figure 3: The trend of Agricultural Output and Government Expenditure in Agriculture.
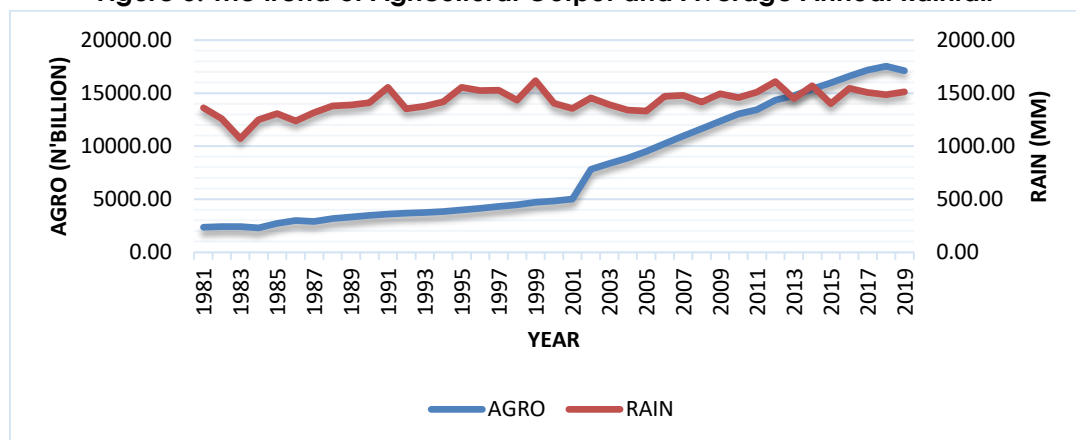

Source: CBN Statistical Bulletin.

Figure 4: The trend of Agricultural Output and Agricultural Tractors and Machinery

Source: WDI.

Figure 5: The trend of Agricultural Output and Average Annual Rainfall

Source: CBN Statistical Bulletin.

IV.   Data and Methodology

IV.1   Data

The study adopts time series data spanning thirty-nine (39) years from 1981 to 2019. The choice of this period was informed by data availability. Data on real agricultural output; government expenditure; ACGSF, a proxy for non-tax incentives; commercial bank loans and advances to agriculture; and average annual rainfall were obtained from CBN statistical bulletin (2018), while data on agricultural machineries and tractors were obtained from World Bank World Development Indicators (2018). Existing studies like Fowowe (2013), Okoh (2015) and Ojiya et al. (2017) measure non-tax incentives using dummy variables, corporate tax rate, value-added tax, tax holidays and indexes. This study significantly departs from previous studies by considering non-tax incentives. Specifically, the study measures non-tax incentives using ACGSF. The ACGSF guarantees the loans provided by the commercial banks to approved agricultural activities up to 75.0 per cent. The argument is that the ACGSF is a form of insurance on agricultural loans. It, therefore, qualifies as a non-tax incentive because the fund encourages lending to the agricultural sector.

IV.2   Model Specification

In line with the extant literature and institutional knowledge, the study specifies a model that captures drivers of AGRO. The independent variables are the ACGSF, a proxy for non-tax incentives; commercial bank loans and advances to agriculture (CBLA); government expenditure on agriculture (GEXA); agricultural machineries and tractors (MAG); and average annual rainfall (RAIN) which are important determinants of agricultural production.

$$AGRO = f \ (ACGSF, \ CBLA, \ GEXA, \ MAG, \ RAIN) \hspace{2cm} (1)$$

Where;
AGRO = Agricultural Output
ACGSF = Agricultural Credit Guarantee Scheme Fund
CBLA = Commercial Banks Loans and Advances to Agriculture
GEXA = Government Expenditure on Agriculture
MAG = Agricultural machinery and tractors
RAIN = Average Annual Rainfall

Based on theoretical postulation, the a priori expectation is that the explanatory variables, credit to the agricultural sector, ACGSF, machinery and tractors, government expenditure and average annual rainfall should have a positive influence on growth in the agricultural sector.

IV.3   Estimation Technique

This study employs the Autoregressive Distributed Lag (ARDL) model developed by Pesaran et al. (2001). Although other popular approaches to co-integration are Engle and Granger (1987) and Johansen and Juselius (1988), the ARDL technique is superior to the previous two approaches for three reasons. First, it estimates the co-integration relationship using the Ordinary Least Squares (OLS) following the selection of the optimal lag for the model. Second, the ARDL technique is not sensitive to the order of integration of the series. In other words, this technique remains statistically significant irrespective of the order of integration of the series, that is, I(0), I(1) or a combination of both. Third, the ARDL bounds testing approach to co-integration does not restrict sample size; it is suitable for large and small sample sizes (Sohag et al., 2015).

Based on equation (1), the ARDL version of the error correction model in its logarithmic form is expressed in equation (2).

$$\Delta LAGRO_t = \beta_0 + \sum_{i=1}^{P}\gamma_i\Delta LAGRO_{t-i} + \sum_{j=0}^{q}\delta_j\Delta LCBLA_{t-j} + \sum_{l=0}^{q}\phi_l\Delta LACGSF_{t-l} + \sum_{m=0}^{q}\rho_m\Delta LGEXA_{t-m} + \sum_{n=0}^{q}\omega_n\Delta LMAG_{t-n} + \sum_{r=0}^{q}\partial_r\Delta LRAIN_{t-r} + \beta_1 LAGRO_{t-1} + \beta_2 LCBLA_{t-1} + \beta_3 LACGS_{t-1} + \beta_4 LGEXA_{t-1} + \beta_5 LMAG_{t-1} + \beta_6 LRAIN_{t-1} + \mu_t \qquad (2)$$

Where;

The variables are as defined in equation (1)
$\gamma_i, \delta_j, \phi_l, \rho_m, \omega_n$ and ∂_r are the short-run parameters
β_1 - β_6 are the long-run parameters
β_0 is the drift component
Δ is the difference operator
μ_t is white noise residual

IV.4   Estimation Procedure

To establish the long-run relationship among the variables in equation (1), the study employs the bounds test approach to co-integration. The bounds test method relies on the F-test or joint significance test. Using the F-test, the null hypothesis of no co-integration among the variables is tested against the alternative hypothesis of the existence or presence of co-integration among the variables. In this approach, the calculated value of the F-statistic is compared with the upper and lower bounds critical values provided in Pesaran et al. (2001). First, if the upper bound critical values are less than the F-statistic, the null hypothesis is rejected, and it is concluded that there exists a long-run relationship among the variables. Second, if the lower bound critical values are more than the F-statistic, then the null hypothesis of the absence of co-integration among the variables is accepted. The last case suggests

that the test is inconclusive if the F-statistic lies between the lower and upper bound critical values.

Thereafter, the long run coefficients of the ARDL model are estimated in line with equation (3)

$$LAGRO_t = \beta_0 + \sum_{i=1}^{p} \gamma_i LAGRO_{t-i} + \sum_{j=0}^{q} \delta_j LCBLA_{t-j} + \sum_{l=0}^{q} \emptyset_l LACGSF_{t-l} + \sum_{m=0}^{q} \rho_m LGEXA_{t-m} + \sum_{n=0}^{q} \omega_n LMAG_{t-n} + \sum_{r=0}^{q} \partial_r LRAIN_{t-r} + \varepsilon_t \tag{3}$$

Finally, the model's co-integration and error correction form are estimated according to equation (4). This allows the evaluation of the short-run dynamics of the respective variables along with their short-run adjustment rates towards the long run as follows.

$$\Delta LAGRO_t = \beta_0 + \sum_{i=1}^{P} \gamma_i \Delta LAGRO_{t-i} + \sum_{j=0}^{q} \delta_j \Delta LCBLA_{t-j} + \sum_{l=0}^{q} \emptyset_l \Delta LACGSF_{t-l} + \sum_{m=1}^{q} \rho_m LGEXA_{t-m} + \sum_{n=0}^{q} \omega_n \Delta LMAG_{t-n} + \sum_{r=0}^{q} \partial_r \Delta LRAINt - r + \lambda ECT_{t-1} + \varepsilon_t \tag{4}$$

Where: ECT = Error Correction Term
λ = parameter of the adjustment term

V. Empirical Analysis, Presentation and Discussion of Results

V.1 Unit Root Test

The study adopts the Augmented Dickey-Fuller (ADF) test to investigate the unit root properties of the variables. The test rejects a null hypothesis that the series is non-stationary, favouring the alternative hypothesis that the series is stationary. The test for stationarity is imperative to avoid spurious regression. The result of the unit root test of the six variables in our model is as in Table 1.

Table 1: ADF Unit Root Test Result

VARIABLE	LEVEL		FIRST DIFFERENCE	
	INTERCEPT	TREND AND INERCEPT	INTERCEPT	TREND AND INTERCEPT
LAGRO	-0.239314	-1.899697	-5.783623***	-5.686991***
LCBLA	-0.569054	-2.865651	-6.590646***	-6.483177***
LACGSF	-0.915192	-1.423707	-5.663689***	-5.661316***
LGEXA	-2.120642	-2.021033	-8.508110***	-6.591445***
LMAG	-5.528044***	-0.761532	-2.146943	-6.544601
LRAIN	-3.092108**	-4.311184***	-9.182521	-9.056132

*** and ** indicate 1% and 5% levels of significance, respectively.
Source: Author's compilation.

The ADF unit root test results presented in Table 1 indicate that some variables are stationary at levels while others are stationary at first difference. In other words, the unit root test results reveal that the variables are of mixed order of integration, that is, I(1) and I(0). The unit root properties of all the series lend credence to the choice of the ARDL model as an estimation technique.

V.2   Bounds Test

We test for co-integration among the variables in the model using the ARDL bounds test, and we select a lag length of 4 based on Schwarz Criterion. The bounds test result is as in Table 2.

Table 2: Bound test

F-Bounds Test		Null Hypothesis: No levels relationship		
F-statistic	**Value**	**Level of Significance.**	**I(0)**	**I(1)**
			Asymptotic: n=1000	
	14.5776	10%	2.08	3
K	5	5%	2.39	3.38
		2.50%	2.7	3.73
		1%	3.06	4.15

Source: Author's compilation.

The bound test result shown in table 2 confirms co-integration in the ARDL model. Specifically, the F-statistic value of 14.5776 is greater than all the upper bound critical values at various levels of significance.

V.3   ARDL Long Run Estimates

Having established the presence of a long-run relationship among the variables based on the bounds test result, the study proceeds to estimate the long-run parameters of the ARDL model.

Table 3: ARDL long-run Estimates

DEPENDENT VARIABLE: LAGRO				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LCBLA	0.055565	0.02367	2.347445	0.0313
LACGSF	0.180361	0.019443	9.2763	0.0000
LGEXA	-0.014322	0.027863	-0.514023	0.6139
LMAG	0.821675	0.37882	2.169038	0.0446
LRAIN	-1.371912	0.332347	-4.127958	0.0007
C	26.74058	4.115585	6.497393	0.0000

Source: Author's compilation.

The ARDL long-run estimates presented in Table 3 above reveal a positive and significant relationship between the ACGSF (a proxy for non-tax incentives) and AGRO in Nigeria. The estimated coefficient shows that a 1.0 per cent increase in the level of non-tax incentives will result in about a 0.2 per cent increase in real agricultural output, *ceteris paribus*. This finding is similar to Orok and Ayim (2017), which hold that an increase in allocation to the ACGSF will significantly improve agricultural output in Nigeria. Although the long-run impact of government expenditure on agriculture on real agricultural output is negative, the impact is rather negligible. It shows that inefficiencies and corruption militate against government expenditure in Nigeria.

Furthermore, the result indicates a positive and significant relationship between commercial bank loans and advances in agriculture and real agricultural output at a 5.0 per cent level of significance. The result implies that a 1.0 per cent increase in commercial bank loans and advances to agriculture will yield an increase in real agricultural output of about 0.6 per cent, all things being equal. This finding further points to the theoretical postulation of the finance-led growth hypothesis, which emphasises the driving role of finance in the growth process.

A further examination of the result shows that average annual rainfall has a negative and significant impact on real agricultural output at a 1.0 per cent level of significance, indicating a significant departure from Ayinde et al. (2010). It implies that changes in the climatic pattern, which has seen the negative impact of excess rainfall, leading to floods with devastating consequences for agricultural production. However, agricultural machinery and tractors have a long run positive and significant impact on real agricultural output at a 5.0 per cent level of significance. This finding contradicts Ojiya et al. (2017) partly due to differences in the choice of the econometric model. The intercept term indicates that when all other variables in the model are held constant, real agricultural output will significantly grow by about 26.0 per cent in the long-run.

V.4   ARDL Error Correction and Co-Integration Form

The Error Correction and Co-Integration form of the ARDL model is presented in Table 4**.**

Table 4: ARDL Error Correction and Cointegration Form.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LAGRO(-1))	0.247123	0.072199	3.422791	0.0032
D(LCBLA)	0.008415	0.016137	0.521459	0.6088
D(LACGSF)	-0.00235	0.01402	-0.167637	0.8688
D(LACGS(-1))	-0.119896	0.022187	-5.403774	0.0000
D(LACGS(-2))	-0.098078	0.017845	-5.496029	0.0000
D(LACGS(-3))	-0.032995	0.015614	-2.113078	0.0497
D(LGEXA)	-0.020763	0.008183	-2.53741	0.0213
D(LGEXA(-1))	-0.031743	0.00794	-3.997717	0.0009
D(LGEXA(-2))	-0.056504	0.007156	-7.895612	0.0000
D(LRAIN)	-0.161244	0.100869	-1.598541	0.1283
D(LRAIN(-1))	0.493183	0.090721	5.436262	0.0000
CointEq(-1)	-0.827256	0.07151	-11.56841	0.0000
Adjusted R-squared	0.842161			

Source: Author's compilation.

The result presented in the table above shows that in the short-run, agricultural output of the previous year has a positive and significant impact on agricultural output for the current year at a 1.0 per cent level of significance. The implication of this finding points to the fact that agricultural inputs like seedlings of previous years are required to boost productivity in succeeding years. Although, the short-run impact of the ACGSF on agricultural output is negative from the current period back to the previous three periods, the impact is only significant from the one period to the previous three periods. The result also indicates that government expenditure for the current period back to the previous two periods also has a negative and significant impact on agricultural output in the short-run. The contemporaneous short-run impact of ACGSF on agricultural output is not significant, implying that its impact is negligible in the short-run. Furthermore, commercial bank loans and advances to agriculture have a short-run positive but insignificant impact on agricultural output. The result also reveals that average annual rainfall for the current period has a negative and insignificant impact on agricultural output. However, the average annual rainfall for the immediate past period has a positive and significant impact on agricultural output in the short-run. It implies that the positive effect of rainfall on agriculture is not immediate but follows a lag.

The error correction term is negative and significant. The error correction term measures the speed of adjustment from short run disequilibrium to long-run equilibrium. The error correction term of -0.827256 suggests that short-run disequilibrium adjusts to long-run equilibrium by about 83.0 per cent per annum. This shows that the speed of adjustment is fast.

The adjusted R-squared value of 0.842161 indicates that the independent variables have explained about 84.0 per cent of the total variations in agricultural output in the model. It implies that the model has a very good fit.

V.5   Post-estimation Diagnostic Tests

We conduct the post-estimation diagnostic tests to ensure that the estimated model is not affected by the problem of serial correlation, heteroscedasticity and non-normality. The diagnostic test results are as in Table 5.

Table 5: Diagnostic Tests

Test name	Test type	Test statistic	Prob. Value
Serial correlation	Breusch-Godfrey	F-stat = 1.240443	0.3418
Heteroscedasticity	Breusch-Pagan-Godfrey	F-stat = 1.317323	0.2881
Normality	Histogram	Jarque–Bera = 0.447571	0.799487
Functional form	Ramsey RESET test	F-stat = 1.831826	0.1947

Source: Author's compilation.

The diagnostic tests presented in Table 5 indicate the absence of serial correlation and heteroscedasticity in the model's residuals. This is because the probability values of the test statistics do not support the rejection of the null hypothesis that the problems do not exist in the model. In addition, the results show that the normality assumption is not violated because the probability value of the Jarque-Bera statistic does not support the rejection of the null hypothesis of normality. The Ramsey reset test result indicates that the functional form of the model is correctly specified.
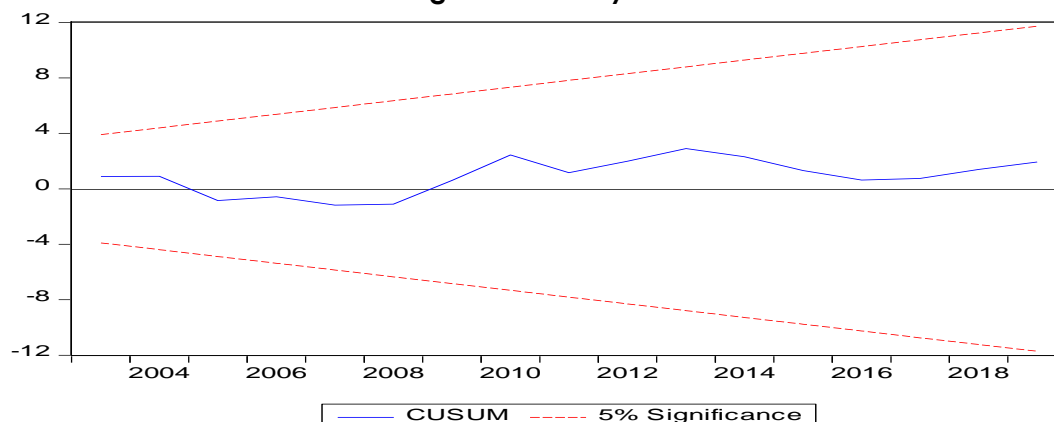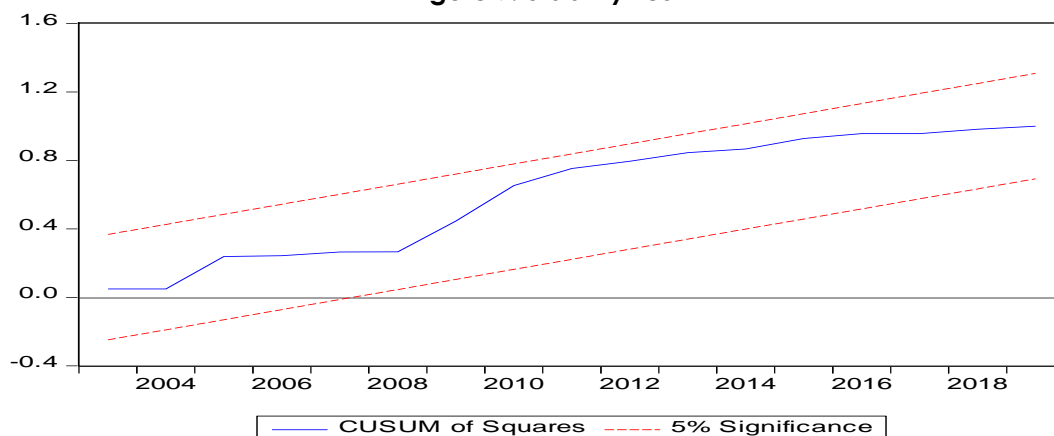
Figure 6: Stability Test

Figure 7: Stability Test

Source: Author's compilation.

We employ the CUSUM and the CUSUM of squares to confirm the stability of the parameters in the model. The CUSUM test checks for systematic change in the regression model parameters, and the CUSUM of squares tests for the sudden change in the regression model parameters. Plots of the CUSUM and CUSUMSQ statistics, as shown in Figures 6 and 7 above, lie within the 5.0 per cent bound, inferring the overall stability of the model.

VI.0   Summary of Findings and Recommendations

VI.1   Summary of Findings

This study empirically investigated the impact of non-tax incentives on agricultural sector output in Nigeria, from 1981 to 2019, using the ARDL model/bounds test approach. The study adopted Agricultural Credit Guarantee Fund as a proxy for non-tax incentives. The findings of this study indicate that in the short-run, specifically in the current year, the impact of the Agricultural Credit Guarantee on agricultural productivity is negative and insignificant. However, the finding indicates a positive and significant relationship between the agricultural credit guarantee scheme fund (ACGSF) and agricultural output in the long-run. Other important findings of this study indicate that the impact of commercial bank loans and advances in agriculture on agricultural output is positive in both the short-run and long run.

VI.2   Recommendations

Based on the study's findings, there is a need for the government to sustain and expand non-tax incentives in the form of the ACGSF, given the long-run positive impact of the scheme on agricultural output in Nigeria. In other words, the government should continue to incentivise the agricultural sector for enhanced productivity. The study specifically recommends scaling up the guarantee scheme

from the current 75.0 per cent to about 85.0 per cent cover to further harness the non-tax incentive's benefit. This will encourage the flow of more funds to the sector. In addition, commercial banks' provision of loans and advances to the agricultural sector should be encouraged and well-structured with appropriate moratoriums taking cognisance of the unique dynamics of each agricultural value chain. This measure will minimise the risks of loan defaults in the sector.

To boost agricultural sector productivity, the government should promote mechanisation beyond granting zero per cent import duty on agricultural machines and equipment by incentivising smallholder farmers through a hire purchase window. Given the negative impact of rainfall found in this study, there is a need to develop flood mitigation mechanisms to dampen the negative impact of excessive rainfall on agricultural output in Nigeria.

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