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YEARS OF GOVERNMENT AGRICULTURAL INVESTMENT IN NIGERIA: ANY SIGNIFICANT EFFECT ON AGRICULTURAL OUTPUT? (RECENT EVIDENCE)

BY

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Despite the agricultural sector's robust performance, Nigeria remains vulnerable to food insecurity and is unable to meet domestic demand. This study seeks the empirically analyze the impact of government agricultural investment on the growth of agricultural output in Nigeria.The study covers the period 1981–2020 using annual data from secondary sources and Augmented Dickey fuller (ADF) test was deployed to test their stationarity. The result from the short run autoregressive distributed lag (ARDL) model results show that government agriculture investment in Nigeria affects agricultural output positively. As such, the government of Nigeria should make more budgetary allocation towards agricultural sector by balancing support across small-scale farming and existing investments as well as support in women farmers.

Keywords: *government expenditure on agriculture, bound test, autoregressive distributed lag. (ARDL), agricultural output*

INTRODUCTION

Investment is defined as an addition to the stockpile of physical capital such as machinery, buildings, roads etc., i.e. anything that sums up to the future productive ability of the economy and changes in the catalogue (or the stock of finished commodities) of a manufacturer (BYJUS, 2022).In this study, investment in agriculture includes government expenditures directed to agricultural infrastructure (e.g. rural feeder roads, water, electricity and storage facilities), subsidization of modern inputs (e.g. fertilizers, pesticides, irrigation, and improved seeds), research and development and education and training, etc.

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Agricultural investment in Nigeria over the years has seen on upward trend due to the relevance of the sector in the nation's economy (eFarms Blog, 2022).Agriculture contribution to the Gross Domestic Product (GDP) makes it the largest sector in the country. In 2014, the sector achieved a GDP of $113.64 billion. The sector contributed $78.45 billion to the GDP in 2017 (Adeyeye 2020). The share of agricultural contribution to GDP as at Q1 2020 stood at approximately 22% (Oyaniran, 2020).

To improve agricultural finance in Nigeria, the federal government (FG) has introduced different financing initiatives. Reminiscent of this was the Commercial Agriculture Credit Scheme (CACS) established in 2009. In 2015, the FG launched another scheme- the Anchor Borrowers' Programme- to create a link between anchor companies involved in agricultural processing and smallholder farmers. Five years later, the government unveiled its 10-year agricultural programme called the Green Imperative. The program is worth $1.2 billion and hopes to inject $10 billion into the economy (Adeyeye (2020).

Older interventions include the National Accelerated Food Production Programme (NAFPP) (early 60s), Agricultural Credit Guarantee Scheme Fund (ACGSF) (1978 -2006), Agricultural Development Project (1974), Operation Feed the Nation (1976), and Green Revolution Programme (1979). The River Basin-Development Authorities (1976), National Agricultural Land Development Authority (1992), and the National Fadama Development Project are other interventions of government to Nigeria's agricultural sector. Better Life Programme for Rural Women (1987) and Family Support Programme (1994)/ Family Economic Advancement Programme (1996) are other social intervention programmes that had the agricultural sector in focus.

The long list of FG's interventions in the agricultural sector suggests the enormity of financial investment into the sector. While the full monetary worth of government intervention into its agriculture sector might be difficult to track, budgetary allocation to the sector can provide insight on recent financial investment.

Between 2015 and 2020, the FG committed over half a trillion naira in budgetary allocation to Nigeria's agriculture sector. This sum represents over 11 per cent of the total budget size for the six consecutive years (Adeyeye, 2020). Yearly, budgetary allocation to the agricultural sector ranged between four per cent and 22 per cent. The year 2018 had the highest allocation to the sector (22.3 per cent) (Adeyeye, 2020).

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Further, the FG earmarked about 15 per cent of the revised 2020 budget to the agricultural sector. It is important to note that most of the budgetary allocation to the sector in the last three years have been for capital items. Capital allocations to the agriculture sector was 73.5 per cent, 90.2 per cent, and 63.9 per cent for 2018, 2019, and 2020 (Adeyeye, 2020).

In contrast to the teeming investment in agriculture in Nigeria, the country remains vulnerable to food insecurity and is unable to meet domestic demand(OBG, 2022).Reports show that over 2 million Nigerian children are suffering from severe malnutrition. In 2018, this estimate was 2.1 million, albeit for Nigerians as a whole. According to a DATAPHYTE analysis, as much as 4.02 million people in northern Nigeria could be victims of worse food insecurity (especially because of the ongoing pandemic) (Adeyeye, 2020).

Table 1: Budgetary Allocation to Agriculture in Nigeria (2015- 2020)

Year	Total Budget Size (₦ trillion)	Total Allocation to Agriculture and Rural Development (₦ Billion)	Share of Size Allocation to Agriculture (%)
2015	4.36	31.87	7.31
2016	6.06	29.63	4.89
2017	7.30	31.75	4.35
2018	9.12	203.01	22.26
2019	8.92	73.36	8.22
2020	10.8	160.46	

Source: Adeyeye (2020)

Against this backdrop, this paper seek to empirically examine the impact of many years of government agricultural investment on the growth of agricultural sector in Nigeria, especially agricultural output. Though the country's agricultural sector comprises four subsectors: crop production, livestock, forestry and fisheries. The focus of this study is on crop production because it accounted for 89.7% of overall nominal sector growth as at the fourth quarter of 2020 and 91.4% for the full year, making it the largest segment (OBG, 2022). Nigeria's major crops include cassava, sesame, rice, cocoa, palm oil, ginger, tomatoes, groundnut, sorghum, millet and wheat. The country has 34m hectares of arable land, with 6.5m of land under permanent crops, and 30.3m hectares of land under permanent meadows and pastures

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(OBG, 2022). According to the World Bank, the sector accounted for around 35% of employment in 2019, making it the country's largest employer of labour (OBG, 2022).

The paper is organized as follows: Section one is the introduction. Section two presents an overview on agricultural production and trade. Section three reviews empirical literature. Section four deals with methodology. Section five is result and discussion. The final section provides the summary, conclusion and recommendations of the study.

Agricultural Production and Trade: Overview

In the early 1960s Nigeria was the world's top producer of palm oil, with a global market share of 43%, ahead of Malaysia and Indonesia (OBG, 2022). Today it is the fifth-largest producer, accounting for less than 2% of total global production. In terms of cocoa production, Nigeria was the second-largest producer in the 1960s, accounting for 18% of the world's cocoa production, whereas today, the country's production is estimated at around 5%, behind that of Ghana and Côte d'Ivoire, which have a global market share of 21% and 39%, respectively(OBG, 2022).

In the fourth quarter of 2020 the total value of trade in agricultural goods reached N588.2bn ($1.6bn), representing 6.5% of overall trade (OBG, 2022). In the first quarter of 2021 this figure rose to N757.4bn ($2bn) (OBG, 2022). The major traded agricultural products were sesame seeds, cocoa beans and cashew nuts. In 2020 the value of agricultural exports were 19.2% higher than the previous year, while agricultural imports were up 78.6% (OBG, 2022). Despite an increase in productivity in some agricultural products, Nigeria's growing population has had to rely on imports to complement local supply. For instance, even though Nigeria is the largest rice producer on the continent – with production concentrated mainly in Kebbi State and Kaduna State (see Kaduna chapter) – output has proven insufficient to meet growing domestic demand. It is estimated that between 2016 and 2019 the country's cumulative agricultural imports outweighed its agricultural exports by a factor of four, at N3.3trn ($8.8bn), and that it lost up to $10bn in annual export opportunities from groundnut, palm oil, cocoa and cotton, as a result of declining production levels.

In 2019 the government took measures to spur local production and reduce the import bill, such as closing borders to neighbouring countries Benin, Niger and Cameroon to prevent the smuggling of certain cheap crops like rice, as well as poultry. However, in early 2021 the borders with Benin were reopened, and it is reported that the Nigerian market is again seeing substantial inflows of foreign rice. Although the policy resulted in a boost in rice production, experts believe that the country should instead focus on raising the productivity of the sector.

Review of Empirical Literature

Agriculture has often been seen as a risky venture in which the returns are slow and the profit levels low. The injection of significant amount of capital into agriculture has been seen as the responsibility of government (Nwosu 1995), especially in developing countries of Africa. Thus public expenditure finance of agriculture has become a prime policy instrument for promoting development in the agricultural sector. Some of the empirical studies on developing countries that address the importance of public financial resources to agriculture include Fan et al (2000); Fan and Zhang (2004); World Bank (2007); Fan et al (2008); Benin et al (2012) and Allen et al (2012). However, the review of empirical studies for this study focuses on Nigeria and they are discussed briefly.

Loto (2011) employs the method of cointegration and error correction mechanism to investigate the impact of government expenditures in various sector of the Nigeria's economy such as education, health, national security, transportation and communication, and agriculture, on economic growth in Nigeria within the period 1980-2000. The findings of the study reveal that government expenditure on agriculture and education impacts negatively on economic growth, though the impact of expenditure on education was observed to be insignificant while, the impact of expenditure in the health sector on economic growth was observed to be positive and significant, more so, the impact of expenditure on national security, transportation and communication were observed to be positive and statistically insignificant.

Lawal (2011) using time series data, attempted to verify the amount of federal government expenditure on agriculture in Nigeria in the thirty-year period of 1979–2007. Significant statistical evidence obtained from the analysis showed that government spending does not follow a regular pattern and that the contribution of the agricultural sector to the GDP is in direct relationship with government funding to the sector.

Uger (2013) examined the impact of Federal Government's expenditure on the agricultural sector. The data used was sourced from the Central Bank of

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Nigeria Statistical Bulletin. Simple regression method was used to analyze the data which indicated impact of agricultural expenditure on its output from 1991 to 2010. The R^2 was 1 percent indicating a weak relationship between the variables which was as a result of inadequate funding. It was recommended that government should reinforce its budgetary allocations to the agricultural sector, ensure proper release of funds, monitor agricultural inputs distribution to farmers and create commodity markets.

Ewubare and Eyitope (2015), examined the effects of government spending on the agricultural sector in Nigeria using quasi-experimental research design. The time series data adopted in the study were generated from the Central Bank of Nigeria (CBN) Annual Statistical Bulletin 2013 and National Bureau of Statistics Bulletin 2013. The ordinary least square of multiple regression, the Johansen co-integration techniques, and the error correction model were used for the tests and analysis. The results showed that the coefficient of determination was 0.9468 (94.68%) and the coefficient of the ECM exhibited a negative sign and statistically significant. Durbin-Watson statistics value was 1.954 and the F-statistics of 33.84 was significant at 5% level. In specific terms, the lag two and three forms of the explanatory variables on government agricultural expenditure were positive and statistically significant. Based on the findings, the study recommended increased funding of these agricultural sector in Nigeria.

Ayunku and Etale (2015) investigated the effect of agriculture spending on economic growth in Nigeria from 1977 to 2010 with particular focus on sectorial expenditure analysis. The study employed Augmented Dickey Fuller (ADF) and Phillips Perron (PP) unit root tests, as well as Johansen Cointegration and followed by Error Correction Model (ECM) tests. Their empirical results indicated that Real GDP was particularly influenced by changes in Agriculture (AGR), Inflation Rate (INF), Interest Rate (INT) and Exchange Rate (EXR), these variables as they stand contribute or promote economic growth in Nigeria. Accordingly, they recommended amongst others things that government should increase spending on agriculture. However, in their study they failed to account for the fact that the impact of agricultural public expenditure may not be instantaneous (it may materialize with lag) and this may cast doubt on the estimates derived from the study.

Aina, &Omojola, (2017) examined the impact of government expenditure on agricultural sector performance in Nigeria for the period 1980 and 2013 using secondary data from the Central Bank of Nigeria Statistical bulletin .

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The result of the Error correction model shows that there is a significant and positive relationship between government expenditure on agriculture and agricultural production output.

The study conducted by Sebastian, Florence and Charity (2018) examined the effect of government agricultural expenditure on agricultural output in Nigeria using time series data from 1981 to 2014. The findings of this paper revealed that there exists positive and significant relationship between government agricultural expenditure (financing) and its output, although a weak one, as rightly shown in our regression analysis. As a sector that provides basic foundation to the Nigerian economy, increased improvement in agricultural production would not only enable Nigeria to feed its teeming population but it would also assure a return to its former position (glory) as an exporter of agricultural products to global markets in the years ahead.

As the review of literature shows, a few studies have been carried on the subject matter of government agriculture expenditure on agricultural growth in Nigeria.This study makes immense contribution to the existing arguments by empirically analyzing government agriculture investment on agriculture output in Nigeria using time series data from 1981-2020 obtained from secondary data. It introduced a few variables of interest and applied the newly developed autoregressive distributed lag (ARDL) cointegration technique to empirically ascertain this relationship.

Methodological

Empirical Model

To capture the effect of government agricultural investment on the growth of agricultural output in Nigeria, the study adopts the Cobb-Douglas production function with modifications. Cobb-Douglas production function models the relationship between production output and production inputs (factors). It is used to calculate ratios of inputs to one another for efficient production and to estimate technological change in production methods (McKenzie2020).

The general form of a Cobb-Douglas production function for a set of n inputs is:

$$Y = f(x_1, x_2, \dots x_n) = \gamma \prod_{i=1}^{n} x_i^{\alpha_i} \quad \dots\dots\dots\dots\dots\dots\dots(1)$$

Where Y stands for output, x_i for input i, and γ and α_i are parameters determining the overall efficiency of production and the responsiveness of output to changes in the input quantities.

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Hence, in line with equation (1) and a little modification; the implicit form of the model representing the relationship of interest in this study is presented as:

$AGD_t = f\,(GEX_t, PAP_t, RWR_t, AVR_t)$ …………………(2)

Where AGD represents agricultural output in tones, GEX represents government expenditure on agriculture in '000 billion naira, PAP represents price of agricultural product (1990=100), RWR represents rural wage rate refers to the labour wage rate for agricultural production activities in the rural area, AVR represents average rainfall describes the annual average rainfall (precipitation)in the country measured in millimeters. The data for the variables are annual data for the period 1981–2020. The sample time span was selected based on the availability of statistical data. Data for agricultural output (AGD), government expenditure on agriculture (GEX), price of agricultural product (PAP), and average rainfall (AVR) were obtained from CBN statistical bulletin. While rural wage rate (RWR) data was collected from rural agriculture daily wage paid workers.

However, the explicit and non-linear form of the model is stated as:

$AGD_t = \alpha \,.\, GEX_t^{\beta_1} .\; PAP_t^{\beta_2} .\; RWR_t^{\beta_3} .\; AVR_t^{\beta_4} \,.\, \mu_t$ ………………(3)

For ease of estimation, equation (3) is linearized by taking the natural logarithm of variables on both sides of the equation. Also, the double-log model is adopted in order to align the variables to the same base (unit of measurement), reduce the incidence of heteroscedasticity and to establish an elasticity relationship while ensuring that the estimates are Best Linear and Unbiased–BLUE (Ejemeyovwi et al., 2018; Adeleye et al., 2020). As such, the stochastic model is expressed as follows:

$InAGD_t = \beta_0 + \beta_1 InGEX_t + \beta_2 InPAP_t + \beta_3 InRWR_t + \beta_4 InAVR_t + \mu_t$ …………..(4)

Where β_0 represents Constant; $\beta_1, \beta_2, \beta_3, \beta_4$: are the relative slope coefficients and partial elasticity of the parameters; μ_t is the stochastic error term; t is time; In is the natural logarithm. The apriori expectations are: $\beta 1 > 0$, $\beta 2 > 0$, $\beta 3 > 0$, $\beta 4 > 0$.

Before analyzing equation (4), the first step was to carry out a unit root test. A unit root tests whether a time series variable is non-stationary and possesses a unit root. The null hypothesis is generally defined as the presence of a unit root and the alternative hypothesis is either stationarity, trend stationarity or explosive root depending on the test used. This paper employs Augmented

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Dickey Fuller test (ADF Test) which is one of the most commonly used statistical test when it comes to analyzing the stationary of a series. The ADF equation is stated below:

$\Delta yt = \delta yt\text{-}1 + \alpha iPi = 1\ \Delta yt\text{-}i + \mu t$ ……………………….. (5)

The testing procedure follows an examination of the student-t ratio for δ. The critical values of the test are all negative and larger in absolute terms than standard critical t-values, so they are called ADF statistics. If the null hypothesis cannot be rejected then the series Y_t cannot be stationary. The decision rule is to reject Ho, if the absolute ADF t-statistic > 5% critical values. If otherwise, accept Ho.

Having determined the nature and stationarity of the time series data, this paper further employed cointegration, a statistical method used to test the correlation between two or more non-stationary time series in the long-run or for a specified time period. The method helps in identifying long-run parameters or equilibrium for two or more sets of variables. It helps in determining the scenarios wherein two or more stationary time series are cointegrated in such a way that they cannot depart much from the equilibrium in the long-run.

In actually analyzing equation (4) (the empirical model), this study applied the autoregressive distributed lag (ARDL) cointegration technique. The ARDL model is considered as the best econometric method compared to others in a case when the variables are stationary at I(0) or integrated of order I(1). The long run relationship of the underlying variables is detected through the F-statistic (Wald test). In this approach, long run relationship of the series is said to be established when the F-statistics exceeds the critical value band.

The autoregressive distributed lag model contains the lagged value(s) of the dependent variable, the current and lagged values of regressors as explanatory variables. The major advantage of ARDL lies in its identification of the cointegrating vectors where there are multiple cointegrating vectors. The Error Correction Model (ECM) can be derived from ARDL model through a simple linear transformation, which integrates short run adjustments with long run equilibrium without losing long run information. The associated ECM model takes a sufficient number of lags to capture the data generating process in general to specific modeling frameworks.

Based on this study's objectives, it is a better model than others to catch the short-run and long-run impact of government agricultural investment on the

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growth of agricultural output in Nigeria. However, this technique will crash in the presence of integrated stochastic trend of I(2). To forestall effort in futility, it is wise to test for unit roots first.

However, equation (4) can be written in ARDL form as follows:

$$\Delta InAGD_t = \beta_0 + \sum_{k-1}^{n} \beta_1 \Delta InAGD_{t-k} + \sum_{k-1}^{n} \beta_2 \Delta InGEX_{t-k} + \sum_{k-1}^{n} \beta_3 \Delta InPAP_{t-k} + \sum_{k-1}^{n} \beta_4 \Delta InRWR_{t-k} + \sum_{k-1}^{n} \beta_5 \Delta InAVR_{t-k} + \lambda_1 In\, AGD_{t-1} + \lambda_2 In\, GEX_{t-1} + \lambda_3 In\, PAP_{t-1} + \lambda_4 In\, RWR_{t-1} + \lambda_5 In\, AVR_{t-1} + \phi_t \ldots\ldots\ldots\ldots\ldots\ldots..(6)$$

Where$\beta_0$represents drift component while Δ shows the first difference, $\phi_t$shows the white noise. The study uses the Akaike information criterion (AIC) for choosing the lag length. After finding the long-run association existing between variables, the study uses the error correction model (ECM) to find the short-run dynamics. The ECM general form of Equation (6) is formulated below in Equation (7):

$$\Delta InAGD_t = \beta_0 + \sum_{k-1}^{n} \beta_1 \Delta InAGD_{t-k} + \sum_{k-1}^{n} \beta_2 \Delta InGEX_{t-k} + \sum_{k-1}^{n} \beta_3 \Delta InPAP_{t-k} + \sum_{k-1}^{n} \beta_4 \Delta InRWR_{t-k} + \sum_{k-1}^{n} \beta_5 \Delta InAVR_{t-k} + Ӝ_1 In\, ECM_{t-1} + \phi_t \qquad \ldots\ldots\ldots\ldots\ldots\ldots..(7)$$

Where Δ represents the first difference while Ӝ is the coefficients of ECM for short-run dynamics. ECM shows the speed of adjustment in long-run equilibrium after a shock in the short run.

After analyzing data through Equation (4), the existence of the long-run relation between the variables under investigation is tested by computing the Bound F-statistic (bound test for cointegration) in order to establish a long run relationship among the variables. This bound F-statistic is carried out on each of the variables as they stand as endogenous variable while others are assumed as exogenous variables.

The null hypothesis of no cointegration among variables in eq. (4) can be tested as:

Ho: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$ against the alternative hypothesis of

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq 0$

The post-estimation techniques employed were the cumulative sum of the recursive residuals (CUSUM) and the cumulative sum of squared recursive residuals (CUSUMSQ) to assess the stability of the coefficients of the ARDL

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model. Also, the Breusch-Godfrey test for serial correlation was conducted as well as the Breusch-Pagan LM test to determine whether or not heteroscedasticity is present in an ARDL model.

Result and Discussion

The pre-estimation results are descriptive statistics and augmented Dickey-fuller test results. The summary results of descriptive statistics for the variables incorporated in the model are presented in Table 2.

An examination of 40 observations in Table 2 reveals the mean, median maximum and minimum value, standard deviation, skewness, kurtosis, Jarque-Berra and probability of the data for the variables incorporated in the model. It shows that between 1981 and 2020, agricultural output (AGD), government expenditure on agriculture (GEX), price of agricultural product (PAP), wage rate (RWR) and average rainfall (AVR) averaged about 139.0853, 2138.213, 3208.989, 1387.500, and 2674.973 with the maximum value of 294.2000, 2307.200, 8009.100, 2500.000, and 6998.300 respectively. The corresponding minimum values agricultural output (AGD), government expenditure on agriculture (GEX), price of agricultural product (PAP), wage rate (RWR) and average rainfall (AVR) are 56.06000, 2307.200, 50.20000, 500.0000, and 192.0000 respectively.

Concerning the normality of the variables, firstly, the data indicated a positively skewed distribution for all the variables. These indicate that the distributions for the variables are skewed right, meaning that the right tail of the distributions are longer than the left. The data for GEX, PAP, RWR, and AVR are fairly symmetrical (i.e., between -0.5 and 0.5) while AGD is moderately skewed (between -1 and – 0.5 or between 0.5 and 1). Secondly, the positive values of kurtosis for all the variables indicate that the distributions are peaked. The positive excess values of kurtosis (>3) for AGD variable indicates that the distribution is peaked and possesses thick tail (Leptokurtic distribution) while GEX, PAP, RWR, and AVR variables are have kurtosis (<3) (platykurtic).

Furthermore, the Jarque–Bera test shown in Table 2 is a goodness-of-fit test of whether sample data have the skewness and kurtosis matching a normal distribution. The null hypothesis of this test is a joint hypothesis of the skewness being zero and the excess kurtosis being zero. Table 2 shows that all the variables (AGD, GEX, PAP, RWR, and AVR) have high Jarque-Bera value (note that the null hypothesis for the test is that the data is normally

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distributed; the alternate hypothesis is that the data does not come from a normal distribution. In general, a large J-B value indicates that errors are not normally distributed. A result of 1 means that the null hypothesis has been rejected at the 5% significance level. In other words, the data does not come from a normal distribution. A value of 0 indicates the data is normally distributed). For the AGD, GEX, PAP, RWR, and AVR variables in Table 2, the null hypothesis of normal distribution is rejected. That means the data does not have a normal distribution. However, natural logarithm was applied for all the data for the variables to harmonize or unify the data for robust estimation as seen in Table 3 and thereafter.

Table 2: Descriptive Statistics of Raw Data for the Variables

	AGD	GEX	PAP	RWR	AVR
Mean	139.0853	2138.213	3208.989	1387.500	2674.973
Median	132.6500	2138.465	3129.100	1350.000	875.5000
Maximum	294.2000	2307.200	8009.100	2500.000	6998.300
Minimum	56.06000	2037.840	50.20000	500.0000	192.0000
Std. Dev.	60.36995	68.13359	2556.836	715.1071	2578.368
Skewness	0.736682	0.521996	0.080488	0.312655	0.317574
Kurtosis	3.137494	2.939449	1.611188	1.910828	1.309930
Jarque-Bera	3.649510	1.822642	3.257854	2.628846	5.432917
Probability	0.161257	0.401993	0.196140	0.268629	0.066108
Sum	5563.410	85528.53	128359.6	55500.00	106998.9
Sum Sq. Dev.	142136.7	181045.2	2.55E+08	19943750	2.59E+08
Observations	40	40	40	40	40

Source: Author's computation using Eviews 10 software

Table 3 presents the results of ADF unit root test in the presence of intercept for variables in equation 4 using automatic selection of Schwarz Information Criterion and maximum lag length of 9. The result reveals that the time series variable are either stationary at levels or at first difference. Agricultural output (InAGD), average rainfall (InAVR), government expenditure on agriculture (InGEX), and rural wage rate (InRWR) were all stationary at first difference, i.e., I(1). However, price of agricultural product (InPAP) was stationary at

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level, I(0). For this reason ARDL approach is used for the co-integration of the model.

Table 3: Result of ADF Unit Root Test of the Variables

VARIABLES	AT LEVEL		REMARKS	FIRST ORDER DIFFERENCE		REMARKS
	ADF Test Stat	Order of Integration		ADF Test Stat	Order of Integration	
InAGD	-1.909256	-		-12.59591	I(1)	***
InAVR	-0.922796	-		-2.807688	I(1)	*
InGEX	-1.677759	-		-13.08177	I(1)	***
InPAP	-2.629148	I(0)	*	-8.770748	I(1)	***
InRWR	-0.912154	-		-6.690940	I(1)	***
Note:	Critical Value: 1% = -3.615588 5% = -2.941145 10% = -2.609066			Critical Value: 1% = -3.615588 5% = -2.941145 10% = -2.609066		

Source: Author's computation using Eviews 10 software
Note: * = 10% level of Significance; ** = 5 % level of significance; *** = 1 % level of significance

The result of the cointegration test based on the ARDL bound testing approach is presented in Table 4. In conducting the bound testing, model selection criteria was Akaike information criterion, the coefficient covariance matrix was ordinary, the maximum lag lengths for dependent and regressors were1. For the fixed regressors trend specification, the model chosen was constant. Also, unrestricted constant was examined.The bounds test results reveal that when agricultural output (AGD) is the dependent variable, the calculated F-

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statistics are 2.069079 and 1.858321under constant and unrestricted constant, respectively. Both values are lower than the lower bounds of critical values at 5% significance level, 2.86 and 2.56 respectively. These results suggest that the null hypothesis of no cointegration cannot be rejected when agricultural output (AGD) is the dependent variable.When government expenditure on agriculture (InGEX) is is the dependent variable, the calculated F-statistics are 1.353422 and 1.274166 under constant and unrestricted constant, respectively. Both values are lower than the lower bounds of critical values at 5% significance level, 2.86 and 2.56 respectively. These results suggest that the null hypothesis of no cointegration cannot be rejected when government expenditure on agriculture (InGEX) is the dependent variable.

On the contrary, as depicted in Table 4, when price of agricultural product (InPAP) is the dependent variable, the calculated F-statistics are 5.475484 and 5.530176 under constant and unrestricted constant. Both calculated F-statistic are higher than the upper bound critical value of 4.01 and 3.49, thus the null hypothesis of no cointegration can be rejected when price of agricultural product (InPAP) is the dependent variable. This suggests that there is a cointegration between price of agricultural product (InPAP) and other variables.

The calculated F-statistics are 1.759701 and 2.201290 under constant and unrestricted constant, respectively when rural wage rate (InRWR) is made the dependent variable. Both values are lower than the lower bounds of critical values at 5% significance level, 2.86 and 2.56 respectively. These results suggest that the null hypothesis of no cointegration cannot be rejected when rural wage rate (InRWR) is the dependent variable. Similarly, when average rainfall (InAVR) is the dependent variable, the calculated F-statistics are 0.957188 and 1.216739 under constant and unrestricted constant, respectively. Both values are lower than the lower bounds of critical values at 5% significance level, 2.86 and 2.56 respectively. These results suggest that the null hypothesis of no cointegration cannot be rejected when average rainfall (InAVR) is the dependent variable.

In sum, the results suggest that all other equations except agricultural product (InPAP) do not have any cointegration, it could be concluded that there is only one cointegrating relationship among the above variables.

However, given the objective of this paper which is to examine the impact of government finance on the growth of agricultural sector in Nigeria, the

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relationship of interest isFInAGD (InAGD /InGEX, InPAP, InRWR, InAVR) but bound testing results suggest that the null hypothesis of no cointegration cannot be rejected when agricultural output (AGD) is the dependent variable. This implies that the error correction model should not be estimated (long run) but only the short run ARDL model should be estimated.

Table 4: Bounds Tests for Cointegration

F-statistics	Constant	Unrestricted constant
FInAGD (InAGD /InGEX,InPAP,InRWR,InAVR)	2.069079	1.858321
FInGEX (InGEX /InPAP,InRWR,InAVR,InAGD)	1.353422	1.274166
FInPAP (InPAP/InRWR, InAVR, InAGD, InGEX)	5.475484	5.530176
FInRWR (InRWR/ InAVR, InAGD, InGEX, InPAP)	1.759701	2.201290
FInAVR (InAVR/InAGD, InGEX, InPAP, InRWR)	0.957188	1.216739
F-critical at 5% level*		
Constant	2.86	4.01
Unrestricted constant	2.56	3.49

Source: Author's computation using Eviews 10 software
Note: * critical values are based on Pesaran et al. (2001) for k= 4 and n= 39 at 5% significance level.

Before estimating the short run ARDL, there was need to find the appropriate lag length for the ARDL model which is very important because of having Gaussian error terms (i.e. standard normal error terms that do not suffer from non-normality, autocorrelation, heteroskedasticity, etc.). As such, it was necessary to determine the optimum lag length (k) by using proper selection criteria such as; the Akaike Information Criterion(AIC), Schwarz Bayesian Criterion (SBC) or Hannan-Quinn Criterion(HQC).

Nevertheless, the information from most of the information criteria in Table 5 suggest lag length of zero (0) (FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz Bayesian Criterion; HQ: Hannan-Quinn

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information criterion). However, one year lagged value of the dependent variables was introduced in the estimated short run ARDL.

Table 5: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	53.85981	NA*	0.004181*	-2.641071*	-2.423379*	-2.564324*
1	54.12116	0.437951	0.004356	-2.601144	-2.339914	-2.509048
2	54.77631	1.062399	0.004446	-2.582503	-2.277735	-2.475058
3	55.40328	0.982824	0.004547	-2.562340	-2.214033	-2.439545

Source: Author's computation using Eviews 10 software
Note: * indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The result of the short run ARDL coefficients is presented in Table 6. The ARDL short-run dynamic results show that in the short-run, government expenditure on agriculture D(InGEX) is statistically significant at 1% level while other variables are insignificant.Specifically, the lagged value of agriculture output D(InAGD(-1)) showed an inverse relationship with agricultural output in the current year. Nonetheless, this result was statistically insignificant.However, it should be noted that despite the contribution to the economy, Nigeria's agricultural sector faces many challenges which impact on its productivity. These include; poor land tenure system, low level of irrigation farming, climate change and land degradation. Others are low technology, high production cost and poor distribution of inputs, limited financing, high post-harvest losses and poor access to markets. These challenges continue to stifled agricultural productivity in the country (FAO, 2021).

The relationship between government expenditure on agriculture D(InGEX) and agricultural output is positive and statistically significant in the current year at 1% significant level. The result shows that one unit increase in government expenditure on agriculture leads to 0.14 per cent increase in agricultural output.Nonetheless, Nigeria's spending on agriculture has remained significantly below the Maputo target of 10 percent. On average, government allocated just 1.9 percent of its annual budget to agriculture in 2010–15, with a low of 0.9 percent in 2015 (OXFAM, 2017). However, the result of this study aligns with Falana (2021) whose finding shows that public agricultural expenditure in Nigeria affects agricultural output positively.

The relationship between average annual rainfall (D (InAVR)) and agricultural output is positive as expected, but it was statistically insignificant in the current year. It should be noted that Nigeria like many African countries, which have their economies largely based on weather-sensitive agricultural productions systems, are particularly vulnerable to climate change (Dinar et al, 2006). This vulnerability has been demonstrated by the devastating effects of recent flooding in the Niger Delta region of the country and the various prolonged droughts that are currently witnessed in some parts of Northern region.

Table 6 shows that a one unit increase in price of agricultural product (D(InPAP)) in the current year leads to 0.011066 per cent increase in agricultural output in the current year. However, this relationship is statistically insignificant at any of the conventional significant levels. Though to encourage farmers to produce more and ensure food sufficiency for Nigeria, the government plans to implement a buy back scheme to guarantee minimum price for agricultural products (Udo, 2016).

Finally, one unit increase in rural wage rate D (InRWR)) leads to 0.027695 per cent increase in agricultural output.That means that if rural wage rate in the agriculture sector is high in Nigeria, agricultural productivity will be high. However, Christiaensen et al. (2017) observed that because of the increased participation of labour in off-farm activities which culminated in scarcity of farm labour and rising labour wage rate, there is great fear that agricultural growth and development may be retarded and the whole effort of achieving

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self-sufficiency in food crop production in Nigeria would be a mirage. Nevertheless, the relationship between rural wage rate (D(InRWR)) and agricultural output in this study appears to be positive and statistically insignificant in the current year.

Table 6: ARDL Short-Run Dynamic Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003659	0.007943	0.460638	0.6482
D(InAGD(-1))	-0.000437	0.034394	-0.012712	0.9899
D(InGEX)	11.78541	0.419831	28.07181	0.0000
D(InPAP)	0.011066	0.015249	0.725706	0.4733
D(InRWR)	0.027695	0.058576	0.472806	0.6396
D(InAVR)	0.000720	0.021759	0.033105	0.9738

R-squared	0.977637	Mean dependent var	0.021584
Adjusted R-squared	0.974142	S.D. dependent var	0.268179
S.E. of regression	0.043124	Akaike info criterion	-3.305534
Sum squared resid	0.059510	Schwarz criterion	-3.046968
Log likelihood	68.80514	Hannan-Quinn criter.	-3.213538
F-statistic	279.7826	Durbin-Watson stat	2.070205
Prob(F-statistic)	0.000000		

Source: Author's computation using Eviews 10 software

To assess the stability of the short-run coefficients of the ARDL model in Table 6, CUSUM and CUSUMSQ tests proposed by Brown et al. (1975) was used. The tests are based on the cumulative sum of the recursive residuals (CUSUM)and the cumulative sum of squared recursive residuals (CUSUMSQ) and are ofa graphical nature whereby the residuals are updated recursively and are plotted against the break points for the 5% significance line. The short-run coefficients are stable if the plot of CUSUMSQ and CUSUM stay within the 5% significance level. Figure 1(CUSUM) shows that the ARDL model appears to be within the 95% critical bounds, implying that all coefficients in the ARDLmodel are stable over the sample period. However, the CUSUM of squares in Figure 2 shows that there is slight deviation from the 95% critical

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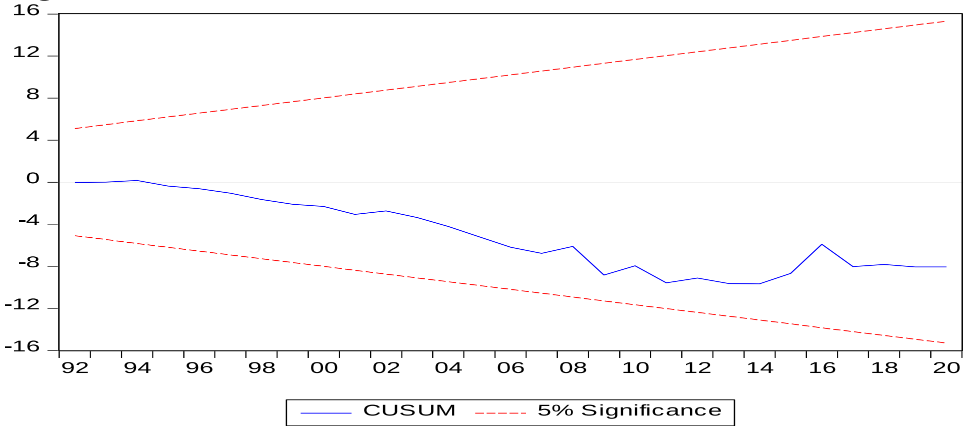
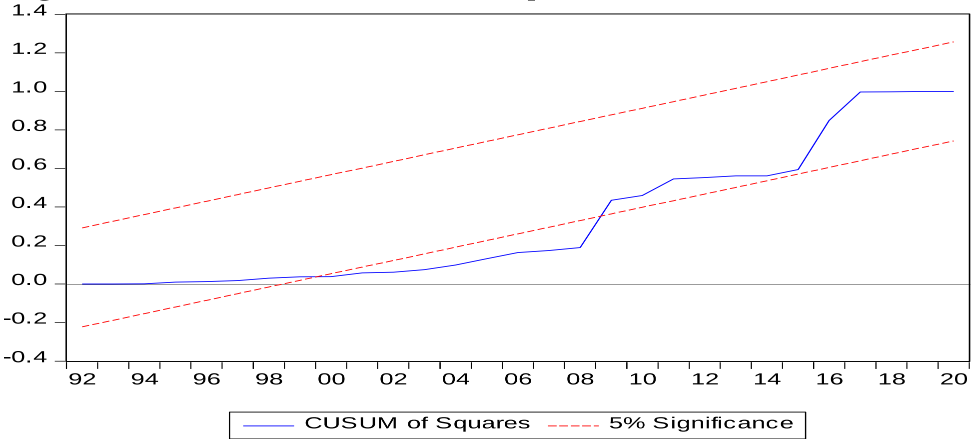
bounds over a period, then the model is stable afterwards. The implication is that this short run ARDL model may be suffering from a bit of structural break.

Figure 1: Plot of the CUSUM for the Short-run ARDL Model



Source: Plotted by author using Eviews 10 software

Figure 2: Plot of the CUSUM of Squares for the Short-run ARDL Model



Source: Plotted by author using Eviews 10 software

In a similar manner, residual diagnostics was also carried on the short run ARDL model in Table 6. Firstly, Breusch-Godfrey test for serial correlation was conducted to see if different lags of the residuals are correlated. From Table 7, it can be seen that the probability Chi-Square (0.4040) is greater than 0.05 at 5% significant level. It can be concluded that the residual in the short-run ADRL model is not serially correlated.

Secondly, to test that all residuals in the ADRL model have a constant variance (i.e., heteroscedasticity test), the Breusch-Pagan LM test was conducted. The result of Table 8 shows that the probability of the Obs*R-square (0.7650) is

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greater than 0.05. In that, we do not reject the null hypothesis of homoscedasticity or constant variance of the residual.

Table 7: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.751400	Prob. F(2,30)	0.4804
Obs*R-squared	1.812740	Prob. Chi-Square(2)	0.4040

Source: Author's computation using Eviews 10 software

Table 8: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.193424	Prob. F(5,32)	0.9628
Obs*R-squared	1.114765	Prob. Chi-Square(5)	0.9528
Scaled explained SS	2.576042	Prob. Chi-Square(5)	0.7650

Source: Author's computation using Eviews 10 software

Summary, Conclusion and Recommendation

In contrast to the teeming investment in agriculture in Nigeria, the country is still at the mercy of food insecurity. This study empirically assessed the impact of government agriculture investment on agriculture output in Nigeria using annual time series data from 1981 to 2020. Secondary data were collected from Central Bank of Nigeria Statistical Bulletin and some econometric techniques were deployed.TheAugmented Dickey fuller (ADF) test was used to test the stationarity of data. The result reveals that the time series variable are either stationary at level or at first difference. For this reason ARDL approach is used for the co-integration of the model. The result of the cointegration test based on the ARDL bound testing approach suggest that all other equations except agricultural product (InPAP) do not have any cointegration, it could concluded that there is only one cointegrating relationship among the variables.

However, given the objective of this study which is to examine the impact of government agriculture investment on agriculture output in Nigeria, the relationship of interest is FInAGD (InAGD /InGEX, InPAP, InRWR, InAVR) but bound testing results suggest that the null hypothesis of no cointegration cannot be rejected when agricultural output (AGD) is the dependent variable. This implies that the error correction model should not be estimated (long run) but only the short run ARDL model should be estimated.

The ARDL short-run dynamic results show that in the short-run, government expenditure on agriculture D(InGEX) is statistically significant at 1% level while other variables are insignificant. In sum, the finding of this paper shows that government expenditure on agriculture in Nigeria affects agricultural output positively. As such, the government of Nigeria should increase the budgetary allocation to the agricultural sector to boost crop/food production, make consistent policies and judicious use of allocated resources. This can be done by critically examining the dominance of investments in infrastructure, private sector projects and research institutions. It should redirect sufficient support to small-scale farmers, for example irrigation, seed and fertilizer, extension services, access to credit and mechanization. In addition, it should support women farmers.

Furthermore, both government and private sector should put effort to drive the agricultural sector through consistent policies, robust funding, and infrastructural development. Similarly, foreign investments should be attracted to the agricultural sector, especially in the areas of physical assets development.

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