Assessing the Impact of Government Expenditure on Agricultural Output in Nigeria

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ABSTRACT

This paper examined the impact of Government expenditure on agricultural output *in Nigeria. Data for the study were collected mainly from secondary sources from 1981 to 2018 covering a period of 38 years. Inferential statistics such as Co-integration Test and Error Correction Model (ECM), Logit Regression model and Augmented Dickey-Fuller (ADF) test were employed to analysis the data. From the study, the result of Error Correction Model indicated that private investment, precipitation, rural population, and electricity are significant determinants of agricultural output per farmer. The result of the Logit Regression model revealed that government capital expenditure, private investment, foreign direct investment, rainfall, rural population, and electricity were key drivers that impacted government capital expenditure on agricultural output per farmer. The result of augmented Dickey-Fuller test indicates that all variables included in the model were stationary at first differentiation (1(1)) except for the logs of rural population and foreign direct investment. The study demonstrated that government capital expenditure had long run relationship with* agricultural output. *Overall, the significant determinants of* agricultural output *in this study, were government capital expenditure, private investment, Foreign Direct Investment, rainfall, rural population, and electricity which means if the past government capital agricultural expenditure, private investment, Foreign Direct Investment, rainfall, rural population, and electricity increased by 1% respectively, this would invariably increase* agricultural output *per farmer in the long-run. The study recommended that government's agricultural expenditure should be adjusted to place emphasis on capital expenditure and to ensure that the capital budget was implemented fully. Government agricultural expenditure should also be prioritized to favour investments in rural electrification, research and economy development that would improve agricultural output in Nigeria.*

Keywords: Agricultural Output, Government Expenditure and Regression analysis

Introduction

Agricultural output (cereals, grains, roots, and tubers), animal husbandry, fisheries, and forests are all included in the definition of agriculture. According to the Central Bank of Nigeria (CBN), the agricultural output (food crop) sub-sector contributed between 75-76% of the agricultural sector's GDP, with the remaining percentage coming from the livestock, forestry, and fisheries sub-sectors (CBN, 2018). In light of the fact that agricultural output production not only provides food for the populace but also raw materials for manufacturing, employment opportunities, and income for the populace, as well as foreign currency from export activities, it follows that food agricultural output production is essential to agricultural activities. This industry, if properly utilised, would significantly and favourably impact the GDP. Poor agricultural output production in Nigeria is caused by a number of variables, such as yearly precipitation, access to inputs, inadequate storage facilities, the prevalence of pests and diseases, a lack of fertiliser, and lack of extension services (Zaknayiba and Tanko, 2013 and Maikasuwa, and Ala, 2013). However, of most importance is the decline in spending/investment in agriculture by the government (Ayunku and Etale 2015 and Ewubare, and Eyitope, 2015).

Government expenditures encompass all government spending and investments and transfer in the course of governance. Traditionally, it has been separated into recurrent and capital expenditure. While capital expenditures refer to spending on the creation of fixed assets, provision of infrastructure- such as the purchase of land, the construction of schools, irrigation systems, and hospitals, as well as the acquisition of other significant tangible assets, recurrent expenditures primarily refer to spending on salaries, wages, operations, current grants, and the purchase of goods and services (CBN, 2018). To maintain the proper running of society, these expenditures are subsequently distributed to important economic sectors including agriculture, education, health, and security, among others.

The Nigerian government's expenditure on agriculture has varied considerably since the nation's independence, gradually declining over time. The low and sluggish increase of agricultural output production was thought to be significantly impacted by this fall in agricultural expenditures (Alabi, 2014, Ewubare and Eyitope 2015). The underperforming agricultural sector, according to Olomola, *et al* in 2015, is to blame for Nigeria's current economic problems. The agriculture industry in Nigeria is experiencing problems that are preventing the growth of agricultural outputs. The Crop subsector GDP contributions decreased from 24% in 2001 to 21% in 2014. The Nigerian agricultural outputs production industry's ability to guarantee food security for the nation's growing population is further hampered by the decreased agricultural output. For instance, while the production of agricultural outputs (food crops) is only increasing by 3.7% each year, the annual demand for food in Nigeria is rising by 6.5%. (Action Aid 2015).

Accordingly, Oguntade (2014) stated that increased government expenditure on agriculture, will help farmers get better inputs like seeds and agrochemicals among others. Government spending on agriculture, if properly managed, might also increase access to agricultural extension services like processing farm produce and rural infrastructure like roads connecting farmers to markets. Like this, financial support from the government will give farmers access to agribusiness loans and storage options, reducing the estimated 40–60 percent post-harvest losses (Alabi, 2014).
The importance of the agricultural output subsector of agricultural production in Nigeria cannot be overstated, as it provides staple foods for human consumption and raw materials for

livestock and other industries. Insecurity has hampered the nation's agricultural output production over the past decade and even more recently. To ensure that the threat to food availability and food security does not exceed the current inadequate thresholds, the government and other key stakeholders are primarily concerned with overcoming this obstacle. Since the budget is a tool for stimulating agricultural production, examining the impact of government agricultural spending on agricultural outputs production in Nigeria is an intriguing and deserving topic of study.

Many have questioned the efficacy and repercussions of government spending on agriculture, despite the fact there are lack of empirical studies to examine government expenditures on agricultural output and this create research gap which this study designed to address. Although, empirical studies have revealed that public funding alone is insufficient to finance the agricultural industry (Benin, 2017) but according to Food and Agricultural Organization (2013), there is no doubt that agriculture requires additional public resources. Foreign Direct Investment (FDI), Overseas Development Assistance (ODA), and remittances play complimentary roles in government agriculture expenditure discussions. Furthermore, development economists have found that the effects of various types of government expenditure on agricultural productivity may vary (Alabi and Abu 2020). Similar to how the degree of the effects of different functional investments in agriculture may vary, government agricultural expenditures may similarly vary according to the goods being targeted (Alabi and Abu 2020). Therefore, studies that advocate raising agricultural expenditures without paying special attention to the varied effects of various types of agricultural investments may not produce the optimal results if implemented. Despite numerous studies on the impact of government expenditures (budget) on agriculture in Nigeria, little is known about the impact of capital and recurrent government expenditures in particular on agricultural output in Nigeria. These are the information gaps that the study aims to address.

METHODOLOGY

Data Required and their Sources.

Data for this study were collected mainly from secondary sources. Data from the Central Bank of Nigeria (CBN) Statistical Bulletin were used to calculate government agriculture expenditures on crop production (million Naira), average rainfall (millimeters), agriculture subsidies (million Naira), agriculture private investment (million Naira), rural development (million Naira), agriculture Research and Development (R&D) expenditure (million Naira), agriculture irrigation (million Naira), agriculture ODA and FDI (USD prices). Private investment in agriculture serves as a stand-in for Gross Fixed Capital formation (GFCF). The depreciated value of gross fixed capital formation used each year was constructed using the following capital formation approach:

Value of GFCF = $GFCF_{year\ X}$ (Knoema, 2019) 1

Where,

$GFCF_{year}$ = Gross Fixed Capital Formation for year under consideration,

δ = Depreciation rate. δ is available in Pen World Table 9.1 (Knoema, 2019). Unemployment data is also available in WDI (2019). Expenditure data were obtained from the

Federal ministries of agriculture and Office of the Accountant General of the Federation in the FCT Abuja.

Method of Data Analysis

Inferential statistics such as Growth Model Estimation, Co-integration, and Error Correction Model (ECM) and t-test were used for the analysis of the relevant data in this study.

Co-integration Test and Error Correction Model (ECM) Analysis

Co-integration and Error Correction Model analyses were conducted in order to assess the long and short run effects of government (capital, recurrent, and total) spending on agricultural output in Nigeria. In Nigeria, co-integration and error correction model studies were done between government expenditure and agricultural output to investigate the impact of government capital agricultural expenditure on agricultural output. It was the same for both the governments' recurrent and total agriculture expenditure.

Co-integration analysis was utilised with non-stationary data to avoid erroneous regressions (McKay *et al*., 1999). In conjunction with the error correction model (ECM), it enabled the calculation of consistent and differentiated long-run and short-run elasticities. The first phase of co-integration analysis was testing the order of integration of the variables. A series is termed integrated if it accumulates past influences to the extent that, after a disturbance, it rarely returns to its 'mean' value; therefore, it is non-stationary. The sequence of integration was decided by the number of differentiations of a stationary series. If series are integrated in the same order, a linear relationship between these variables can be inferred, and co-integration can be determined by analysing the order of integration of this linear relationship. Formally, variables are co-integrated (m,n) if they are integrated to the same order, n, and if there exists a linear combination between them with an order of integration m-n that is strictly less than that of either variable. In practice, economists seek co-integrated interactions that are steady, as only such relationships can be used to characterize long-term stable equilibrium states. Before performing the co-integration test, the studied time series were inspected for the presence of a unit root (Moroza, 2008). To determine if the time series were stationary or non-stationary, the Augmented Dickey – Fuller test (ADF) (Kwaitkowski *et al*., 1992) was conducted, and co-integration testing was then performed.

RESULTS AND DISCUSSION

The Impact of Government Expenditure on agricultural output Production in Nigeria

The findings of the Augmented Dickey-Fuller (ADF) test for unit roots in the variables used to estimate the impact of government agricultural expenditure on agricultural output in Nigeria are presented in Table 1 Except for the logs of rural population and Foreign Direct Investment, all variables were stationary at first differentiation (1(1)) except for the logs of rural population and foreign direct investment (FDI). In other words, all other variables included in the model were differenced to make them stable, but the logs of rural population and FDI were used at their levels (1(0)).

Table 1 shows that FDI and rural population stationary at levels. This means that they are of the order 1(0).

Table 1: Augmented Dickey-Fuller (ADF) test for unit root
Source: Computed by the Author 2022

	At Level		After Differencing		
Variables	Test Statistics	Critical Value at 1%	Test Statistics	Critical Value at 1%	Remark
Log Crop GDP per Farmer	0.119	-3.696	-5.544	-3.702	I(1)
Log Crop Total Public Expenditure per Farmer	-2.421	-3.702	-8.347	-3.709	I(1)
Log Crop Capital Expenditure per Farmer	-0.576	-3.702	-4.662	-3.702	I(1)
Log Crop Recurrent Expenditure per Farmer	-2.302	-3.702	-8.021	-3.709	I(1)
Log Private Investment per Farmer	-1.308	-3.696	-5.582	-3.702	I(1)
Log Subsidy Expenditure per Farmer	-0.166		-4.517	-3.709	I(1)
Log Rural Infrastructure Expenditure per Farmer	-0.166	-3.702	-4.521	-3.709	I(1)
Log Rand D Expenditure per Farmer	-0.169	-3.702	-4.524	-3.709	I(1)
Log Irrigation Expenditure per Farmer	-0.165	-3.702	-4.514	-3.709	I(1)
Log ODA	-0.989	-3.696	-4.262	-3.702	I(1)
Log FDI	-5.819	-3.696	-25.949	-3.702	I(0)
Log NAGPE	-1.505	-3.696	-7.627	-3.702	I(1)
Log Rainfall	-3.501	-3.696	-7.776	-3.702	I(1)
Log Rural Population	-5.971	-3.696	-5.830	-3.709	I(0)
Log Electricity consumption (Kilowatt)	-2.391	-3.696	-7.945	-3.702	I(1)

This is because their critical values at levels are less than the values of the test statistics. For example, for FDI the critical value (at 1% significance level) at level is 3.696, while the test statistics is 5.819. For rural population, the critical value (at 1% significance level) at level is 3.696, while the test statistics is 5. 971. For, other variables specified in the study, their critical values (at 1% significance level) at level are higher than their test statistics. For example, for crop GDP the critical value (at 1% significance level) at level is 3.696, while the test statistics is 0.119. This suggests that those variables that are not stationary at levels have to be differenced to make them stationary. Edeh *et.al*, (2020) states that after examining the time series data for stationarity, the variables were found to be 1(0) and 1(1) having a long run relationship in the model. When this is done, variables that are not stationary at levels become stationary after first differencing, hence they are of the order 1(0) as reported in the table below

Regression Result of the Impact of Government Capital Expenditure on Crop Production (Long and Short Run)

Table 2 displays the results of a regression examining the effect of government capital investment on crop output in the long and short run. The table revealed an F value of 1122.20, which is statistically significant at the 1% level. The adjusted R Squared value of 0.9964 indicates that lagging government agricultural capital expenditure, private investment, NAGPE, ODA, FDI, rainfall, rural population, and electricity can account for 99.64% of the variance in crop production per farmer. Government capital expenditure, private investment, FDI, rainfall, rural population, and electricity are the key drivers of the effect of government capital expenditure on agricultural output production per farmer. All explicative variables are appropriately signed in accordance with a priori assumptions.

In addition, Table 2 demonstrates that the regression coefficient of lagged government capital agriculture expenditure is 0.1438 and positive. This suggests that agricultural output per farmer will grow by 0.1438% if government expenditure on agricultural capital increases by 1%. It also indicated that an increase in agricultural capital expenditures by the government will enhance crop production (agricultural output) in Nigeria. This study's coefficient of 0.1438 compares favorably to Alene and Coulibaly's (2009) estimated elasticity of 0.17, although it is lower than Thirtle *et. al,* estimate's of 0.36. (2003). In their studies carried out in parts of Africa, Asia and Latin America, estimations were conducted using simultaneous equation systems, and the potential endogeneity of explanatory variables was handled using their lagged values. The result of this analysis verifies the assumption that the effect of government agricultural spending materializes with lags, as the lagged government capital expenditure on agricultural output production is, in our judgement, considerable. The estimated elasticity of 0.1438 falls within the typical range of 0.10–0.30 for Africa (Goyal and Nash, 2017; Benin, 2015).

The private investment regression coefficient was 0.0851. This suggests that agricultural output per farmer will increase by 0.0851 percent if private investment increases by 1percent. The result of 0.0851 is similar to the projected 0.12 impact of private farm investment on the value of per capita household total agricultural output in Ghana (Benin, *et.al*, 2009). The large and positive association between private investment and agricultural output per farmer highlights the significance of private investment in Nigeria's agricultural output. The positive and strong relationship between lagging government expenditures and private investment suggests that government agricultural expenditures can attract rather than dissuade private agricultural investment.

FDI has a regression coefficient of 0.0271. This suggests that agricultural output per farmer will grow by 0.0271 percent if FDI increases by 1 percent. Although the impact of FDI may be small given the estimated regression coefficient value of 0.0271 (which is significant and positive at only a 10% level of significance), this value is greater than the estimated regression coefficient value of 0.0119 for ODA, which is not significant even at a 10% level of confidence. This illustrates that Nigeria can give FDI money precedence over ODA. Alabi (2014) observed that the influence of ODA on agricultural output in Africa was limited. He reported that bilateral foreign agricultural help has a greater impact on agricultural productivity than multilateral aid, although multilateral aid has a greater impact on agricultural GDP.

The rainfall regression coefficient was 0.2110. This indicated that rainfall had a positive and statistically significant association with agricultural output per farmer in Nigeria. This also highlights the significance of favourable weather conditions in enhancing agricultural output in Nigeria. Benin *et.al.* (2009) showed that the effect of weather conditions (rainfall) varies by crop output. Specifically, he predicted a positive and substantial influence of rainfall in the cocoa sector model, but a negative and non-significant association between rainfall and output in the non-cocoa sector model (Benin, 2017). Allen *et.al*, (2012) showed that precipitation appeared to have a nonlinear connection with crop output, as excessive precipitation in one region throughout a season can be detrimental to crop output. Literature documents this nonlinear and strong link between climatic variables and agricultural production (Maddison *et al.*, 2006). Ike and Inoni (2006) also demonstrated that rainfall is a limiting factor in the production of certain agricultural output s (tubers) in Nigeria.

The rural population regression coefficient is 3.1708. This indicates that rural population (from which labour supply is sourced) has a significant and positive association with crop output per farmer in Nigeria.

The electricity generation regression coefficient is 0.4616. This suggests that agricultural output per farmer will grow by 0.4616 percent if energy generation increased by 1 percent. This is consistent with Arjun and Alan's research (1975). They noted that a steady electricity supply is one of the many critical prerequisites for a substantial increase in Africa's agricultural output. This is because farmers in the majority of African nations have limited and expensive access to fuel and power for agricultural operations and crop processing. Additionally, Lu (2017) cites a positive and considerable effect of power generation on GDP growth. In his analysis, he demonstrated a long-run equilibrium link and bidirectional Granger causation between electricity and economic growth. According to his findings, a 1% increase in electricity usage increases the real GDP by 1.72 percent.

Table 2: Regression Result of the Impact of Government Capital Expenditure on Agricultural Output (Long and Short Run)

Long Run	Dependent Variable is Crop GDP per Farmer			Short Run	Dependent Variable is d.(Crop GDP per Farmer)		
		F(8, 24)	1122.2			F(9, 22)	13.37
		Prob > F	0.0000***			Prob > F	0.0000
		R-Squared	0.9973			R-squared	0.8455
		Adj.R-squared	0.9964			Adj R-squared	0.7822
Variables	Coefficient	T_ratio	P>(t)	Variables	Coefficient	T_ratio	P>(t)
Government Capital Expenditure$_{(t-1)}$	0.1438***	2.29	0.000	d.(Capital Expenditure) $_{(t-1)}$	0.1699***	3.01	0.006
Private Investment	0.0851***	4.07	0.000	d.(Private Investment)	0.0965***	4.40	0.000
NAGPE	-0.0639	-1.51	0.143	d.(NAGPE	-0.0090	-0.18	0.855
ODA	0.0119	1.62	0.118	d.(ODA)	0.0087	0.92	0.367
FDI	0.0271*	1.77	0.089	FDI	0.0321*	1.95	0.064
Rainfall	0.2110***	3.46	0.002	d.(Rainfall)	0.2081***	4.36	0.000
Rural Population	3.1708***	16.88	0.000	Rural Population	3.5228	1.02	0.317
Electricity	0.4616***	5.98	0.000	d.(Electricity)	0.3552***	4.67	0.000
				ECM	-0.8409***	-3.41	0.003
Constant	-48.2501***	-15.74	0.000	Constant	-0.1139	-1.24	0.229

Source: Computed by the Author from Data obtained from the Federal Ministry of Finance, Abuja,2O22*** and * Significant at 1% and 10%, respectively.

The Regression Results on the Impact of Government Recurrent Expenditure on agricultural output (Long and Short Run).

Table 3 provides regression Result of the Impact of government recurrent expenditure on agricultural output (Long and Short Run). The estimated error correction model (ECM) under the short run model in Table 3 is -0.8367, and its significance at the 1% level indicated the existence of co-integration between the variables indicated in the equation in Table 3. The ECM value of -0.8367 showed a probability of 83.67 percent that the short run disturbance in the government recurrent expenditure would result in a long run link between the variables. All variables that were important in the short run were also significant in the long run, with the exception of rural population, which was not significant in the short run but was in the long run. This may be because small-scale farming allows farmers to rely on family labour. Nonetheless, as farm size expands, so does the demand for laborers in the Long-term,

Table 3 displays an F value of 597.17, which is statistically significant at the 1% level. This indicates that the variables listed in Table 3 together explained the variation in agricultural output per farmer in Nigeria. The adjusted R Squared value of 0.9933 suggests that all exogenous variables in the model accounted for 99.33% of the variation in crop production per farmer. Private investment, precipitation, the rural population, and electricity are significant determinants of agricultural output per farmer.

The regression coefficient of lagged government recurrent expenditure is -0.0014, as shown in Table 3 indicates that an increase in past government recurrent expenditures has no significant effect on agricultural output production per farmer in Nigeria, as it is not significant even at 10%. Kenny (2019) who investigated the role of Agricultural sector performance on economic growth in Nigeria revealed amongst other findings that Agricultural Credit had positive but statistically insignificant impact on GDP.

The private investment regression coefficient was 0.1015. This suggests that agricultural production per farmer will grow by 0.1015 percent if private investment increases by 1 percent. This is close to a 0.12 impact estimate of private farm investment on the per capita value of total household agricultural output (Benin *et. al.*, 2009). The large and positive association between private investment and crop yield per farmer highlights the significance of private investment in Nigerian agricultural production.

The rainfall regression coefficient was 0.2372. This indicated that precipitation had a significant and positive relationship with crop production per farmer in Nigeria. In addition, this highlights the significance of weather conditions in enhancing agricultural production in Nigeria

Benin, (2017), reported a negative and non-significant association between rainfall and production in the non-cocoa sector model. The rural population regression coefficient was 3.5035. This indicated that rural population (from which labour supply is sourced) had a significant and positive association with crop production per farmer in Nigeria. The electricity consumption regression coefficient was 0.5200. This indicated that agricultural output per farmer will grow by 0.52. % if energy generation increased by 1%. This is consistent with Arjun and Alan's findings (1975). They noted that a steady electricity supply is one of several critical prerequisites for a substantial increase in Africa's agricultural production. This is because farmers in the majority of African nations have limited and expensive access to fuel and power for agricultural operations and crop processing. Additionally, Lu (2017) cited a positive and considerable effect of power generation on GDP growth. In his analysis, he demonstrated long run equilibrium link and bidirectional Granger causality between electricity and economic growth. According to his findings, a 1% increase in electricity usage increases the real GDP by 1.72 percent. Multiple studies have revealed that electricity usage is a significant factor in GDP growth (Ogundipe, 2013).

Table 3: Regression Result of the Impact of Government Recurrent Expenditure on Agricultural output (Long and Short Run)

Long Run	Dependent Variable is Crop GDP per Farmer			Short Run	Dependent Variable is d.(Crop GDP per Farmer)		
		F(8, 24)	597.17***			F(9, 22)	10.50***
		Prob > F	0.000			Prob > F	0.000
		R-squared	0.995			R-squared	0.8112
		Adj.R-squared	0.9933			Adj R-squared	0.7339
Variables	Coefficient	T_ratio	P>(t)	Variables	Coefficient	T_ratio	P>(t)
Recurrent Expenditure$_{(t-1)}$	-0.0014	-0.08	0.938	d.(Recurrent Expenditure) $_{(t-1)}$	0.0090	0.74	0.469
Private Investment	0.1015***	3.59	0.001	d.(Private Investment)	0.1078***	4.48	0.000
NAGPE	-0.1029*	-1.78	0.089	d.(NAGPE	-0.0519	-0.86	0.401
ODA	0.0170	1.60	0.122	d.(ODA)	0.0025	0.26	0.801
FDI	0.0127	0.61	0.546	FDI	0.0001	0.01	0.995
Rainfall	0.2372***	2.83	0.009	d.(Rainfall)	0.2120***	4.00	0.001
Rural Population	3.5035	12.37***	0.000	Rural Population	-2.6802	-0.67	0.509
Electricity	0.5200	4.92***	0.000	d.(Electricity)	0.4315	5.36***	0.000
				ECM	-0.8367	-3.87***	0.001
Constant	-53.4721	-11.05***	0.000	Constant	0.0855	0.82	0.421

Source: Computed by the Author from Data obtained from Federal Ministry of Finance, Abuja, 2022 * and *, Significant at 1% and 10%, respectively**.

CONCLUSION

The impact of Government expenditures on agricultural output in Nigeria was examined in the paper. From the study, it was revealed that variables such as private investment, foreign direct investment (FDI), rainfall, rural population, and electricity were key drivers that influenced or impacted government capital expenditure on agricultural output per farmer. This indicates that government capital expenditure had long run relationship with agricultural output in Nigeria. The study further revealed that the significant determinants of agricultural output were government capital expenditure, private investment, Foreign Direct Investment (FDI), rainfall, rural population, and electricity.

To this end, government's agricultural expenditure should be adjusted to place emphasis on capital expenditure and to ensure that the capital budget was implemented fully in such a way that would impact on agricultural output in Nigeria.

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