

Original Research Paper

ANALYSIS OF AGRICULTURAL PUBLIC CAPITAL EXPENDITURE AND AGRICULTURAL ECONOMIC GROWTH IN NIGERIA 1961 - 2010

ABSTRACT

Aims: This study investigated the impact of agricultural public capital expenditure on agricultural economic growth in Nigeria over the period 1961 to 2010.

Study design: The data used for the study was obtained from Central Bank of Nigeria 2010 statistical bulletin and annual report.

Methodology: The Augmented Dickey-Fuller test was used in testing for the stochastic property of the series (unit root test) and the cointegration test was conducted using Engle and Granger two step cointegration test.

Results: The result of the Engle and Granger cointegration showed that there exist a long run relationship between all the explanatory variables and explained variable. The Error Correction Mechanism (ECM) indicated that if the economy is out of equilibrium, 12% of disequilibrium will be corrected for annually.

Conclusion: The study therefore recommends that the proportion of government capital expenditure that goes into agricultural expenditure financing should be increased. Since this exerts significant positive effects on agricultural economic growth.

Keywords: *Agricultural capital expenditure, Agricultural economic growth, cointegration, Long run, Error Correction Mechanism*

1. INTRODUCTION

In an agrarian economy like the type that exists in Nigeria, agricultural production provides the needed fulcrum upon which a sustainable development would blossom [5]. Apart from being the main source of food for most of the population, the agricultural sector contributes substantially to GDP and thus has remained vital to the Nigerian economy [13]. It provides the means of livelihood for over 70 percent of the population, plus being a major source of raw materials for the agro-allied industries as well as a potent source of the much needed foreign exchange earnings ([38]; [30]).

According to the [8], the Federal Government of Nigeria on a yearly basis often allocates funds to the various sectors of the economy for the overall development of the nation. Thus part of the seriousness of government to sustain the agricultural sector can be evidenced on its various allocations to this sector of the economy.

Government spending is referred to as an outflow of resources from government to other sector of the economy [28]. Government spending or public spending is sub-divided into current and capital expenditure. Capital expenditure has been defined as payment for non-financial assets used in production while current expenditures are payments for non-repayable transactions within a year [8].

In Nigeria, government expenditure has continued to rise due to the huge receipts from production and sales of crude oil, and the increase demand for public goods like roads, communication, power, education, health, among others [28]. Available statistics show that total government expenditure (capital and recurrent) and its components have continued to rise in the last three decades. Government capital expenditure rose from N5,004.60 million in 1977 to N10,163.40 million in 1980 and further to N24,048.60 million in 1990. The value of capital expenditure stood at N239,450.90 million and N759,323.00 million in 2000 and 2001, respectively. Furthermore, the agricultural component of capital expenditure also shows a rising trend between 1977 and 2007 [28].

Agricultural growth is associated with performance in four constituent sub-sector, crops, livestock, fisheries and forestry. The crop sub-sector had, on average, the largest share of production, followed by livestock, forestry and the fishery sector, which grow substantially in the past 1974 period. Currently, the crops subsector contribute up to 85% of the agriculture GDP, while livestock contributes about 10%, fisheries about 4%, and forestry about 1%. On a comparative basis, the share of the crop sector declined up to the early 1980s while the performance of fisheries steadily improved over the past 50 years. Nevertheless, the crops subsector over all remains the dominant agricultural economy of Nigeria. Accordingly, the growth performance of the agriculture sector has been largely driven by the performance of the crop sub-sector [11]

According to [16], the Nigerian economy has had a truncated history. In the period 1960 – 70, the Gross Domestic Product (GDP) recorded an average of 3.1 percent growth annually. During the oil boom era, roughly 1970 – 78, GDP grew positively by 6.2 percent annually which is a remarkable growth. However, in the 1980s, GDP had negative growth rates. In the period 1977 – 1988 the GDP responded to economic adjustment policies and grew at a positive rate of 4.0%. In the years after independence, industry and manufacturing sectors had positive growth rates except for the period 1980 – 1988 when industry and manufacturing grew negatively by -3.2 percent and -2.9 percent respectively. According to [32], real annual growth rate of gross domestic product from 2000 to 2007 in the Nigerian economy averaged 8.8 percent, while the agricultural sector grew at 3.7 percent in 2007. Though agriculture accounts for about 40 percent of GDP, the level of growth in this sector is unsatisfactory and has lagged behind other sectors due to variety of factors.

A catalogue of reasons has been advanced for the relative poor performance of Nigeria's agricultural sector. Key among these include interest and foreign exchange rate volatilities, poor infrastructure base, policy inconsistency and unnecessary intervention by the public sector which sends wrong signal to the private sector [11]. Other important constraints include inadequate public agricultural expenditure, over dependence on crude oil revenue, rural-urban migration, inadequate processing and storage capacity, smallness of farm holdings, ageing population, use of inefficient traditional technology and increasing population pressure, etc.

In an attempt to solve these problems of agricultural sector, the federal and state governments of Nigeria intervene through some agricultural policies and programmes. Notable among these policies are the National Accelerated Food Production Programme (1973), Agricultural Development Programme (ADP) (1975), The River Basin and Rural Development Authorities (1976), Operation Feed the Nation (OFN) (1976), Land Use Decree (1978), Green Revolution (GR) (1980), Fertilizer Company of Nigeria (NAFCON), National Agriculture Land Development Authority (NALDA) (1991), Cassava Multiplication Programme (1985-1999), and the latest is the Transformation Agenda of the Federal Ministry of Agriculture (2011). Meanwhile, these policies have not helped much in improving

significantly the agricultural sector as the costs involved are still more than the benefits realized.

1.1 Statement of problem

The agricultural sector has been affected with numerous problems which has been the result of the poor performance of the sector itself. This has attracted various strategies including expansion of public expenditure on agricultural activities by different government in the country. Overtime this expenditure has perhaps been on the increase without expressly translating to corresponding expansion or increase in agricultural economic growth. There is still the massive importation of rice, fish, wheat and other agricultural products into the country. There is still great variability in the income of farmers and food is still expensive for consumers. Nigeria cannot be said to be food secure. The current transformation agenda of the current Government sets out to make a difference.

Several studies have been carried out on Government expenditure and agricultural output. They include [31] who analyzed the impact of government expenditure on economic growth in Nigeria; [22], examined the level of government spending on the education sector and its contribution to GDP; [6] used a disaggregated approach to determine the components (that include capital, recurrent, administrative, economic service, social and community service, and transfer) of government expenditure that enhances growth and those that do not. Most of these studies have focused on using simple regression not minding the spurious correlation associated with non-stationary series and some used data covering short period of time. However, [6] used cointegration but his views limited to the components of government expenditure that enhances growth and those that do not. There is seemingly paucity of information on the impact of agricultural public or government capital expenditure on agricultural economic growth over the period 1961 to 2010 using cointegration modeling. Hence this research will fill this gap and provides the required empirical information.

1.2 Literature review

Several studies have been undertaken in Nigeria and elsewhere to assess the relationship between capital expenditure and economic growth. According to [25] the relationship between government (capital expenditure) and economic growth has continued to generate series of controversies among scholars in economic literature. The empirical literature includes: [6], [19], [21], [37], [35], [17] and [3].

[6] use of disaggregated approach in order to determine other components of government expenditure that enhances growth. He concluded that there was no significant relationship between most components of government expenditure and economic growth in Nigeria.

[21] investigated the relationship between government expenditure and economic growth in Thailand for the period 1993 to 2006. They made use of the Granger causality tests and Ordinary Least Square (OLS) method. Their finding revealed that government expenditure and economic growth are not co-integrated but indicated a unidirectional relationship. This is because causality runs from government expenditure to growth, and also detected a significant positive effect of government spending on economic growth.

[19] made use of the heterogeneous panel data to study the impact of government expenditure on economic growth. The result was that countries with large government expenditure tend to experience higher growth.

Government spending and economic growth are directly related. It has been established in literature by some authors that there is a link between economic growth and government spending; for example [27]. They believe that there is a nexus between government spending and economic growth.

[37], [35], [17] and [4] confirmed a negative correlation between economic growth and spending on health and education. Also, [37] confirmed a short run negative correlation between education and economic growth. They went further to analyse the long run positive relationship between educational spending and economic growth. The relationship between spending on defense and health on economic growth is inconclusive. [37] reported a non significant and no impact of government spending on defense on economic growth.

The issue of whether government spending on the sector matters or not is further evidenced by the study carried out by [33] to investigate the growth effect of government expenditure in Lebanon over several years (1962 to 2007). They applied Johansen cointegration technique to examine the nature of government expenditure and its impact on economic growth. The study focused on different sectors and the results from the education sectors shows that government spending on education has a positive effect on growth in the long run and negative impact in the short run, while expenditure on defense and health are negatively correlated in the long run and insignificant in the short run.

[9] used an econometric model that takes government expenditure and quality of governance into consideration, in a cross-sectional study that includes 71 countries. The results revealed that both the expenditure and quality of the government are associated with economic growth. [2] employed multivariate co-integration and variance decomposition approach to examine the causal relationship between government expenditure and economic growth for Egypt, Israel, and Syria. In the bivariate framework, the authors observed a bi-directional (feedback) and long run negative relationships between government spending and economic growth. Moreover, the causality test within the trivariate framework (that include share of government civilian expenditure in GDP, military burden, and economic growth) illustrated that military burden has a negative impact on economic growth in all the countries. Furthermore, civilian government expenditures have positive effect on economic growth for both Israel and Egypt.

[24], examined the causal relationship between GDP and public expenditure for the US data during the period 1947 – 2002. The causality results revealed that total government expenditure causes growth of GDP. On the other hand, growth of GDP does not cause expansion of government expenditure. Moreover, the estimation results indicated that public expenditure raises the US economic growth. The authors concluded that, judging from the causality test Keynesian Hypothesis exerts more influence than the Wagner's law in US. [23] employed the trivariate causality test to examine the relationship between government expenditure and economic growth, using data set on Greece, United Kingdom and Ireland. The authors found that government expenditure granger causes economic growth in all the countries they studied. The finding was true for Ireland and the United Kingdom both in the long run and short run. The results also indicated that economic growth granger causes public expenditure for Greece and United Kingdom, when inflation is included.

[7] also examined the effects of government expenditure on economic growth for a panel of 30 developing countries over the decades of 1970s and 1980s with a particular focus on sectoral expenditures and employed regression technique. Their results revealed that the share of government capital expenditure in GDP is positively and significantly correlated with economic growth with the exception of current expenditure which was insignificant. Furthermore, [10] analyzed the relationship between public expenditure and economic

187 growth in Sri Lanka over the period 1952 to 2002 and applied Johansen cointegration
188 technique and Granger causality test. The finding suggests that the growth of public
189 expenditure in Sri Lanka is not directly dependent and determined by economic growth.
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191 [26] investigated the relationship between government expenditure and economic growth in
192 Nigeria. He employed the Bounds Test approach to co-integration based on unrestricted
193 Error Correction Model and Pair wise Granger Causality tests. The results from the Bounds
194 Test indicate that there exists no long-run relationship between government expenditure and
195 economic growth in Nigeria only when real GDP is taken as dependent variable. In addition,
196 the causality results reveal that government capital expenditure granger causes economic
197 growth. While no causal relationship was observed between government recurrent
198 expenditure and economic growth.
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2. MATERIAL AND METHODS

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2.1 The data

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204 Secondary data were collected for this study. The data are annual and were obtained from
205 Central Bank of Nigeria (CBN) 2010 Statistical Bulletin and Annual report.
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2.2 Model specification

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209 Co-integration model specification:

$$\text{LogAGDP}_t = \beta_0 + \beta_1 \log \text{ACEX}_t + \beta_2 \log \text{AFPI}_t + \beta_3 \log \text{ALF}_t + \mu_t \quad - \quad - \quad - (1)$$

210

211 Where

212 AGDP_t = Agricultural Contribution to Gross Domestic Product (Million Naira)

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β_0 = Intercept

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$\beta_1 - \beta_5$ = Elasticities of variables present in the model

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ACEX_t = Agricultural capital expenditure (million naira)

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AFPI_t = Agricultural Foreign Private Investment (million naira)

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ALF_t = Agricultural Loanable Fund (million naira)

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μ_t = Error term.

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220 The model of co-integration and error correction has been acclaimed to offer a means of
221 obtaining consistency yet distinct estimate of both long run and short run elasticities by
222 carefully taking care of non-stationarity and the so-called spurious regressions (see, for
223 example, [20]; [36]; [1], [29]).

224

225 At one time conventional wisdom was that non-stationary variables should be differenced to
226 make them stationary before including them in multivariate models. However, [14]
227 introduced the concept of co-integration, which showed that it is possible for a linear
228 combination of integrated variables to be stationary in which case they are said to be co-
229 integrated.

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2.2.1 Augmented Dickey – Fuller (ADF) Test

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232 A stationary series have a finite variance, transitory innovations from the mean and tendency
233 for the series to return to their mean value. This means that a stationary series has a mean,
234 variance and autocorrelation that is constant overtime, implying that the error structure is
235 time invariant [34].
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238 In contrast, a non-stationary series have a variance which is asymptotically infinite, the
239 series rarely cross the mean and innovations to the series are permanent. That is any
stochastic shock may not return to a proper mean level. A classical example of a non-

stationary series is a random walk where $p = 1$. Thus, Y_t is said to be integrated of order $I(1)$. Since α is unity, Y is said to have a “unit root” [15].

According to [15] a non-stationary time series has important asymptotic consequences; regression estimates do not converge in probability with increased sample size, R-square values have non-degenerated distributions, and divergence in t-value distributions often exist such that asymptotically correct critical values do not exist. Regressions involving non-stationary variables in levels often display first order serial correlation and lead to spurious results.

To carry out the unit root test for stationarity, the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests are used to examine each of the variable for the presence of a unit root (an indication of non-stationarity). The DF test assumes that the data generating process is AR(1) process, and so if this is not so the autocorrelation in the error term will bias the test since it includes the first difference in lags in such a way that the error term is distributed as white noise.

The test for the stationary or order of the integration of the data series and testing for co-integration were carried out using Augmented Dickey-Fuller (ADF) tests. ADF test was used because it captures additional dynamic left out by the DF and ensures that the error term is white noise through the inclusion of additional lag length. The test procedure is given by:

$$\Delta AGDP_t = \beta_1 + \beta_2 + \delta AGDP_{t-1} + \theta_i \sum_{i=1}^m \Delta AGDP_{t-i} + \varepsilon_t \quad (2)$$

$$\Delta ACEX_t = \beta_1 + \beta_2 + \delta ACEX_{t-1} + \theta_i \sum_{i=1}^m \Delta ACEX_{t-i} + \varepsilon_t$$

$$\Delta AFPI_t = \beta_1 + \beta_2 + \delta AFPI_{t-1} + \theta_i \sum_{i=1}^m \Delta AFPI_{t-i} + \varepsilon_t \quad (3)$$

$$\Delta ALF_t = \beta_1 + \beta_2 + \delta ALF_{t-1} + \theta_i \sum_{i=1}^m \Delta ALF_{t-i} + \varepsilon_t \quad (4)$$

$$\Delta ALF_t = \beta_1 + \beta_2 + \delta ALF_{t-1} + \theta_i \sum_{i=1}^m \Delta ALF_{t-i} + \varepsilon_t \quad (5)$$

N/B: The model is a deterministic trend with drift.

The decision rule is that the t-statistics on the coefficient of the variable β_1 which is expected to be negative, must be significantly different from the critical value for a given sample size. The null hypothesis is that the variable of interest is non-stationary (i.e. it is integral of order one $I(1)$).

3. RESULTS AND DISCUSSION

This section presents the results of unit root (stationarity) tests, cointegration tests and error correction models.

3.1 Stationarity test

The time series behavior of each of the series is presented in Table 1 below using ADF test at both level and first difference of the series. The null hypothesis of the presence of the unit root (non-stationary) was tested against the alternative hypothesis of the absence of a unit root (stationary). The variable; Agriculture Foreign Private Investment (AFPI) was stationary at level thus there was no need for differencing it. However, the variables; Agricultural Gross Domestic Product (AGDP), Agricultural Capital Expenditure (ACEX) and Agricultural Loanable Fund (ALF) were not Stationary at their levels thus the need differencing them to make stationary. On application of the Augmented Dickey-Fuller (ADF) test on their first differences, the non stationary variables became stationary as indicated by the t – values of the Augmented Dickey-Fuller (ADF) which are all negative and larger (in absolute terms) than the standard critical values, thus leading to rejection of the null hypothesis. From the results, it is evident that the variables Agricultural Gross Domestic Product (AGDP),

292 Agricultural Capital Expenditure (ACEX), Agricultural Loanable Fund (ALF) are integrated of
 293 order 1 that is are I(1). However, the variable; Agricultural Foreign Private Investment (AFPI)
 294 is integrated of order (0), that is I (0). We then proceed to discuss the results of cointegration
 295 between the explained and each of the explanatory variables.

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Table 1: Result of the unit root test

Logged Variables	Level	First Difference	Order of Integration
Agricultural Gross Domestic Product (AGDP)	-2.77	-4.80***	I(1)
Agricultural Capital Expenditure (ACEX)	-2.03	-10.39***	I(1)
Agricultural Foreign Private Investment (AFPI)	-3.59**	-	I(0)
Agricultural Loanable Fund (ALF)	-2.69	-6.55***	I(1)

298 *Critical value at 1% = -4.16; 5% = -3.50; ** - $P < 0.05$; *** - $P < 0.01$; tests were performed by*
 299 *including intercept and trend.*

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3.2 Engle and Granger Cointegration test

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303 The result of Engle and Granger two step cointegration tests are extracted into the table 2
 304 and table 3. The first step involves performing regression analysis using Ordinary Least
 305 Square regression method. The results are shown in table 2. Then the residual (ECM) of the
 306 regression are stored. Next, ADF unit root test is performed on the residual (ECM) testing for
 307 the presence of a unit root. If there is unit root in ECM then the variables are non-stationary,
 308 therefore there is no cointegration in the variable; otherwise the variables are cointegrating
 309 variables.

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Table 2: Step 1 – OLS regression result

Variable	Coefficient	Standard Error	T-value	P-value
Constant	0.042	1.024	0.041	0.966
ACEX	0.037	0.117	0.314	0.75
AFPI	0.691	0.145	4.764	0.000
ALFM	0.362	0.157	2.308	0.025
$R^2 = 0.96$		F-Stat = 373.35***		
Adj $R^2 = 0.95$		DW – Stat = 0.273		

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*** - $P < 0.01$

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314 The results of the Engle and Granger cointegration regression (step 2) and test statistics are
 315 shown in table 3. The null hypothesis was rejected as revealed in the ADF results, where the
 t - values for the test on residuals are all negative and larger in absolute terms than the

critical values. This indicates that there exist a long run relationship between all the explanatory variables and the explained variable. In other words, the explanatory variables are cointegrated with the explained variable. It also means that the study can proceed to estimate the Error Correction Model.

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Table 3: Step 2 – Unit root test of the residual (ECM)

Variable	t-statistic	Probability	ADF – test statistic
ECM	-4.21***	0.000	1% = -2.61 5% = -1.95 10% = -1.61

322 *** - $P < 0.01$

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3.3 Error Correction Model

The error correction modeling involves three steps. The first is to estimate a long-run model (this is already done as shown in table 2); the second is to include the error term (ECM) from the long run model in a dynamic over-parameterised model and the third is to work on this model until one obtains the parsimonious model which is then interpreted.

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Overparameterised model

Dependent Variable: DLOG(AGDPM)				
Method: Least Squares				
Date: 07/08/13 Time: 18:07				
Sample (adjusted): 1964 2010				
Included observations: 47 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.100664	0.055806	1.803816	0.0801
DLOG(ACEXM)	0.037868	0.040820	0.927687	0.3601
DLOG(ACEXM(-1))	0.026753	0.039498	0.677328	0.5028
DLOG(ACEXM(-2))	0.027906	0.042133	0.662325	0.5122
DLOG(AFPIM)	0.102148	0.140823	0.725366	0.4732
DLOG(AFPIM(-1))	-0.009374	0.131023	-0.071543	0.9434
DLOG(AFPIM(-2))	-0.040168	0.072151	-0.556714	0.5814

DLOG(ALFM)	0.047421	0.081369	0.582784	0.5639
DLOG(ALFM(-1))	0.025606	0.079623	0.321593	0.7497
DLOG(ALFM(-2))	-0.038385	0.078998	-0.485897	0.6302
DLOG(AGDPM(-1))	0.458947	0.164165	2.795637	0.0085
DLOG(AGDPM(-2))	-0.204087	0.176699	-1.154997	0.2561
ECM(-1)	-0.059766	0.052241	-1.144049	0.2606
R-squared	0.632577	Mean dependent var		0.185580
Adjusted R-squared	0.599369	S.D. dependent var		0.168250
S.E. of regression	0.165761	Akaike info criterion		-0.527130
Sum squared resid	0.934213	Schwarz criterion		-0.015387
Log likelihood	25.38755	Hannan-Quinn criter.		-0.334558
F-statistic	1.115987	Durbin-Watson stat		1.965044
Prob(F-statistic)	0.379616			

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Therefore based on the result from table 3, an over-parametrised AGDP model was estimated. Every variable was set at 2 lag. The parsimonious interaction involves dropping insignificant variables. Therefore, the size of the model was reduced by imposing zero coefficients on those lags where t – statistics is low. Through simplification, a more parsimonious and interpretable model was produced as shown in the equations and table 4.

Table 4: Parsimonious model result

Variable	Coefficient	Std. Error	t-statistic	Prob.
Constant	0.1150	0.03976	2.8944	0.0061
DLOG(ACEX)	0.0313***	0.02548	3.2307	0.0054
DLOG(ACEX(-1))	0.02724	0.02474	1.1012	0.2772
DLOG(AGDP(-1))	0.4747***	0.15013	3.1622	0.0029
DLOG(AGDP(-2))	-0.1781	0.15424	1.1549	0.2548
ECM (-1)	-0.0528***	0.04683	3.1284	0.0057

$R^2 = 0.63$	Schwarz criterion = - 0.5235
Adj $R^2 = 0.59$	Durbin – Watson = 1.985
F-stat = 2.50**	

** - $P < 0.05$; *** - $P < 0.01$

The parsimonious result is shown in table 4. According to the result R^2 value of 0.63 shows that all the variables can explain about 63% of variation in Agricultural Gross Domestic Product. The F- statistics of 2.50 was significant at 5%, showing the joint significant of the variables included in the model and the Durbin Watson value of 1.985 implies that the model does not suffer from autocorrelation problem.

In terms of the significant of the individual explanatory variables, it was observed that Agricultural Capital Expenditure (ACEX) and the past value of Agricultural Gross Domestic Product (AGDP (-1)) are the two significant determinants of AGDP in Nigeria for the period of analysis. ACEX was statistically significant at 1% and had a positive effect on AGDP. This agrees with the apriori expectation. This implies that holding other variables constant a unit increase in ACEX will lead to a unit increase in AGDP. This result agrees with [21] who found out that there exist a significant positive effect of government spending that include capital expenditure on economic growth in Thailand during the period of study. The lagged variable of the dependent variable (DLOGAGDP(-1)) was significant at 1% and had a positive effect. With this it means that the previous Agricultural Gross Domestic Product (AGDP) affect the current Agricultural Gross Domestic Product. This implies that there exists a positive influence or significant relationship between the agricultural gross domestic product or agricultural economic growth of the previous year on the agricultural economic growth of the current year in Nigeria. The ECM also has the correct sign of negative and it is statistically significant at 1%, meaning that about 5.2% of the errors are corrected yearly. Also, if the economy is out of equilibrium, 12% of disequilibrium will be corrected for annually.

4. CONCLUSION

Based on the findings, the study therefore concludes that the reduction in agricultural capital expenditure by government would have negative repercussions on agricultural economic growth in Nigeria. The study therefore recommends that the proportion of government capital expenditure that goes into agricultural expenditure financing should be increased since this component exerts significant positive effect on agricultural economic growth. To achieve this increment, Maputo declaration of the commitment to the allocation of at least 10 percent of National budgetary resources to agriculture and rural development policy implementation within five years should be taking into cognizance. Though this fall short of the 25 percent recommendation of food and agricultural organization.

COMPETING INTERESTS

All the contributing authors have declared that there is no competing interest among us.

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