



Research Article

Econometric Relationship between the Agriculture Sector Performance and Economic Growth in Nigeria

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Abstract: The impact of the agricultural sector in maintaining sustainable economic growth has been a continuous major subject of controversy among scholars. Although some scholars claimed that agriculture is the bedrock for any growing economy and thus a precondition for industrialization, others failed to subscribe to this. This study examines the interaction between the agricultural sector and economic growth in Nigeria from 1981 to 2019 using data obtained from the World Bank development indicators. The unit root test indicates that the variables are all integrated after the first difference which informed the decision to adopt the Vector Error Correction Model (VECM) technique. The result of the estimation shows that Agricultural output has a significantly positive relationship with GDP in the long run. Granger causality shows a uni-directional causal relationship running from agricultural output to GDP. This study recommended that since the agriculture sector is a machine for economic growth in Nigeria, efforts to add value to the sector should be made through increased investment by both government and private sectors. Secondly, the linkages between the agriculture sector and other sectors be strengthened to increase the effect of agriculture sector growth on growth across the sectors. This can be achieved through increased productivity and the development of the agriculture value chain.

Keywords: agriculture output, economic growth, gross capital formation, Nigeria

JEL Codes: O47, C01, F41, N57, Q10

1. Introduction

Over the ages, agricultural prosperity has been acting as the most powerful tools in an attempt to eradicate extreme poverty, boost shared prosperity and by projection could feed 9.7 billion people by 2050 (World Bank, 2020). Growth in the sector is more than double times more effective in raising the economic fortune among the poorest compared to other sectors. This is vital particularly in the transition economies like Nigeria where further research shows that in 2018, 65 percent of poor working adults made a living through agriculture. This implies that agriculture in these economies is a central resource required to achieve the desired macroeconomic goal of economic growth. Globally, the importance of the sector cannot be under mined by any economy. For instance, in 2018, agriculture sector contribute immensely to the

global GDP with about 4% of the aggregate. In many developing economies particularly for which Nigeria is one, the sector in question accounts for no less than 25% of their GDP. However, with this plausible achievement, the role of the sector in achieving economic growth, which is expected to transcend poverty reduction, and food security are all at risk due to the surge in climate change. Another recent event that is signaling a threat to the performance of the sector is the ongoing war in Russia and Ukraine. This is believed could cut crop yields, especially in the world's most food-insecure regions. Agriculture, forestry and land use change are responsible for about 25 percent of greenhouse gas emissions. Mitigation in the agriculture sector is part of the solution to climate change.

Nigeria is a country that is situated in the South of the Sub-Saharan Africa and occupies a total land area of 93 million hectares, which lies between longitude 3° and 14° E and latitudes 4° and 14° North. The ecological diversity of Nigeria ranges between the southern mangrove and the northern Sahel. As a consequence, there is considerable diversity in response to the ecological variability. It is one of the largest countries in Africa, with an estimated population of about 202 million (World Bank, 2019). Before the discovery and production of oil in commercial quantity in the 1970s, the Nigeria economy was dominated by the agricultural sector (Nzeka, 2013). Most of the foreign earning and export were majorly from the sector. However, after the discovery of the oil in commercial quantity, the sector lost its dominant position, thus, the oil sector became the mainstay of the economy. Despite the above, the agriculture still remains relevance in the operation of the economy. The country has highly diversified agro-ecological conditions, which makes it possible for the production of a variety of agricultural products. Thus, agriculture constitutes one of the most significant sectors of the economy (Manyong et al., 2018). Note that four sub-activities make up the Agricultural sector in Nigeria: Crop Production, Livestock, Forestry and Fishing (Nzeka, 2013). Harnessing Nigeria agricultural endowment wisely will help diversify the economy and reduce over-reliance on the oil sector and importation (Ike, 1982). Nigeria economy has been inconsistent due to unstable oil prices and continues rise in the price of imported goods. All these challenges have undesirable effects on Nigeria's balance of payments, employment level and other sectors' productivity as well as the purchasing power of the people (Oyinbo et al., 2019). The sector has witnessed significant transformation by commercialization at the small, medium and large-scale enterprise levels (Byerlee, 2010). However, the sector is not without challenges. These challenges range from out-of-date land tenure practice that limits access to large land for commercial use, a very poor level of irrigation practice. Others include, reluctant in the adoption of research findings and technologies by the successive governments, lack of access to credit, poor harvest due to inefficient fertilizer procurement and distribution, wastage of farm produces as a result of insufficient storage facilities and lack of infrastructure to access markets with the farm produces and poor market price, changes in average temperatures all pose a great challenge to agriculture. These challenges among other things seem to have posed a serious threat to the performance of the sector, thereby causing fluctuation of output in the sector. For instance, in 2002, the contribution of the agricultural output to the national GDP stood at N 9.99 billion. This could not be sustained as the performance of the sector crashed to N 7.54 billion in 2003. Subsequently, it rises successively to N 65.5 billion in 2008 but later fall drastically to N 22.44 in 2009. The fluctuation continuous up to the 2017 when stability was established. Thus, the output of the sector stood at N 50.26, N 53.99 and N 70.27 for 2017, 2018 and 2019 respectively. The most recent among these challenges is the consistent farmers-herder's crisis in some parts of the country which has made the Agricultural Production System highly vulnerable to adverse seasonal variations. These have all contributed to low agricultural productivity with high postharvest losses and waste in Nigeria (Inusa et al., 2018). This is in addition to the long-aged negligence of the sector by the successive government following the discovery of oil particularly the oil boom of the 1970s. This call for a review of the presumed contribution of agriculture to the economy of Nigeria. It is based on this background that this study seeks to investigate the impact of the agricultural sector on Nigeria's economy between 1981 and 2019 with the view of ascertaining how impactful or otherwise this sector has been on the Nigeria's economy. Besides, this study is coming at a critical moment when the world is expected to face food crises owing to the climate change and the war between Russia and Ukraine. Diversification especially for the developing countries like Nigeria is not an option as a way of escaping the impending global food crises. Therefore, the finding from this study is expected to serve as a blue print for the emerging economies.

2. Literature review

Several scholars have tried to explain the relation between the agricultural sector and economic growth. Economists and other social scientists have undertaken research works in respect of the Agricultural sector and Economic Growth.

Aristotle, Aristarchus and Warren Anderson, etc. in the past furnished us with the account that the bedrock of growth and development of any nation lies within the scope of agriculture. The physiocrats in their philosophy are the thought that agriculture is the backbone that supports the growth and development of any economy. The physiocrats with all fate perceived the agricultural sector as the propeller of any economy whether developed or under developed (Bekun, 2019). Ahungwa et al. (2018) studied the trend analysis of the economic variability of agriculture to GDP. The regression analysis reveals a positive and significant relationship between the agricultural sector and GDP. Ewetan et al. (2017) examined whether there exists any long-run relationship between agricultural output and economic growth in Nigeria. Their findings showed that there exists an insignificant negative relationship between agricultural output and economic growth in Nigeria. In a study examined by Onunze (2016) on the impact of agricultural development on Nigerian growth. The study clears the argument that has existed among development economists. It was empirically uncovered that a positive relationship exists between the agricultural sector and economic growth. In an empirical study on the contribution of the agricultural sector on the economic growth of Nigeria, by Bekun et al. (2017), the study shows the pivotal and important role agricultural sector could play to the economic growth of Nigeria if given full attention. In contradiction to other studies, Dim (2013) in his work titled “Does agriculture matter for economic development, empirical evidence from Nigeria”, observed a different result that agricultural output negatively impacts on economic development but shown to be statistically significant in Nigeria.

Olajide et al. (2012) observed a positive relationship between GDP and agricultural output using Ordinary Least Squares (OLS). From his work, it was shown that the agricultural sector reported for about 35 percent of the GDP. The study of Onoja et al. (2012) revealed that agricultural loans enhance high productivity in agriculture thereby precipitating overall national growth. Anyanwu (2012) finds that the production of major staples in Nigeria contributed significantly to GDP growth. Cao (2012) in his work titled “agricultural productivity structural change and economic growth in China”, he found that agricultural growth accounts for the development in other non-agricultural sectors and aggregate national growth. Obayelu (2012) finds that domestic saving is low among rural dwellers/farmers in Nigeria. He highlights the effect of high expenditure on food, which is a consequence of low income due to low productivity, on the saving capacities of the farming households in the study. Izuchukwu (2011) studied “the contribution of the agricultural sector to economic development” in Nigeria. The result showed that a positive relationship exists between GDP and agriculture. Azuh and Oluwatoyin (2010) revealed that agricultural performance has contributed a positive impact on economic development and poverty reduction. Awokuse (2009) argued that economic growth in Nigeria depends to a large extent on growth in the agriculture sector. The work of Shirgba (2007) revealed a positive relationship, though insignificant, between economic growth and agricultural products. The study revealed that poverty has a damaging effects and socio-economic disadvantages that could be curtailed through involvement in cassava production.

Adegbenro (2005) proved that there exists a positive relationship between GDP and agricultural products. The findings of Fan (2005) revealed that higher growth in agriculture reduces both rural and urban poverty and leads to development. (Gollin et al., 2002; Thirtle et al., 2003) argued that agriculture should be the foundation of economic growth. Results of several studies, including Irz et al. (2001) and Thirtle et al. (2001), show that an increase in agriculture growth results in an increase in the income level of the poorest of the population.

A study by Gerfa et al. (2001) proved that agricultural productivity is relevant for economic growth and poverty reduction. Their findings indicated that economic growth can be improved through higher agricultural productivity. The most direct contribution of agriculture to economic growth, according to Irz et al. (2001), is an increase in the incomes of farmers and therefore their purchasing power.

Evenson (1993) examined the economic contribution of agricultural extension to agricultural rural development in Nigeria. The result proved that extension services improve agricultural output which impacts the Gross Domestic Product. Ranis and Fei (1961). The linkages agriculture has with other sectors are too weak and its innovative structures inadequate for promoting economic growth. Timmer (1995) revealed that the agriculture sector contributes to economic growth through the provision of better caloric intake and food availability. The contributions of the previous studies

were centered on the direct influence of the agriculture sector on economic growth. Thus, this study is a deviation from the previous studies in the sense that it tries to look at the indirect influence of the sector on economic growth. This is done by examining the contribution of the agriculture sector to environmental degradation.

3. Research methodology

3.1 Model specification

The main intention of this study is to investigate the impact of the agricultural sector on economic growth in Nigeria. The study is modeled after the work of Bekun et al. (2017) with a modification and extension of more variables. The added variables include capital formation, exchange rate and interest rate. These variables act as a lubricant to the agriculture sector which justified the essence of adding them. Capital formation serves as the major factor that determines economic growth in any economy. Thus, adding it to the model will help avoid the problem of variable omission. Besides, in order to determine the true effect of a variable on economic growth, a major factor such as capital formation need to be incorporated in a model. Data were extracted from the World Bank ranging from 1981 to 2019. The variables used includes gross capital formation (% of GDP), interest rate, agricultural output (% of GDP) and exchange rate. Therefore, the variables used are viewed in a linear econometric model as follows:

$$GDP = f(GCF, INT, AGO, EXCR) \quad (1)$$

$$Y_t = X$$

$$\log GDP_t = a_0 + a_1 GCF_t + a_2 INT_t + a_3 AGO_t + a_4 EXCR_t + U_t \quad (2)$$

GDP = Gross Domestic Product

GCF = Gross Fixed Capital Formation

INT = Interest rate

AGO = Agricultural Output

EXCR = Exchange Rate

U_t = error term.

3.2 VECM approach

It is important to state here that this study employed majorly the Vector Error Correction Model (VECM) which is a popular method for research analysis. However, for the sake of space the empirical equations and procedures are not stated.

4. Analysis of the empirical results

This section presents the empirical finding of this study which includes the unit root test, cointegration test and granger causality test. This study basically relies on the Augmented Dickey-Fuller (ADF) technique to determine the stationarity level of the variables of interest. To determine whether or not there is cointegration amongst the variables, the Johansen cointegration technique is employed while the pairwise granger causality test is carried out to find out the causal relationship between the variables of interest. The result from the ADF test is presented in Table 1 which proved

that all variables were stationary at first difference. This informed the decision to adopt the VECM as the best approach for estimation.

Table 1. Result of stationarity (unit root) test

Variablesx	ADF statistics	1% Critical value	5% Critical value	10% Critical value	Order of integration
LGDP	-4.226311	-3.621023	-2.943427	-2.610263	I(1)
LGCF	-4.291208	-3.621023	-2.943427	-2.610263	I(1)
LINT	-4.048659	-3.639407	-2.951125	-2.614300	I(1)
AGO	-6.279535	-3.626784	-2.945842	-2.611531	I(1)
LEXCR	-5.207559	-3.621023	-2.943427	-2.610263	I(1)

Source: Researcher's computation using E-views 10

Table 2. Results of the Johansen co-integration test

Trace test				
Hypothesized No. of CE(s)	Eigen value	Trace statistic	0.05 Critical value	Prob.**
None*	0.555404	79.79068	69.81889	0.0065
At most 1*	0.420504	49.79888	47.85613	0.0325
At most 2	0.311926	29.61184	29.79707	0.0525
At most 3	0.242900	15.27906	15.49471	0.3453
At most 4	0.137742	2.483432	3.841466	0.0512
Maximum eigen value				
Hypothesized No. of CE(s)	Eigen value	Max-eigen statistic	0.05 Critical value	Prob.**
None	0.555404	29.99180	33.87687	0.1358
At most 1	0.420504	20.18705	27.58434	0.3284
At most 2	0.311926	13.83278	21.13162	0.3789
At most 3	0.242900	10.29562	14.26460	0.1932
At most 4	0.137742	2.483432	3.841466	0.0512

Source: Researcher's computation using E-views 10

Table 2 represents the Trace and the Maximum Eigen value statistics for the model. The null hypothesis of the absence of a co-integrating relation among the variables will be rejected at the 5 percent level for both statistics. The Trace statistic indicates that there are two co-integrating equation and non for the Maximum Eigen value statistic. The existence of co-integration is indicative of a long-run relationship between the dependent variable and the independent variables.

4.1 Short-term dynamics and Error Correction Model (ECM)

According to Table 3, the relationship between agricultural output and GDP is shown to be negative, meaning for every one-unit increase in agricultural output will translate to 54% and 55% decrease in GDP in the current and last previous year respectively which is consistent with the findings of Ewetan et al. (2017) in the case of Nigeria. Gross fixed Capital Formation (GCF) and Interest rate (INT) are positively related to GDP both in the previous and the current period. Specifically, every one-unit increase in gross fixed capital formation translates to 29% and 15% increase in GDP in both current and last previous years. More so, every 1% increase in interest rate brings about a 4% and 14% increase in GDP the same two years. The relationship between exchange rate and GDP is shown to be negative, meaning that a 1% increase in exchange rate brings about 8.9% and 3% decrease in GDP in the current period and the last previous year. Meanwhile, the Error Correction Model (ECM) which represents the long-run coefficients is both negative (-0.349191) and significant (0.0097). This means the deviating movements in the dependent variable are pulled back to equilibrium in the long run at a speed of 34.9%.

Table 3. Error correction dynamics

	Coefficient	Std. error	T-statistic	Prob.
CointEq1	-0.349191	0.028167	-2.811459	0.0097
D(GCF(-1))	0.285172	0.267708	1.065234	0.2974
D(GCF(-2))	0.145640	0.304430	0.478401	0.6367
D(INT(-1))	0.040602	0.148386	0.273626	0.7867
D(INT(-2))	0.138024	0.145842	0.946389	0.3534
D(AGO(-1))	-0.542053	0.394930	-1.372529	0.1826
D(AGO(-2))	-0.554667	0.358920	-1.545377	0.1353
D(EXCR(-1))	-0.089391	0.120351	-0.742752	0.4648
D(EXCR(-2))	-0.030095	0.113327	-0.265558	0.7928
C	0.101453	0.050991	1.989630	0.0581

Source: Researcher's computation using E-views 10

4.2 Long run coefficients

According to Table 4, the relationship between agricultural output and GDP is positive and significant applying the rule of thumb (i.e. variables are significant if the absolute value of T-statistics is greater than 2). This implies that a unit increase in AGO results to 16.6% increase in GDP in the long-run which corroborates Izuchukwu (2011) in the case of Nigeria. The implication is that the agriculture sector should be repositioned by the government in an attempt to achieve more benefits from the sector and to contribute more to the general economic growth in Nigeria in the long run as submitted by Bekun et al. (2017). Ahungwa et al. (2018). This is informative to the policymakers and stakeholders. The relationship between GCF and GDP is positive and significant meaning that a unit increase in gross fixed capital formation translates to 88% increase in GDP. This is fully supported by the Cobb-Douglas production function which emphasizes on the contribution of capital to productive capacity. The relationship between INT and GDP is negative and insignificant meaning that a 1% increase in interest rate translates to a 27% decrease in GDP. More so, the relationship between EXCR and GDP is negative and significant meaning that a 1% increase in exchange rate translates to 87% decrease in GDP.

4.3 Diagnostic tests

According to Table 5, the probability that the residuals are normal (0.497850) is greater than 0.05, indicating that the null hypothesis is rejected. Thus, the residuals are normal. Similarly, the VEC Residual Serial Correlation LM Tests shows that there is no serial correlation, no heteroscedasticity and the model is reliable; the Ramsey Regression Specification Error Test (RESET) determined that the model is well specified and does not require the additional independent variable to explain GDP.

Table 4. Long-run coefficients for GDP

Cointegrating Eq.	Coefficient	Std. error	T-statistic
GCF(-1)	0.88221	(1.36008)	[2.85440]
INT(-1)	-0.27368	(1.01530)	[1.25449]
AGO(-1)	0.16616	(2.57718)	[-4.72072]
EXCR(-1)	-0.87180	(0.41197)	[2.11620]
C	2.98231		

Source: Researcher's computation using E-views 10

Table 5. Residuals of diagnostics tests

Tests	Value	Prob.	Decision
Normality	1.3949	0.4979	Residuals are normal
Serial correlation	1.405089	0.1442	No serial correlation
Heteroscedasticity	305.6827	0.8276	No heteroscedasticity
Ramsey reset	1.684684	0.1015	Model is well specified

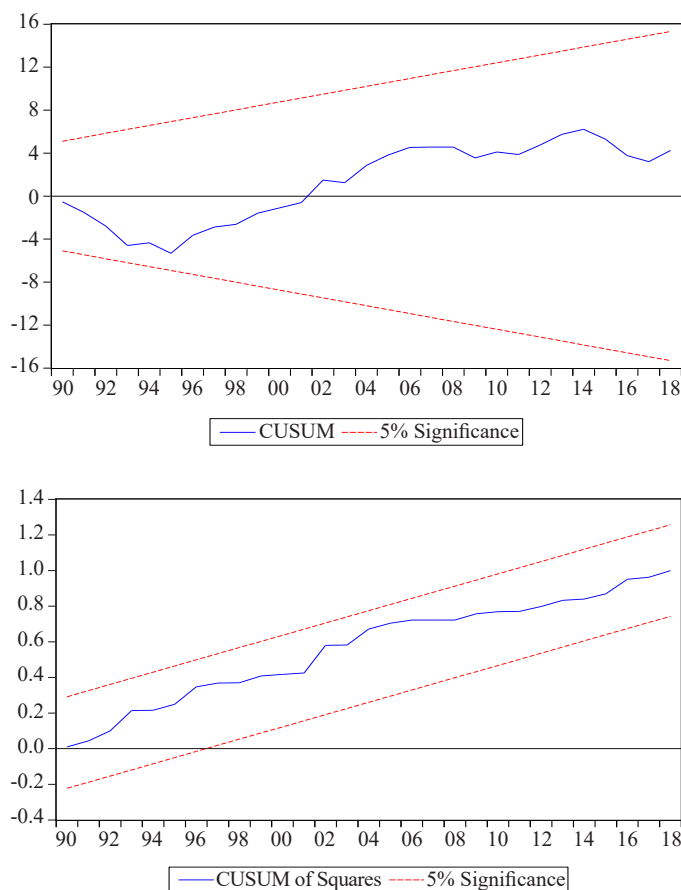
Source: Researcher's computation using E-views 10

Table 6. Granger causality result

Null hypothesis	Obs	F-statistic	Prob.
GCF does not Granger Cause LGDP	37	5.48019	0.0090
LGDP does not Granger Cause GCF		0.61112	0.5490
INT does not Granger Cause LGDP	37	1.63571	0.2107
LGDP does not Granger Cause INT		2.67893	0.0840
AGO does not Granger Cause LGDP	37	10.3078	0.0004
LGDP does not Granger Cause LAGO		10.3078	0.3957
EXCR does not Granger Cause LGDP	37	8.23233	0.0013
LGDP does not Granger Cause EXCR		0.12370	0.8841

Source: Researcher's computation using E-views 10

Also, the stability of the parameters of the model was examined using the plots of the Cumulative Sum of recursive residuals (CUSUM) and Cumulative Sum of Squares of recursive residuals (CUSUMSQ). The CUSUM and CUSUMSQ in Figure 1 and stayed within the 5 percent critical line, indicating the constancy and stability of the regression estimates throughout the period covered by the study which is suitable for the policy guide.



Source: Researcher's computation using E-views 10

Figure 1. CUSUM and CUSUMSQ for stability

The result in Table 6 revealed a unidirectional causal interaction running from agricultural output to GDP. This means that agricultural output is a predictor of GDP. Another interesting outcome is the unidirectional link running only from gross capital formation to GDP which implies gross capital formation could determine the growth rate in the Nigeria economy. Finally, the exchange rate was observed to granger cause GDP. This implies that the exchange rate could predict the growth of GDP in Nigeria.

5. Conclusion and recommendation

This study focuses on investigating the interaction between the agricultural sector and economic growth in Nigeria for the period between 1981 and 2019 employing various techniques of econometric analysis. The effects of agricultural output and exchange rate were estimated to be inversely related with GDP in the short run while the effects of Gross capital formation and interest rate were estimated to be positively associated to GDP. The estimated long run effects showed that contrary to the short term, agricultural output and gross capital formation have a significant positive

relationship with GDP. This means that in the short run, the capital formation will cost present consumption, thus, reduced the production of the consumer goods, which by extending limits economic growth. Agriculture output on the other hand will take a long time before yielding positive results. The effect of interest rate is negative and statistically insignificant to GDP, however, the exchange rate is shown to have a negative significant relationship with GDP. The deviating movements in the dependent variable are pulled back to equilibrium in the long run at a speed of 34.9%. Lastly, the Granger causality test showed that there is a unidirectional causal relationship running from agricultural output AGO and real exchange rate EXCR to GDP gross fixed capital formation GCF.

Based on the findings from the study, the following recommendations were made; first, since this study reaffirms that the agriculture sector is an engine of economic growth in Nigeria, efforts should be made to add value to the sector through increased investment by both government and private sector. In addition, the study also recommends that the direct linkages between the agriculture sector and other sectors be improved on to increase the effect of the agriculture sector growth on growth across the sectors. This can be achieved through increased productivity and the development of agriculture value chain. Policy Strategies such as low-interest rate on loans, and subsidized farm equipment be adopted that will make agriculture more profitable and attractive, less laborious with improved technology to attract investors and the youths back to the sector. This will in turn trickl down to improve economic growth through the multiplier effect. Government and policymakers should embark on diversification and enhance more allocation in terms of budgeting to the agricultural sector. No investor will like to invest in an economy with an unstable exchange rate, therefore, this study recommends the need for the government to stabilize the exchange rate in order to boost the confidence of both domestic and foreign investors.

Conflicts of interest

There is no conflicting interest between the authors.

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