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Review Article

Macroeconomic Variables and Agricultural Output in Nigeria

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Abstract

The research work investigated the effect of macroeconomic variables on agricultural output in Nigeria. The study spanned from the period of 1995-2020, making it 26 observatory years. The agricultural output growth represented the explained variable while money supply, commercial bank loan on agriculture, exchange rate, interest rate, recurrent government expenditure on agriculture and inflation rate represented the explanatory variables which served as the selected macroeconomic variables under study. The stationary of the variables were checked using the Augmented Dickey-Fuller test. The researcher went further to test for the long run relationship using the Johansen Co-integration technique. The OLS analysis was computed which shows that the model is statistically significance, judging with the p-value of the F-statistic. The analysis also presented that money supply, exchange rate and inflation have a positive relationship with agricultural output within the given period of study while commercial bank loan on agriculture, interest rate and recurrent government expenditure on agriculture have a negative link with the explained variable. Based on the findings, the researcher made its recommendation in the work.

Keywords: Agriculture; Output; Macro economics; Variables; Nigeria

Introduction

Agriculture has been defined as the production of food and livestock, and the purposeful tendering of plants and animals. Agricultural sector plays a critical function in economic growth and development especially in developing countries like Nigeria. Most times, it is referred to as the foundation of a country's economy. In economic development theory propounded by Lewis, 1954, agriculture was regarded as the basis for industrial growth and development. Recent researches on the causes of development and underdevelopment have identified agricultural transformation as key to economic liberation of worsening countries. In the development and growth arises for most developing nations from the functions of agriculture are basically from its relationships with other sectors of the economy. In this view, it can be presumed that agriculture is the foremost determinants of achieving economic development and whether war against poverty can be won or lost in the long run, (Eyo, 2008;Omotor, Orubu & Inoni, 2009).

Nigeria is a vast agricultural country, endowed with substantial natural resources which include 68 million hectares of arable land, fresh water resources covering about 12.6 million hectares, 960 kilometers (km) of coastline and an ecological diversity which enables the country to produce a wide variety of crops and livestock, forestry and fisheries products (Buren, 1998). The country is divided into six agro-ecological zones transiting in south-north direction from the Atlantic coast to the arid savanna of Sahel. These are the Mangrove Swamp, Rainforest, Derived Savanna, Guinea Savanna, Sudan Savanna and Sahel Savanna Zones.

Prior to the discovery of oil in 1956, the agricultural sector was inarguably the backbone of the economy and the major source of revenue for the country. It was the cornerstone of the Nigerian economy due to her large exports of rubber, groundnut, hides and

skin, cocoa, coffee, palm oil and palm kernel (Sylvester 2018). In the 1960s, agriculture provided about 65% of the total output of the GDP, more than 80% of Nigerian export earnings and about 50% of government revenue (PWC, 2019). The sector contributed on the average, about 35% of the Nigerian GDP and 88% of the foreign exchange income derived from the non-oil exports. (CBN, 2010). It also provided employment for about 70% of the labor force (WDI, 2017). This has changed. The ascendancy of the oil sector in the 1970s followed by the rise in crude oil revenue in the early 1970s, hasty the government's loss of interest for agricultural sector. The 65-70% of total output accounted in the sector in 1960s, fell to about 40% in the 1970s and crashed to less than 2% in the late 1990s (PWC, 2019). Due to the overdependence on oil and the externally determined pricing and production quotas, the shocks to the macroeconomic variables foreshadow economic imbalance. This deepened the possible outlook of other sectors such as the agriculture, manufacturing and service sectors. The volatility of oil prices is a key factor affecting the behavior of macroeconomic variables which arose from the sometimes conflicting fiscal, monetary and trade policies of developing economies (Guo & Kliesen, 2005; Narayan & Narayan, 2007; Salisu & Fasanya, 2013).

Some of the main factors undermining agricultural production include climate change, inadequate budget to agricultural sector and low productivity due to poor planting material amongst others. In addition, the decline in food production which has led to increasing food importation in Nigeria can be likened to farmer's difficulty to obtain fertilizers and uneasy access to soft loans. Consequently, food production profile in Nigeria has been at lower ebb, which has led to a rise in import of stable food per annum (Anigbogu, Agbasi & Okoli, 2015).

Macroeconomics refers to the study of a nation's overall economic performance. The federal government tries to influence the performance of the national economy through various policies such as the monetary, fiscal and trade policies. Changing macroeconomic policies affect national income, interest rates, prices, inflation rates, exchange rates, among others, all of which influence the agricultural sector. They serve as indicants that signal the current trends in the economy. These policies in the economy, affect all sectors' functions in the country. Hence, understanding the nexus between the agricultural output and macroeconomic variables in the economy will better the path for good policies on economic growth and development in Nigeria.

Literature has reported that in spite of Nigeria's rich agricultural resource endowment, there has been a gradual decline in agriculture's contributions to the nation's economy (Manyong et al., 2005). Less than 50% of the Nigeria's agricultural lands are under cultivation (PWC, 2019). Even then, smallholder and traditional farmers who use rudimentary production techniques, with resultant low yields, cultivate most of this land. The smallholder farmers are constrained by many problems including those of poor access to modern inputs, soft loans and credit, inadequate access to markets, poor infrastructure, land and environmental degradation, and inadequate research and extension services.

In line to these mentioned facts, will result to the question; what are the effects of macroeconomic variables on agricultural output in Nigeria? To this end, this article is designed to ascertain the effects of macroeconomic variables on agricultural output in Nigeria over a period of 1995-2020.

Literature Review

In accordance with the Cobb Douglas production function that provides a useful basis for analyzing productivity drivers. The Cobb-Douglas production function models the relationship between production output and production inputs (factors). Therefore, output is a function of inputs of labor (L), capital (K) and advancement in technology (T). It starts with the idea of production functions, namely, that the quality of output (Q) in any sector is a function of the amounts and quantities of factors of production (inputs). There are many other factors affecting economic performance, their model proved to be remarkably accurate (Anigbogu, Agbasi& Okoli, 2015). The function they used to model production was of the form; $P(L, K) = BL^{\alpha} K^{\beta}$; Where: P = total production (the monetary value of all goods produced in a year), L = labor input (the total number of person-hours worked in a year), K = capital input (the monetary worth of all machinery, equipment, and buildings), B = total factor productivity (efficiency coefficient), α and β are the output elasticity of labor and capital, respectively. These values are constants determined by available technology. The major purpose of the production

function is to address the efficiency in the use of factor inputs in production and the resulting distribution of income to those factors, while abstracting away for the technological problems of achieving technical efficiency. In agricultural production, efficient allocation of agricultural inputs helps farmers to attain their desired objectives. It avails farmers the opportunity of enhancing their productivity and income. At the micro-economic level efficient allocation of agricultural resources (farmland, credit facilities, fertilizers, seedlings, and labor, among others) help farmers to contribute to food production, employment generation, industrial raw material and export product for foreign exchange earnings.

Enilolobo et al. (2019) investigated the effect of macroeconomic indicators on agricultural output in Nigeria using quarterly time series data for the period 1981-2018 from various publications of the CBN statistical Bulletin and National Bureau of Statistics. The results of the study revealed that the inflation rate in Nigeria is volatile over the period of study and inflation volatility has a negative but significant impact on agricultural growth. Exchange rate and cost of funds also possess varying impacts on agricultural output. Eyo (2008) has empirically found that in Nigeria, macroeconomic policies significantly can reduce inflation, increase foreign private investment in agriculture, introduce favorable exchange rates and make agricultural credit have a significant effect on agriculture output growth. Nwanji, et al. (2019) studied the effects of foreign trade on agricultural output in Nigeria using time series data ranging from 1981-2018. The study showed that foreign trade in fact exerts negatively on agricultural output in Nigeria. Oyetade, Sheri and Azam (2016) examined the impact of macroeconomic variables influencing agriculture in Nigeria from 1981-2013. The study utilized multivariate co-integration approach for investigating their relationship. They found that a long run relationship between the agricultural output and the explanatory variables (commercial bank loan on agriculture, interest rate, inflation rate, exchange rate, food import value, unemployment rate). The study concluded that commercial bank loan, interest rate, food import value are significant variables that affect agricultural output in Nigeria, whereas, exchange rate, inflation rate and unemployment rate are insignificant. The study recommended that adequate financing of agriculture will improve the sector. Iganiga and Unemhilin, (2017) found government capital expenditure to be positively related to agricultural output while total credit to agriculture and population growth rate were negative. Gil et al. (2009) specified that any changes in the monetary policy and the exchange rate have an effect on the agricultural sector but not in the opposite direction. This study also found that agricultural output and exports response to the changes of monetary policy, precisely in the money supply. Olarinde and Abdullahi (2014) investigated the impact of macroeconomic policies on agricultural output specifically on crop production in Nigeria looking specifically at the implications on food security. The paper adopted the time series data stretching over the period of 1978-2011. The findings of the research showed that in the long run, agricultural output is responsive to changes in government spending, agricultural credit, inflation rate, interest and exchange rates. While results of the variance decomposition indicate that, a significant variation in Nigeria's agricultural food output is due to changes in exchange rate and government expenditure movements.

Methodology

Data Sources

The research study uses time series data from secondary sources for the period of 26 years, 1995-2020, sourced from Central Bank of Nigeria Statistical Bulletin and World Development Indicators (WDI). The data was processed and analyzed by applying econometrics tools & techniques using E-View 9.0 statistical package. This annual data was analyzed through the unit root test for stationary test, a co-integration test for long run relationship test and the regression analysis using Ordinary Least Squares (OLS).

The Cobb-Douglas production function serves as a platform on which the empirical model used is formulated. This is given below:

$$AOG_t = \beta_0 + \beta_1 MS_t + \beta_2 CBLA_t + \beta_3 EXR_t + \beta_4 INT_t + \beta_5 RGEA_t + \beta_6 INF_t + \varepsilon_t \ldots. (1)$$

Where; AOG is Agricultural Output Growth; MS is Money Supply; CBLA is Commercial Bank Loan on Agriculture; EXR is Exchange Rate; INT is Interest Rate; RGEA is Recurrent Government Expenditure on Agriculture; INF is Inflation Rate; ε is the Error Term; L is Log. Two variables which are in high values were logged (AOG & MS). The equation becomes;

$$LAOG_t = \beta_0 + \beta_1 LMS_t + \beta_2 CBLA_t + \beta_3 EXR_t + \beta_4 INT_t + \beta_5 RGEA_t + \beta_6 INF_t + \varepsilon_t \ldots\ldots (2)$$

The principles of economic theory examine the apriori expectation and make reference to the sign and size of the parameters of economic relationship. It is expected that;

$$\beta_1 > 0; \beta_2 > 0; \beta_3 <> 0; \beta_4 < 0; \beta_5 > 0; \beta_6 <> 0.$$

Where $\beta > 0$ denotes a positive relationship between AOG and the coefficients of the explanatory variables, $\beta < 0$ denotes the negative relationship, while $\beta <> 0$ implies that the coefficient could be a positive or negative one.

Results and Discussion

Unit Root Test

The results presented in Table 1 below shows the stationary (unit root) test conducted for all the variables. The properties of each macroeconomic variable were analyzed first in order to determine the stationary of the selected variables. Augmented Dickey Fuller (ADF) was used to ensure that the data is stationary, before proceeding to the co-integration form.

Variable	*ADF Statistic*	*Level of Significance*	*Lagged difference*	*Critical Values*	*Order of Integration*	*Probability value*
LAOG	-4.612885	5%	2	-2.991878	I(1)	0.0013
LMS	-3.168443	5%	2	-2.991878	I(1)	0.0347
CBLA	-10.82323	5%	2	-2.943427	I(2)	0.0000
EXR	-4.277755	5%	2	-2.941145	I(1)	0.0017
INT	-6.857084	5%	2	-2.941145	I(1)	0.0000
RGEA	-6.994961	5%	2	-2.943427	I(1)	0.0000
INF	-13.78712	5%	2	-2.938987	I(0)	0.0000

Source: Author's Computation using E-view 9.0

Table 1: The ADF Unit Root Test Result.

The result indicates stationary of all variables in different orders; AOG, MS, INT, EXR& RGEA were stationary at first differencing; CBLA was stationary at second differencing, whereas, INF was stationary at level.

Co-integration Test

Having ascertained the stationary of all variables, the co-integration test was computed to check for the long run relationship existing among variables. The Johansen Co-integration was applied to attain this.

Hypothesized No. of CE(s)	*Eigen value*	*Trace Statistic*	*0.05 Critical Value*	*Prob.***
None *	0.983682	254.9888	125.6154	0.0000
At most 1 *	0.935848	156.2167	95.75366	0.0000
At most 2 *	0.748030	90.30071	69.81889	0.0005
At most 3 *	0.655439	57.21802	47.85613	0.0052
At most 4 *	0.515920	31.64639	29.79707	0.0303
At most 5	0.318278	14.23427	15.49471	0.0767
At most 6 *	0.189384	5.039058	3.841466	0.0248

Source: Author's Computation using E-view 9.0

Table 2: The Unrestricted Co-integration Rank Test (Trace) Result.

The test result in Table 2 indicates six co-integrating equations at the 0.05 level of significance. The * denote rejection of the hypothesis at the 0.05 level of significance. Hence, we conclude that there exists a long run relationship among the examined variables.

Estimate of Equation

The estimate of the equation for achieving the objective is computed and presented using Ordinary Least Squares (OLS) in Table 3 below:

$$LAOG_t = \beta_0 + \beta_1 LMS_t + \beta_2 CBLA_t + \beta_3 EXR_t + \beta_4 INT_t + \beta_5 RGEA_t + \beta_6 INF_t + \varepsilon_t \ldots\ldots (2)$$

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	6.638363	0.295745	22.44626	0.0000
LMS	0.330969	0.024130	13.71578	0.0000
CBLA	-0.000270	0.000120	-2.255907	0.0361
EXR	0.001909	0.000814	2.345628	0.0300
INT	-0.018485	0.010299	-1.794778	0.0886
RGEA	-0.001993	0.001282	-1.554736	0.1365
INF	0.002086	0.001371	1.521297	0.1447
R-squared	0.981784	Mean dependent var		9.182380
Adjusted R-squared	0.976032	S.D. dependent var		0.534393
S.E. of regression	0.082733	Akaike info criterion		-1.921591
Sum squared resid	0.130050	Schwarz criterion		-1.582873
Log likelihood	31.98069	Hannan-Quinn criter.		-1.824053
F-statistic	170.6740	Durbin-Watson stat		1.661708
Prob(F-statistic)	0.000000			

Source: Author's Computation using E-view 9.0.
Dependent Variable: LAOG
Method: Least Squares
Date: 04/03/22 Time: 11:32
Sample: 1995 2020
Included observations: 26

Table 3: Regression Results.

The result of Table 3 shows the OLS analysis. From the table, LMS has a positive and significant impact on AOG, based on the coefficient of 0.33 and p-value of 0.0000, which is less than the 0.05 level of significance. The positive coefficient conforms to the apriori expectation between LMS & AOG. A unit increase in LMS will bring about 0.33 unit increase in AOG, holding other variables constant. This implies that those monies meant for agricultural sector, duly utilized, increases its output.

Contrary to our apriori expectation, CBLA has an inverse relationship with AOG. A unit change in CBLA brought about an inverse change in AOG indicating a possible wrong utilization of loans by farmers who borrow them. Its P-value of 0.0361 shows its statistical significance in affecting AOG.

EXR has a positive and significant impact on AOG, based on the coefficient of 0.001909 and p-value of 0.0300, which is less than the 0.05 level of significance. The positive coefficient conforms to the apriori expectation between EXR & AOG. A rise in EXR (devaluation in currency) will bring about an increase in demand of agricultural products by 0.001909 units, holding other variables constant, which may imply that a fall in the currency value of the country makes export of agricultural goods cheaper, which attracts more for-

eign buyers, which encourages the farmers to produce more.

INT has a negative and insignificant impact on AOG. Based on the coefficient of -0.018485 and p-value of 0.0886, which is greater than the 0.05 level of significance. The negative coefficient conforms to the apriori expectation between INT& AOG. A unit increase in INT will bring about -0.018485unit decrease in AOG, holding other variables constant. It shows that as interest rate rises, farmers do minimize their request for loans; this reduces investment in the sector and a decrease in output.

Also, in an opposing direction with our apriori expectation, RGEA has an inverse relationship and insignificant effect towards AOG with its coefficient as -0.001993 and its p-value as 0.1365, which is greater than the 0.05 significance level. We may have to conclude that expenditure of government on agriculture has no significant impact in the sector. This may be that the high rate of corruption in the system makes them not to duly utilize that expenditure on agriculture, they pen down in papers for the sake of publicity. Small scale farmers, who take part more in agricultural activities, rarely benefit from government incentives, schemes and programs on agriculture.

INF, as expected, conforms to the apriori expectation of a positive link with AOG, having its coefficient as 0.002086but has statistical insignificant effect towards AOG as its p-value, 0.1447 is greater than the 0.05 level of significance. This shows that a unit increase in INF will bring about 0.002086 unit increase in AOG, having other variables constant.

From the table, the R2 of 0.981784 shows that a percentage change in the independent variables will bring about 98% increases in AOG while the remaining 2% is due to other stochastic variables. The F-Statistic which shows the whole significance of the model has its p-value as 0.000000 which is less than the 5% significance level implies that our model is statistically significant. The Durbin-Watson statistic identifies that there is absence of autocorrelation in the model having its value as1.661708, which is approximately equal to 2.

Conclusion and Recommendations

The study examined the impact of macroeconomic variables on the agricultural output in the given period of study; 1995-2020. Based the variables under study, money supply, exchange rate and inflation rate identifies a positive impact on the output of agriculture, while commercial bank loan on agriculture, interest rate and government expenditure on agriculture has an inverse effect on the output.

From the findings of the study, it is recommended that; massive funding of the agricultural sector is very necessary, the allocated expenditure of the government for the sector should be brought up to date and be monitored in order to ensure adequate utilization of the funds for the benefit of the sector. A favorable interest rate should be placed for farmers to easily access the loans of the financial institutions, which will ensure increase the productivity of the sector. A sound monetary, trade and fiscal policies should be formulated and implemented to attain a sustainable growth in the sector which will also positively affect the Gross Domestic Product (GDP) of the country. Also, the arable lands should be made easily accessible for farmers. The federal government should formulate a means to offer soft loans to rural farmers who may not be able to afford the cost of taking loans from the financial institutions. As much emphasis is given to the oil sector by the federal government, such should also be accredited more to the agricultural sector, diversification should set in, and the production capacity should be widen and also boost exportation from the sector.

References

1. Anigbogu TU, Agbasi OE and Okoli IM. "Socio-economic factors influencing agricultural production among co-operative farmers in Anambra state, Nigeria". International Journal of Academic Research in Economics and Management Sciences 4.3 (2015): 43-58.
2. Buren R. Africa south of the Sahara, 27th (Ed.), Europa Publication Ltd., New York (1998).
3. CBN. Statistical Bulletin of Central Bank of Nigeria (2010).

4. Enilolobo OS, Mustapha SA and Ikechukwu OP. "Nexus between agriculture and unemployment in Nigeria". Journal of Economics, Management and Trade 22.5 (2019): 1-13.
5. Eyo EO. "Macroeconomics environment and agricultural sector growth in Nigeria". World Journal of Agricultural Sciences 4.6 (2008): 781-786.
6. Gil JM, Ben-Kaabia M and Chebbi HE. "Macroeconomics and agriculture in Tunisia". Applied Economics 41.1 (2009): 105-124.
7. Guo H and Kliesen K. "Oil Price Volatility and U.S. Macroeconomic Activity". Review/Federal Reserve Bank of St. Louis 57.6 (2005): 669-683.
8. Iganiga BO and Unemhilin DO. "The impact of federal government agricultural expenditure on agricultural output in Nigeria". Journal of Economics 2.2 (2017): 81-88.
9. Manyong VM., et al. "Agriculture in Nigeria: Identifying opportunities for increased commercialization and investment". IITA, Ibadan, Nigeria (2015): 190.
10. Narayan PK and Narayan S. "Modeling oil price volatility". Energy Policy, Elsevier 35.12 (2007): 6549-6553.
11. Nwanji TI., et al. "The effect of board composition and financial performance of financial services firms in the Nigerian stock exchange market". The International Journal of Business & Management 7.8 (2019): 230-243.
12. Olarinde MO and Abdullahi H. "Macroeconomic policy and agricultural output in Nigeria: Implication for food security". American Journal of Economics 4.2 (2014): 99-113.
13. Omotor DG, Orubo CO and Inoni E. "Policy reforms and agricultural exports in Nigeria: An empirical analysis". The Singapore Economic Review 54.04 (2009): 589-603.
14. Oyetade PO, Shri DA and Nor AA. "Macroeconomic factors and agricultural sector in Nigeria". Procedia -Social and Behavioral Science 219 (2016): 562-570.
15. PWC. Unlocking Nigeria's agricultural exports (2019).
16. Salisu AA and Fasayan IO. "Modelling oil price volatility with structural breaks". Energy Policy 52 (2013): 554-562.
17. Sylvester O. "The Nigerian economy before the discovery of crude oil: The political ecology of oil and gas activities in the Nigerian aquatic ecosystem (2018): 71-81.
18. World Development Indicators (2017).

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