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Full Length Research Paper

Agricultural Production: Driver for Economic Growth and Rural Poverty Reduction in Nigeria

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ABSTRACT: The research provides empirical information on the relationship between agricultural production and the growth of Nigerian economy with a focus on poverty reduction. The study employed the mean annual time series data of selected index of Nigerian agricultural production for the period of 1979 to 2019 to investigate the long run relationship between agricultural production and economic growth. The data were analyzed using unit root tests and the bounds Autoregressive Distributed Lag (ARDL) testing approach of co-integration. The results of ARDL and Vector Error Correction Model (VECM) supported evidence of long and short run relationships between agricultural production and economic growth in Nigeria. This implies agricultural production was significant in influencing the favorable trend of economic growth in Nigerian. The paper concluded that, despite the growth of the Nigerian economy, poverty is still on the increase and this calls for a shift from a monolithic oil-based economy to a more diverse one with agriculture being the lead sector. The research recommended pro-poor policies be designed for alleviating rural poverty through increase investment in agricultural development by both the public and private sectors of Nigeria.

Keywords: Agriculture, agricultural productivity, co-integration, economic growth, poverty

INTRODUCTION

The growth and development of any nation depends to a large extent on the development of agriculture (Iganiga and Unemhilin, 2011). According to International Development Association IDA (2009), agriculture is the most important productive sector in most low-income countries in terms of its shares of Gross Domestic Products (GDP) as well as employment generation. In countries where the share of agriculture in overall employment is large, broad-based growth in agricultural incomes is essential to stimulate growth in the overall economy. Therefore, the ability of agriculture to generate overall GDP growth and its comparative advantage in reducing poverty will vary from country to country (FAO, 2012). In Nigeria, over 70% of the poor and food insecure live in rural areas, and most of them depend on agriculture for their livelihoods. To support broad-based poverty reduction and food security in Nigeria, smallholder agriculture must be a central investment focus (Garvelink *et al.,* 2012).

Although, Nigeria is a vast agricultural country endowed with substantial natural resources, the agricultural sector has been growing at a very low rate as productivity is low and basically stagnant. The rural economy has not been promoted in a sustainable way to create employment opportunities in rural areas so as to reduce regional income disparities and ultimately reduce poverty (Anriquez and Stamoulis, 2007). More so, Tsigas and Ehui (2006) observed that development indicators for rural areas lag behind those for urban areas: incomes are lower, infant mortality rates are higher, life expectancy are shorter, illiteracy is more widespread, and greater proportions of the people lack access to clean and improved sanitation services. Thus, the agricultural sector has a critical role to play in poverty reduction in Nigeria as over 45% of the GDP comes from the sector and it employs about 60% of the working population (Nwafor *et*

al., 2011). Although, the agricultural sector may have contributed significantly to the improved growth performance in Nigeria in the past, its actual contribution appears to be much short of the overall potential as the sector still has the highest poverty incidence and tackling poverty entails tackling agricultural underdevelopment.

Several literatures abound on the theoretical relationship between agriculture and economic growth (Irz *et al.,* 2001; Sandi *et al*., 2007; Awokuse, 2009). Previous studies have concentrated on market-based inter-sectoral linkages as the sources of agricultural contribution to economic growth. Similarly, Timmer (2005) studied the role of agriculture in development and noted that structural transformation is a general equilibrium process that cannot be explained by looking at agriculture alone. Despite the myriads of existing literature on relationship between agriculture and economic growth in across the sub-Saharan Africa, there exists a relative dearth of empirical information on the relationship between agriculture and economic growth in Nigeria with the implication on rural poverty. The causal dynamics between agriculture and economic growth is an empirical question worthy of further investigation. Therefore, this research was designed to fill the existing research gap by providing empirical information on agriculture-economic growth nexus and its implication for poverty reduction. Specifically, the study investigated the long run and short-run relationship between agriculture and economic growth using the index of Nigerian agricultural production extending over the period of 1979 to 2019.

Theoretical framework

Scholarly literature exists on relationship between agriculture and economic growth (Gollin *et al.,* 2002; Thirtle *et al.,* 2003; Sandri *et al.,* 2002; World Bank, 2008). Growth in agricultural sector can fuel growth in non-agricultural economy through a variety of mechanisms, some direct and some indirect. According to Johnston and Mellor (1961), there are five inter-sectoral linkages that agriculture contributes to economic growth and development. The sectors are linked via: (i) supply of surplus labor to firms in the industrial sector, (ii) supply of food for domestic consumption, (iii) provision of market for industrial output, (iv) supply of domestic savings for industrial investment, and (v) supply of foreign exchange from agricultural export earnings to finance import of intermediate and capital goods. Timmer (2005) also identified non-market based inter-sectoral linkage through which agriculture contributes indirectly to economic growth and observed that agriculture contributes indirectly to economic via its provision of better caloric nutrient intake by the poor, food availability, food price stability, and poverty reduction.

Higher agricultural productivity is vital for economic growth, especially in Africa, because of strong growth linkages and comparative advantages in trade. Higher agricultural productivity can deliver a triple dividend; sustain food security, higher human development and lower pressure on land and water (UNDP, 2012). Relationship exists between agriculture and poverty as there is a wide consent that agriculture plays an important role in economic development and poverty reduction (Cuong, 2010). World agricultural productivity, particularly in poor countries, is key to global food security and the fight against hunger and poverty (Von Braun *et al.,* 2008). Theoretical postulations and country experiences in developing regions underscore the crucial role of agricultural growth for poverty reduction (Eboh *et al.,* 2012). While growth is essential for poverty reduction, it should be noted that it does not always lead to rapid reduction. Nwafor et al. (2011) illustrated this in two scenarios. In one scenario, a country grows at 5% per annum and reduces the poverty rate by 50% after 5 years. In another scenario, the same country can grow at the same 5% per annum and reduce poverty by 10% in 5 years. The growth in the first scenario is normally said to be pro-poor because is more able to reduce poverty. This difference in the poverty outcomes of growth results from the sources of growth in the different scenarios. Using Nigeria as an example, a 5% growth coming primarily from the oil sector would have lesser impact on the poverty level compared to the same 5% which comes primarily from the agriculture sector. This is because the agricultural sector is a major employment of a larger proportion of Nigerian population (Tersoo, 2013; Dim and Ezenekwe, 2013). Hence, when growth comes from sectors that most poor people work in (the agricultural sector in Nigeria's case), poverty is reduced faster. However, an exception to this is when the revenue from the oil sector is invested for the development of the non-oil sectors especially agriculture. This is a better option as growth in agriculture induced solely from revenue generated from the agricultural sector cannot be sustained because low produce prices will discourage further production. However, growth in agriculture induced from investments from other sectors is very sustainable even when agricultural produce prices falls. Strong agricultural growth, particularly increased productivity, has been a feature of countries that have successfully reduced poverty (Wiggins, 2009). Agriculture contributes to poverty reduction because it provides employment to the poor, who have also generally low skills and education. Growth in agriculture also contributes to greater supply of food-stuffs and lower food prices, and benefits both rural and urban poor (Grewal and Ahmed, 2011).

METHODOLOGY

Study area

The study was conducted in Nigeria. The country is a

sovereign nation located in West Africa bordering Niger in the north, Chad in the northeast, Cameroon in the east and Benin Republic in the west. Its southern coast is on the Gulf of Guinea in the Atlantic Ocean. Nigeria is the most populous African country with a population of over 206 million people with a population density of 226 per Km^2 (UN Data, 2020). The country has a total land area of 910,770 Km^2 and occupies about 14 percent of land area in West Africa. Nigeria lies between longitudes 4^0N and 14^0N, and Latitudes 3^0E and 15^0E. The country is located within the tropics and therefore, experiences high temperature throughout the year. The mean annual temperature is 27°C. Average maximum temperature vary from 32°C to 41°C while mean minimum figures range from 21°C to 13°C. The climate of the country varies with annual rainfall greater than 3500mm with annual rainfall less than 600mm.

Methods of data collection

The study employed time series data on the index of agricultural production, real gross domestic product, interest rate, exchange rate and inflation rate extending over the period of 1979 to 2019. The mean annual time series data of the selected variables were employed in the study. The data were sourced from the publications of Central Bank of Nigeria (CBN) annual reports and statistical bulletin, World Bank Development Index, International Monetary Fund (IMF) and the National Bureau of Statistics (NBS, 2019).

Analytical framework

The research used the auto-regression distributed lag (ARDL) bound testing procedure to estimate the co-integration (Long run) relationship between economic growth and its determinants as well as the short run dynamics. The bound test is computed based on an estimated error correction version of ARDL model, by Ordinary Least Square (OLS) estimator (Pesaran *et al.,* 2001), The bound testing procedure was chosen because it does not require that the variables must be integrated of the same order. Hence it is applicable irrespective of whether the regressors in the model are purely 1(0), purely 1(1) or mutually co-integrated. More so, the short run parameters of the model can be estimated simultaneously. An F-test of the joint significance of the coefficients of the lagged values of the variables was used to test the hypothesis of no co-integration among the variables against the presence of co- integration among the variables.

Ho: $\psi_1 = \psi_2 = \psi_3 = \psi_4 = \psi_5$ (no co- integration)
Ho: $\psi_1 \neq \psi_2 \neq \psi_3 \neq \psi_4 \neq \psi_5$ (alternative hypothesis)

According to Pesaran et al. (2001), the F-test has a nonstandard distribution irrespective of whether the variables are 1(0) or 1(1). If the computed F-statistics falls above the upper bound critical value, then the null of no co-integration is rejected. If it falls below the lower bound, then the null cannot be rejected, if it falls between the lower and upper bounds, then the result would be inconclusive. The optimal lag length for the specified ARDL model was determined based on the Akaiki Information Criterion (AIC).

Model specification

The relationship between economic growth, agricultural production, interest rate, exchange rate and inflation rate is expressed implicitly as:

$$ECG = f(AGP, ITR, ECR, IFR) \quad (1)$$

The choice of interest rate, exchange rate and inflation rate is based on economic theory that, these are monetary policy variables that determine the rate of economic growth. Trend was not considered as a variable of interest in this study. Following Perasan et al. (2001), the ARDL model is expressed as unrestricted error correction model (UECM) to test for co-integration between the variables as follows:

$$\Delta \ln ECG_t = \psi_o + \sum_{i=1}^{p} \psi_1 \Delta \ln ECG_{t-1} + \sum_{i=0}^{p} \psi_2 \Delta \ln AGP_{t-1} + \sum_{i=0}^{p} \psi_3 \Delta \ln ITR_{t-1} + \sum_{i=0}^{p} \psi_4 \Delta \ln ECR_{t-1} + \sum_{i=0}^{p} \psi_5 \Delta \ln IFR_{t-1} + \beta_1 \ln ECG_{t-1} + \beta_2 \ln AGP_{t-1} + \beta_3 \ln ITR_{t-1} + \beta_4 \ln ECR_{t-1} + \beta_5 \ln IFR_{t-1} + \mu_t \quad (2)$$

Once the co-integration is established the long run relationship is estimated using the conditional ARDL model specified as:

$$\Delta \ln ECG_t = \psi_o + \beta_1 \ln ECG_{t-1} + \beta_2 \ln AGP_{t-1} + \beta_3 \ln ITR_{t-1} + \beta_4 \ln ECR_{t-1} + \beta_5 \ln IFR_{t-1} + \mu_t \quad (3)$$

The short run dynamic relationship is estimated using an error correction model specified as:

$$\Delta \ln ECG_t = \psi_o + \sum_{i=1}^{p} \psi_1 \Delta \ln ECG_{t-1} + \sum_{i=0}^{p} \psi_2 \Delta \ln AGP_{t-1} + \sum_{i=0}^{p} \psi_3 \Delta \ln ITR_{t-1} + \sum_{i=0}^{p} \psi_4 \Delta \ln ECR_{t-1} + \sum_{i=0}^{p} \psi_5 \Delta \ln IFR_{t-1} + \mu_t \quad (4)$$

Where:
ECG = Economic growth given by real GDP (naira)
AGP = Agricultural production given by index of agricultural production
ITR = Interest rate (percent)
ECR = Exchange rate (naira per US dollar)
IFR = Inflation rate (percent)
ψ_o = Constant
μt = White noise
Ψ_1- ψ_5 = Short run elasticities
$\beta_1 - \beta_5$ = long run elasticities
Ecmt-1 = Error correction term lagged for one period

Table 1: Result of Augmented Dickey Fuller Test

Variables	ADF Statistics	Lag	Test Critical values (5%)	Decision
Level				
lnECG	-2.106678	0	-3.513523	Non stationary
lnAGP	-3.002617	0	-3.513523	Non stationary
lnIFR	-3.818031	0	-3.513523	Stationary
lnECR	-2.002812	0	-3.513523	Non stationary
lΔnITR	-2.813401	0	-3.513523	Non stationary
First difference				
Δln ECG	-6.212724	0	-3.525507	Stationary
ΔlnAGP	-6.766347	0	-3.513523	Stationary
ΔlnECR	-5.103355	0	-3.513523	Stationary
ΔlnITR	-6.788568	1	-3.528656	Stationary

ln = logarithm, Δ = difference operator, Lag length was automatic based on Schwarz Info. Criterion. *Source: Author's Computation from E-view 7.1*

Table 2: Result of Phillips-Perron (PP) Unit root results

Variables	PP Test at Levels	Band width	Test Critical values (5%)	Decision
lnECG	-1.8966420	16	-3.513523	Non stationary
Level				
lnAGP	-3.008776	1	-3.513523	Non stationary
lnIFR	-3.678869	5	-3.513523	Stationary
lnECR	-2.102812	2	-3.513523	Non stationary
lΔnITR	-2.856379	3	-3.513523	Non stationary
First difference				
Δln ECG	-6.721220	16	-3.525507	Stationary
ΔlnAGP	-6.713454	1	-3.525507	Stationary
ΔlnECR	-5.188134	1	-3.525507	Stationary
ΔlnITR	-9.241341	1	-3.525507	Stationary

ln = logarithm, Δ = difference operator, Band width was automatic based on Newey-.West using Bartlett Kernel.

Δ = First difference operator
ln = Natural logarithm
P = lag length.

RESULTS AND DISCUSSION

Unit root test

The unit root test was conducted to ensure that the regress and is integrated of order one and none of the variables is integrated of order 2 or beyond because the computed F-statistics provided by Pesaran et al. (2001) are valid for only variables that are 1(0) or 1(1). The unit root test was carried out using Augmented Dickey Fuller (ADF) test and Phillip Perron (PP) test. The results of the ADF and PP tests (Tables 1 and 2) showed that all the variables were not stationary at level. The result indicated that ECG, AGP, ECR and ITR were integrated of order one while IFR was integrated of order zero. This implies that the variables under study are not integrated of the same order and this justifies the use of bound approach to co-integration over other conventional approaches that require the variables to be integrated of the same order. The entire series was subjected to further test at first differencing. It was evident that all the variables achieved a stationary trend process after the first differencing for the ADF and PP tests. This means that the series are integrated in order 1. Having established that all the variables are integrated in order one, the study employed the ARDL co-integration approach to determine whether there is a co-integrating relationship between agricultural growth, interest rate, inflation rate, exchange rate and real economic growth of Nigeria.

ARDL bounds test for co-integration

The ARDL Bound test investigates the long-run relationship between the variables. The computed F-statistics was 4.88 as shown in (Table 3). This value is above the upper bounds of the critical value of 4.06 at 5% level of significance. This implies that there is co-integration (long run relationship) between economic growth and agricultural production, interest rate, exchange rate and inflation rate and hence, the null hypothesis of no co-integration between the variables is

Table 3: ARDL bounds test for co-integration.

Critical value	Lower bound value	Upper bound value
1%	3.66	5.17
5%	2.78	4.06

Computed F-statistics FIn ECG (InAGP, InECR, InIFR, InITR) = 4.88.
Source: Author's Computation from E-view 7.1

Table 4: Estimated long-run coefficients using the ARDL approach.

Regressor	Coefficients	Standard Error	T-Ratio	Probability
Constant	1.3627	0.5986	2.2765	0.034
LAG	3.2880	1.4571	2.2565*	0.044
LIF	-3.4881	1.9612	-1.7786**	0.088
LIR	-1.2870	3.7821	-0.4626	0.665
LECR	0.4621	0.1937	2.3856	0.277

Dependent Variable: LGDP, * (P < 0.05), ** (P <0.1).*Source: Author's Computation from E-View 7.1.*

rejected and the alternative is accepted.

Estimated long run relationship

The result of long run estimated parameters indicated that agricultural production and inflation rate has a statistical significant relationship with economic growth over the period covered in the study (Table 4). However, interest rate and exchange rate do not have a significant relationship with economic growth. Given the long run estimates of the ARDL co-integrated results for economic growth model, the interpretation of the long run coefficients are based on the elasticities of the estimated results. The coefficient of the long run agricultural production (InAGP) is positive indicating a positive relationship between agricultural production and economic growth which conforms to *a priori* expectation. The coefficient is 3.288 which mean that agricultural production is elastic in relation to economic growth. The result showed that a 1% change in agricultural production will bring about 3.3 increases in economic growth and is statistically significant (P< 0.05). The coefficient of inflation rate InIFR is negative (-3.4881) and was statistically significant (P< 0.1) and this conforms to *a priori* expectation. The coefficient is less than one which means that inflation rate is inelastic in relation to economic growth indicating that a unit increase in inflation rate will lead to decrease of economic growth by 3.488. The coefficient of exchange rate (In ECR) was positive (0.4621) while that of interest rate was negative (-1.2870) and are not statistically significant. The coefficients are less than one which means that exchange rate and inflation rates are inelastic in relation to economic growth indicating a change in exchange rate and interest rate will lead to less than proportionate change in economic growth. The VECM coefficient is the speed of adjustment factor which tells how fast the system adjusts in order to restore equilibrium. It also shows the reconciliation of the variables over time right from the disequilibrium position to the period where equilibrium is restored. The result of the vector error correction model (VECM) for the dependent variable ΔGDP has a negative sign, is between zero and one and from the t-statistics, it is statistically significant (P < 0.1). The significance of the error correction model indicates that there is a steady long run equilibrium state between Real GDP and the independent variables. The adjustment speed is -0.7622. In addition, the coefficient lies between 0 and 1 and t-statistics is 3.1284 which is greater than 2 in absolute value; therefore it is statistically significant. Thus, current period would be corrected in subsequent periods. This further shows that the system has the ability of converging during instances of external shocks.

Estimated short run relationship

The results of the short run dynamic coefficients associated with long run relationship were obtained from the error correction model as shown in (Table 5). The Vector Error Correction Model (VCM) is used to determine the speed of adjustment of the variables i.e. how errors generated in the short run are corrected in the long run equilibrium path. From the results, the estimated error correction coefficient was -0.7622, which is highly significant (0.002). This implies a fairly high speed of adjustment to equilibrium after a shock. Approximately 76% of the equilibria from the previous year's shock converge back to the long run equilibrium in the current year. Agricultural production and inflation rate were found to be significant variables influencing economic growth at 5% and 10% levels of probability, respectively. The coefficient of inflation rate was negative (-1.7442) and was found to be insignificant just as in the case of the long run relationship. Exchange rate was positively

Table 5: Results of the ARDL Short-run Relationship.

Regressor	Coefficients	Standard Error	T-Ratio	Probability
ΔLAG	2.8654	1.1774	2.4336**	0.032
ΔLIF	-1.8341	1.0715	-1.7118***	0.056
ΔLIR	-1.7442	2.3151	-0.7534	0.476
ΔLECR	2.7342	1.4996	1.8233**	0.048
Emc (-)	-0.7622	0.2436	3.1284*	0.002
R-squared	0.7822			
S.E of Regression	0.320			
Log-likelihood	-9.1605			
Akaike Info. criterion	13.1607			
F-Stat.	12.6512[0.067]			
R-Bar-squared	0.761			
Durbin Watson –statistic	1.8466			

Dependent Variable: LGDP. *(P <0.01), ** (P < 0.05), *** (P < 0.1). *Source: Author's Computation from E-view 7.1*

Table 6: ARDL Model Diagnostic Tests.

LM Test Statistics		Probability
A: Functional Form	χ2(1) = 0.3261	[0.578]
B: Heteroscedasticity	χ2(1) = 1.2072	[0.772]
C: Serial Correlation	χ2(1) = 0.6210E-3	[0.977]
D: Normality	χ2(2) = 1.0187	[0.682]

NB: A: Ramsey's RESET test using the square of the fitted values
B: Based on the regression of squared residuals on squared fitted values
C: Lagrange multiplier of residual serial correlation
D: Based on a test of skewness and kurtosis residuals
Source: Author's Computation from E-view 7.1

related to economic growth with a coefficient of 2.7342 and was statistically significant (P< 0.1).

Diagnostic tests

Table 6 showed the outcome of the Ramsey's RESET test, heteroscedasticity, Jarque Bera normality test and Lagrange multiplier test of residual serial correlation. The results indicated the model passed all the tests and this implies that it has a correct functional form, meaning its residuals are serially correlated, normally distributed and homoscedastic.

Implications for rural poverty alleviation

The study established the significant influence of agricultural production in enhancing economic growth in Nigeria, Nevertheless, economic growth does not always translate into poverty reduction as evident in Nigeria and this is not uncorrelated to the monolithic economy of Nigeria which the country depends solely on oil proceeds. This calls for appropriate policy measures aimed at diversifying the economy. Findings revealed the relevance of agricultural development as a panacea for economic growth and therefore advocates for investment in the agricultural sector by all tiers of government that will promote economic growth and ultimately result in poverty reduction. This is in line with Badiene, (2008) who noted that agricultural growth has been key to reducing poverty and hunger in Africa. More importantly, to achieve economic growth that will translate into poverty reduction, agriculture has to be prioritized as pivot to the economy because a larger proportion of the populations of Nigeria rely directly or indirectly on agriculture as a means of livelihood in rural Nigeria.

Conclusion and Recommendations

The study concluded that the key to sustain agricultural production is to make the farm sector more productive through better and efficient policies so as to maintain the positive relationship between agricultural production and economic growth in Nigeria as revealed by the findings of this study. The study reveals a significant loon and short run relationship between agricultural production and economic growth. Thus, it is necessary to emphasize how agricultural production in Nigeria can be improved which in turn will increase the level of economic growth. Therefore, the monolithic nature of the Nigerian economy

which basically relies on oil proceeds should no longer be allowed. The study suggests the need for government to diversify the economy away from its major dependency on oil by promoting the development of the agricultural sector. This will create more employment opportunities for the teaming unemployed population, provide more investment opportunities, increase non-oil exports, improved technology, external reserves leading to favorable foreign exchange conditions and improved economic growth for the country.

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