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Impact of agricultural sub-sectors performance contribution to Nigerian economic growth: Empirical evidence using Autoregressive Distributed Lag (ARDL) model

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Abstract: The agricultural sector in Nigeria has been the mainstay of the economy; however, there is tranquil negativity in the productivity of the sector and its contributions to economic growth. This study empirically examines the impact of agricultural sub-sectors' performance contribution to Nigerian economic growth, using time series data of 1981 to 2023. Augmented Dickey Fuller (ADF) and Philipps Perron (PP) test were used in examining the stationarity of the data series. Bound test was used to determine co-integration of agricultural sub-sectors and real GDP. Subsequently an autoregressive distributed lag (ARDL) model was used to determine the relationship of the variables under study. The study findings revealed that there was no long run relationship among the studied relationship variables. However, the combination effect of the aggregate agricultural sector has a significant contribution to economic growth. Conversely, only livestock and fishery subsectors significantly contribute to economic growth in the short-run relationship. The study, therefore, implies the viability of the subsectors as source of economic growth in Nigeria. It can be recommended that government agricultural programs and policies shall be sector specific and toward holistically improving specific value chains especially in the livestock and fishery sub-sectors.
Keywords: Subsectors, Agriculture, Philip Perron, Performance, Growth and Economy

INTRODUCTION

Agriculture is the heart of economic growth, development and poverty eradication in developing countries by serving as an engine and solution to economic prosperity (Sertoğlu, Ugural & Bekun, 2017) Agricultural sector remains the largest contributor providing inputs, food, employment opportunities, raw materials for other industries, provision of foreign earnings from exportation of the surpluses, and more importantly the enormous advantage of the value added in the various production process (Ehighebolo, 2023). The agricultural sector in Nigeria was the mainstay of the economy as it contributed about 80% of receipts on exports, 65% of GDP and about 50% of the government revenue during 1960s. This contribution over the years has taken a descending turn, leading to a low contribution of agriculture to GDP of about 26.84% in 2021 (CBN, 2022). This state of the sector decline was blamed on the 1970s oil glut and its consequences on several occasions, which had decreased Agricultural contribution to GDP during the period (Falola & Haton, 2008). The sector also continues to rely on primitive methods to sustain a growing population without efforts to add value. Even though Nigeria is blessed with fertile and cultivable arable land running into millions of hectares across different regions suitable for crop cultivations and livestock breeding, miles of flowing rivers and resourceful Atlantic Ocean with varieties of fishes and vast rich forest belt. There is still a negative reflection on the sector's productivity, its contributions to economic growth, and its ability to perform its traditional role of food production.

It is the realization of this fact that the nation's government initiated several agricultural reforms and policies aimed at improving the sector's performance. These include but are not limited to National Accelerated Food Production Programme (NAFPP), Agricultural Development Projects (ADPs), Operation Feed the Nation (OFN), Fadama I,II and III, National Economic Empowerment Development Strategy (NEEDS), Agricultural Trade Policy and agricultural subsidies, Agricultural Promotion Policy (APP) and more Agricultural transformation Agendas such as GEEPs and anchor borrower programs (FMARD, 2022). These established policies have recorded an improvement in the sector over the years. However, the potential of the sector in the country is still in doubt toward achieving the goal of sustainable food production, poverty reduction, ameliorating unemployment and general economic growth.

Previous studies have revealed a positive impact of the Agricultural sector's contribution to economic growth; however, the studies have employed varied approaches of evaluation; most of the scholars have evaluated the relationship by considering the agricultural sector as an aggregate, for instance, Ahungwa et.al. (2012); Abula (2016); Ekpo, (2017), and Jonathan et al (2020) have evaluated and revealed the positive impact of agricultural sector aggregate on economic growth using time series data. More recent studies have assessed the implication of disaggregated agricultural sub-sectors' impact on economic growth and development (e.g Agboola et al, 2020; Akpan, 2021; Ehighebolo, 2023) using varied econometric approaches and they revealed specific agricultural sub-sectors implication on economic growth over a varied period. For instance, Edotola & Etumnu (2013) and Sertoğlu, Ugural & Bekun (2017) have revealed only positive impact of crop production sub-sector on Nigeria's economic growth using data series of 1981 to 2011. Consequently, in a quest for more robust policies that will accelerate agricultural sector productivity and enhance economic growth. This study evaluated the impact of Agricultural sub-sectors contribution to economic growth over the period of 43 years (1981-2023).

The study specifically addressed the following specific objectives.

i. Determine long run relationship between agricultural subsectors and economic growth
ii. Ascertain the influence of agricultural subsectors performance contribution to Nigeria's economic growth.

METHODOLOGY

To investigate the impact of crop, livestock, fishery and forestry subsectors on the economic growth of Nigeria, time series data from 1981 to 2023 for all the variables were obtained from the Central Bank of Nigeria's website (CBN) and Nigerian Bureau of Statistics (NBS). This study utilized Real GDP as a proxy for economic growth.

Modifying the regression model obtained from Akpan, (2021), the baseline equation for this study is expressed as

$RGDPt = f(Crop, Livst, Forestry, FISHt, \varepsilon_t$ ....(1)

Where

RGDP = Real Gross Domestic Product
Crop = Crop production Value
Livst = Livestock Value
Forestry = Forestry Value
Fish= Fishery Value

Equation (1) is transformed to natural logarithms as follows:

$LnGDPt = \alpha_0 + \beta_1 LnCrop_t + \beta_2 LnLivst_t + \beta_3 LnForestry_t + \beta 4 LnFish_t + \varepsilon_t$.................... (2)

The study made use of Augmented Dickey-fuller (ADF) and Phillip-Perron (PP) test to ascertain the level of stationarity of the variables, a Bound test was carried to test for a coin-integrating relationship between the variables. Furthermore, the diagnostics test of Autocorrelation, Heteroscedasticity and normality test was carried out to determine the consistency and reliability of the estimated relationship.

ARDL Econometric Model: The method of data analysis adopted for this study is ARDL. The technique is adopted due to its advantages over other time-series data analysis techniques. Some of these advantages are: it's a more robust econometrics technique for estimating the level relationship between dependent variables and a set of independent variables that may not necessarily be integrated of the same order, the model is used in determining the long-run relationship between series with a different order of integration (Pesaran & Shin 1999).

The general model to be estimated is represented by:

$LnGDPt = \rho_0 + \rho_1 LnCrop_t + \rho_2 LnLivst_t + \rho_3 LnFish_t + \rho_4 LnForestry_t + \rho 5 GDP_{t-1} + \varepsilon_t$… (3)

where GDP is the real per capita GDP (a proxy for economic growth), LnCrop is crop production, Lnlivst is the Livestock sub-sector contribution to GDP; Lnfish is the Fish sub-sector contribution to GDP, and LnForestry is the Forestry sub-sector contribution to GDP and ε is the error term.

The autoregressive distributed lag stationarity (ARDL) representation of the cointegration test equation to be tested for each model is given by:

$\Delta LnGDPt = \propto_0 + \sum_{i=0}^{1} \propto_1 i \Delta LnCrop_{t-i} + \sum_{i=0}^{2} \propto_{2i} \Delta LnLivest_{t-i} + \sum_{i=0}^{3} \propto_{3i} \Delta LnFish_{t-i} + \sum_{i=0}^{4} \propto_{4i} Ln\Delta Forestry_{t-i} + \sum_{i=0}^{5} \propto_{5i} \Delta LnGDP_{t-i} + \sigma_1 LnCrop_{t-1} + \sigma_2 LnLivest_{t-1} + \sigma_3 LnFish_{t-1} + {}_4 LnForestry_{t-1} + \sigma_5 LnGDP_{t-1} + U_t$ …………………………….. (4)

where all other variables are as defined, except Δ, which is the difference operator, $\propto 0, \propto i, 1 - \propto i, 5$ and $\sigma i, 1 - \sigma i, 5$, which are the respective coefficients, and $\mu 1t$, which is the error term.

The null hypothesis of the non-existence of a cointegration relationship is:

$H0: \sigma i, 1 = \sigma i, 2 = \sigma i, 3 = \sigma i, 4 = \sigma i, 5 \neq 0$ ……………. (5)

This was tested against the alternative hypothesis of the existence of a cointegration relationship, that is:

$H1$:

$\sigma i, 1 \neq \sigma i, 2 \neq \sigma i, 3 \neq \sigma i, 4 \neq \sigma i, 5 \neq 0$…………………(6)

The evaluation of the cointegration relationship was done with the aid of the lower and upper bound F-statistic critical values of Pesaran et al. (2001:300). A cointegration relationship is only valid when the calculated F-statistic is greater than the upper bound, otherwise it is inconclusive, or the null hypothesis of no level effect cannot be rejected.

The variables included in the ARDL representations were found to be none cointegrated, therefore only the short-run equation was estimated as given below

$\Delta LnGDPt = \propto_0 + \sum_{i=0}^{1} \propto_1 i \ \Delta LnCrop_{t-1} + \sum_{i=0}^{2} \propto_{2i} \Delta LnLivest_{t-2} + \sum_{i=0}^{3} \propto_{3i} \Delta LnFish_{t-3} + \sum_{i=0}^{4} \propto_{4i} \Delta LnForestry_{t-4} + \sum_{i=0}^{5} \propto_{5i} \Delta LnGDP_{t-5} + U_t$ ……(7)

RESULT AND DISCUSSION

Unit Root Test result for Stationarity

This section shows the various results of the tests carried out. Foremost, the Augmented Dickey–fuller and Phillip Peron are presented. Table 1 presents a summary of the stationarity result. All series have stochastic behaviour in ordinary form. However, series at their first difference and second difference form is stationary. The outcome of the ADF is like the PP. Based on the conclusion of the stationarity result, the article proceeds to estimate the long-run relationship using bound test co-integration test given the fact of mixed order of stationarity among the series variable

Table 1: Unit Root Test result

Series	Philipps Perron	Integration order	Augmented Dickey Fuller	Integration order
LnGDP	-5.2002***	I(1)	-5.215107***	I(1)
LnCrop	-6.0995***	I(1)	-6.099528***	I(1)
LnLivst	-9.8434***	I(2)	-9.428021***	I(2)
LnFish	-4.6103***	I(1)	-5.526581***	I(2)
LnForestry	-6.8409***	I(1)	-6.758236***	I(1)

Source: Authors' computation using E-views 9.

Co-integration: ARDL Bound Test

The result for the integration was shown in table 2. The result indicates that the computed F-statistic is lower than the upper critical bound at the 5% and 10% level of significance. This implies that there is no cointegration between the series, and it therefore implies that all the independent variables in the estimated equation are not cointegrated with the dependent variable over the study period. This indicated that the agricultural subsectors have only short run impact on the national economic growth

Table 2: ARDL Bound Test

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	K
F-statistic	2.265462	4
Critical Value Bounds		
Significance	I0 Bound (lower)	I1 Bound (upper)
10%	2.2	3.09
5%	2.56	3.49
2.50%	2.88	3.87
1%	3.29	4.37

Source: Authors' computation using E-views 9.

ARDL Short-Run Result

The short run result for the relationship between the variables is presented in table 3. The results F- value that is significant at 1% level of confidence and 0.93 value of R^2 indicate the overall fitness of the models in determining the influence of agricultural subsectors on economic growth. The results further show that only Livestock and fishery sub-sectors significantly influence economic growth at a 10% significance level. The coefficient of Livestock, which is positive and significant, implies that the magnitude of change in economic growth will increase by 2.45 units with a unit change in livestock productivity output, meaning that more investment in the livestock sub-sector will hasten economic growth. On the other hand, the negative and significant fishery sub-sector coefficient implies that value added from fishery sub-sector leads to a decline in the country's economic growth. This is true because most fish products are imported to the country, and importation decreases national GDP. Furthermore, the results have indicated the need for more investment in livestock subsector and effort by government to encourage and support domestic fish value chain to discourage importation, which has an inverse relationship with economic growth.

Table 3: ARDL Short-Run Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOGGDP(-1)	0.781613	0.164468	4.75238	0.0000
LOGGDP(-2)	-0.01491	0.21225	-0.070267	0.9444
LOGGDP(-3)	-0.24747	0.17861	-1.385544	0.1755
LOGCROP	-0.0243	0.435436	-0.055798	0.9558
LOGLIVST	2.455204	1.294439	1.896732	0.0669
LOGFSH	-0.47893	0.278278	-1.721057	0.0949
LOGFRSTRY	-0.81429	0.666973	-1.220877	0.2311
C	-6.41512	3.575223	-1.794328	0.0822
R-squared	0.936941	Mean dependent var		11.22965
Adjusted R-squared	0.923147	S.D. dependent var		0.384005
S.E. of regression	0.106455	Akaike info criterion		-1.46533
Sum squared resid	0.362648	Schwarz criterion		-1.12755
Log likelihood	37.30649	Hannan-Quinn criter.		-1.3432
F-statistic	67.92291	Durbin-Watson stat		2.105034
Prob(F-statistic)	0.0000			

Source: Authors' computation using E-views 9.

Diagnostic check

The result for post-estimation diagnostic check was presented in Table 4. The result shows no serial correlation among the residuals; give that Breusch-Godfrey Serial Correlation LM Test that has shown no significance. The residual has constant variance over time and is normally distributed, given the insignificance value of ARCH Heteroskedasticity Test; implying that the series of the variable's relationship is homoscedastic. In addition, Figures 1 also present the stability graph of the models. It can be deduced from the figure that the models are stable for forecast; given the fact that CUSUM line falls in between the lower boundary and the upper boundary. The result implies the consistency and reliability of the estimated relationship making the recommendation of the study paramount for policy implication.

Table 4: Diagnostic check

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	1.094169	Prob. F (2,30)	0.3478
Obs*R-squared	2.719417	Prob. Chi-Square (2)	0.2567
Heteroskedasticity Test: ARCH			
F-statistic	0.84441	Prob. F (1,37)	0.3641
Obs*R-squared	0.870195	Prob. Chi-Square (1)	0.3509

Source: Authors' computation using E-views 9.

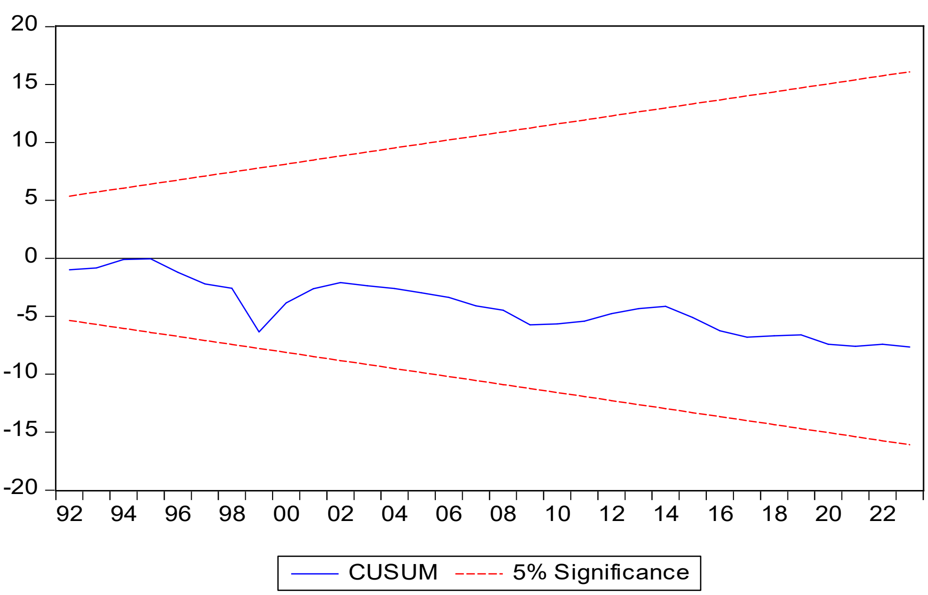

Figure 1: CUSUM graph for Stability diagnosis

CONCLUSION AND RECOMMENDATIONS

This study established the relationship between economic growth and agricultural subsectors. However, in the short run, the aggregate of agricultural subsectors significantly contributed to economic growth. Meanwhile, only livestock and fishery sub-sectors had a significant influence on the economic growth. This study proffers the following recommendations to ensure sustainability and enhance economic growth.

i. The Agricultural programs and policies shall be sector-specific and toward holistically improving specific value chains,
ii. The government should improve and support fish production technologies, given that they are paramount to national economic growth.
iii. Given its positive relationship with economic growth, the government and private enterprises should strengthen livestock sub-sector value chains with innovative technology to increase productivity.

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