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Empirical Comparative Analysis ofAgricultural Crops, Livestock, Forestry and Fishery Sectors Relative to Economic Development in Nigeria

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ABSTRACT

Nigeria is blessed with a wide variety of potentials, ranging from biological resources such as agricultural crops, animals, and forests to mineral resources and most of all human resources. Many Nigerians engage in agriculture as well as forestry activities however, while many nations in the world are reaping bountiful harvest, Nigeria is among the few that have greatly retarded from their past glorious heights in these sectors. The contribution of Agricultural crop, livestock, forestry as well as fishery sector to economic growth in Nigeria between 1981 – 2014 was investigated in this study.Secondary data was collected andanalysed using tools such as descriptive statistics - time series analysis was used to study the trend of growth of the variables. In addition, inferential analysis such as unit root test, stationarity test, co-integration regression and error correction model (ECM) were performed. The findings indicated that there is a positive relationship between crop production, fish output, forestry, livestock production and Gross Domestic Product (GDP). A unit change in Crop production (CPP), Fishery (FIY), Forestry (FRY) and Livestock production (LIY) was found to change real GDP by 0.995033, 0.973790, 0.965423, 0.995804 respectively. It is therefore concluded that the sectors boost the rate at which the GDP increases. Hence, the development of forestry and the crop sector are a sine qua non for economic growth and should be accorded maximum priority.

Keywords*:* Agricultural Crop, Livestock, Forestry, Fishery, Gross Domestic Product (GDP)

Introduction

Forestry and agricultural sectors play significant roles in virtually all social and economic activities of a country though there activities are usually concentrated in the less developed rural areas.According to the report by Central Bank of Nigeria (CBN), between 1978 and 2008 the average share of government total spending on agriculture and Forestry related economy in the total government spending on economy was 3.11% (CBN 2009). The shares of forestry/agricultural output in the total Gross Domestic Product (GDP) of the Nigerian economy in 1978 was 23.28% and increases further to 33.21% in 1983. It increases further to 40.60% in 1988 and increased again to 48.57% in 2002 before declining to 32.85% in 2008 (CBN, 2009).The shares of forestry/agricultural output in the total Gross Domestic Product (GDP) of the Nigerian economy in 1978 was 23.28% and increases further to 33.21% in 1983. It increases further to 40.60% in 1988 and increased again to 48.57% in 2002 before declining to 32.85% in 2008 (CBN, 2009). In the 1960s, forestry and agriculture accounted for 65-70% of total exports. It fell to about 40% in the1970s and graphed to less than 2% in the late 1990s (CBN, 2001; Olajide *et al.* 2012).

The decline in these sectors were largely due to rise in crude oil revenue in the 1970s (Samuel, 2025). Less than 50% of the Nigeria's cultivable agricultural land is under cultivation (FRN, 2025). The small

holder farmers are constrained by many problems including those of poor access to modern inputs and credit, poor infrastructure, inadequate access to markets, land and environmental degradation, and inadequate research and extension services (Lawal, 2011). Ayoola and Oboh (2020) reported that the government share on agricultural spending was 1.67% of total spending in the economy in 1978 which increased to 2.5% in 1983 and further increased to 4.59% in 1989. In 1995, it declined to 1.9% and dipped further to 0.59% in 1996. In 2001, it increases to 6.38% and slumped again to 1.31%. In 2005, it increased again to 3.99% and increased further to 5.28% in 2008. Ewetan *et al*., (2017) also submitted that in the early 1980s and late 1990s, there was high level correlation between the Nigerian Gross Domestic Product (GDP) and agricultural output. Thereafter, from early 2000s there was wider gap between GDP and agricultural output.

The response of the Nigerian economy to the various agricultural policy measures has been mixed. Between 1970 and 1982 agricultural growth rate stagnated at less than 1% with sharp decline in the production of export crops. During this period, Nigeria turned a net importer of agricultural produce (FMA, 1984). The performance of the sector was undermined by other unfavourable policies created by the macroeconomic environment; specifically the introduction of the structural adjustment programme (SAP) which placed ban on the importation of some food items in order to increase the output of local products (CBN, 1992). This negatively affected the growth and the profit margin of agricultural activities leading to reduction of farm holdings and enterprises. The performance of agriculture in the post SAP era of 1989 to 1997 through to 2000 was one of unsteady progress in production, growth rate and contribution to the Gross Domestic Product (CBN, 2014). The average growth during this period was 4.0% although agriculture still accounts for 88% of the non-oil foreign exchange earnings and employs about 70% of the active labour force of the population (FMA 2001).

Viewed against the population growth rate of 2.83% (FMA, 2001) the agricultural growth rate which is higher than the population growth rate has continued to guarantee the sector's ability to meet the demands on it for food, although this increase in agricultural production cannot be excised from the readiness of the peasant farmers to adopt new system of farming viz-a-viz: Mechanization which has been on the increase in the recent years, the bulk source of power in average Nigerian farm is still human.

Table 1: Structure of economy, 1970 to 2004 (percentage of GDP at current factor cost).

Variable	1970	1980	1990	2000	2003	2004
Oil sector	6.0	29.1	39.3	4 8.2	44.6	48.2
Non-oil sector	94.0	70.9	60.7	51.8	55.4	51.8
Agric	41.3	20.6	29.7	26.3	26.4	16.6
Industry	7.8	16.4	7.4	4.5	4.8	8.7
Services	45.0	33.8	23.6	21.0	24.2	26.5

Source: National Bureau of Statistics/IMF in Daramola *et al.* (2007)

Many Nigerians engage in agricultural practices as well as forestry activities however, while many nations in the world are working hard and reaping their harvest in this direction, Nigeria is among the few that have greatly retarded from their past glorious heights in these sectors, down to a near zero scale of production. This

according to Chigbu, (2005) is attributed to acts of irresponsibility and ill-purposeful leadership. In view of this, the study explored the impact ofagriculture (Crop, Livestock, Fishery) and Forestry sectors on Nigeria's economic growth while focusing on the degree of causality and the extent to which long-run relationship existing between the sectors and economic growth in Nigeria.

Methodology

Study area

The Federal Republic of Nigeria is located in West Africa between latitude 4º-14ºN and longitude 3º-15ºE. It is bordered by the Gulf of Guinea to the south, Benin to the West, Niger to the North and Cameroon and Chad to the East, Nigeria comprises of 36 states and its Federal Capital Territory, Abuja. There are over 200 million people with more than 250 ethnic groups within Nigeria.The major ethnic groups being Hausa/Fulani/ Igbo and Yoruba who predominantly live in the northern, eastern and western parts of the country, respectively. Nigeria has a total land area of 923,768sqkm including 13,000km^2 of water, a border length of 4,047km and a coastline of 853km (NPC, 2006).

Data Source

In order to examine the effect of the sectors on economic growth, four variables were considered as the independent variables, they are output on forestry sector, crop production, animal production and fisherywhile the economic growth, proxy by Gross Domestic Product (GDP) as dependent variable. All data were sourced from the Central Bank of Nigeria (CBN) statistical bulletin. The time series data cover 33 years ranging from 1981 to 2014 empirically testing the significant contribution of the sectors to economic growth.

Gross Domestic Product (GDP)

The rate of growth of GDP per capita is calculated from data on GDP and population for the initial and final periods while autoregressive distributed lag (ARDL) bound testing procedure was used to examine the co-integration relationship between economic growth and its agricultural determinants (crop production, livestock production, forestry and fishery) as well as the short run dynamics. The bound test is basically computed based on an estimated error correction version of autoregressive distributed Lag (ARDL) model, by ordinary least square (OLS) estimator (PESARAN *et al.*2001).

Data analysis

Data were analyzed using tools such as descriptive statistics - time series graphs to study the trend of growth of the included variables, mean, median, standard deviation and so on. Also, inferential analysis such as unit root test, stationarity test, co-integration regression and error correction model (ECM) were performed.

Model Specification

Unit Roots Test

The usage of ordinary least squares (OLS) methodology on time series data usually requires that the data be stationary to avoid the problem of spurious regression, (Noula*et al.*, 2013;Gujarati,2004). A series is therefore stationary if it is the outcome of a stationary process. The following decision rule is used;

* If the ADF test statistic is greater than the critical value, then the series is stationary.

*If the ADF statistic is less than the critical value, the series is non-stationary.

The relationship between Economic growth, crop production, livestock production, fishery and forestry is expressed implicitly as:

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$$GDP = F(CPP, LPP, FRY, FIY) ----- (i)$$

The choice of crop production, livestock production, forestry and fishery as explanatory variables is based on economic theory as they have been selected in agricultural sector to determine their influence on economic growth over the period under study. Trend is not included as an explanatory variable as it was not considered as a variable of interest in this study.

$$\begin{aligned} \Delta Ln\, GDP &= \Psi o + \Sigma Pi \\ &= 1\,\Psi 1 \Delta LnGDPt - i \\ &+ \Sigma Pi \\ &= 0\,\Psi 2 \Delta Ln\, CPPt - i \\ &+ \Sigma Pi \\ &= 0\,\Psi 3 \Delta LPPt - i + \Sigma Pi \\ &= 0\,\Psi 4 \Delta Ln\, FRYt - I \\ &+ \Sigma Pi \\ &= 0\,\Psi 5 \Delta Ln\, FIYt - i \\ &+ \beta 1 LnGDPt - 1 \\ &+ \beta 2 LnCPPt - 1 \\ &+ \beta 3 LnLPPt - 1 \\ &+ \beta 4 LnFRYt - 1 \\ &+ \beta 5 LnFIYt - 1 + Ut \\ &----- (ii) \end{aligned}$$

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

$$\begin{aligned} LnGDP = {} & \Psi + B1\, In\, GDPt - 1 \\ & + \beta 2\, In\, CPPt - 1 + \end{aligned}$$

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

$$\begin{aligned} \Delta Ln\, GDPt &= \Psi o + \Sigma Pi \\ &= t\,\Psi 1 \Delta In\, GDPt - i \\ &+ \Sigma Pi \\ &= o\Psi 2\, \Delta\, In\, CPPt - i \\ &+ \Sigma pi \\ &= o\Psi 3\, \Delta Ln\, LPPt - i \\ &+ \Sigma Pi \\ &= o\Psi 4 \quad \Delta LnFRYt - i \\ &+ \Sigma pi \\ &= o\Psi 5\, Ln\, FIYt - i \\ &+ \text{ɗ} ecmt - i + ut \end{aligned}$$

Where

GDP = Gross domestic product (Naira) usedto measure the Economic growth
CPP = Crop production
LPP = Livestock production
FRY = Forestry
FIY = Fishery
$\Psi 0$ = Constant term
Ψt = White noise
$\Psi 1 - \Psi 5$ = Short run elasticities (coefficients of the first – differenced explanatory variables)
$\beta 1 - \beta 5$ = Long run elasticities (coefficients of the explanatory variables)
$ecmt - 1$ = Error correction term Lagged for one period
б = Speed of adjustment
Δ = First difference operator
Ln = Natural logarithm
P = Lag length

The analysis of the data was carried out using E views 9.0

Method of Evaluation

The evaluation was based on three criteria; economic criteria, statistical criteria and econometrics criteria.

Economic Criteria: This evaluation consist of deciding whether the estimates of the parameters are theoretically meaningful, and statistically satisfactory. Economic criteria helps to know when they are deviating from what is actually required.

Statistical criteria; the following were used:

The R^2: Also known as co-efficient of multiple determinations.The value of R^2 lies between 0 and 1. The higher the R^2, the

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better the goodness of fit of the regression plan to the sample observation and the closer the R^2 to zero, the worse the fit (Gujarati, 2004).

The F- test: The test aims at finding out whether the joint influence of the explanatory variable on the dependent variable is statistically significant.

Decision Rule:

If F calculated (F) is greater than $f-tabulated(i.eF*)$ is greater than f-tabulated (i.e $F* > F$ tab). With the chosen level of significance with $k-1$ and $N-K$ degree of freedom, we reject the null hypothesis, that is, we accept that the regression model is significant. But if $F* < F$ tab, we accept null hypothesis, that is, we accept that the regression model is not significant with K-1 and $N-K$degree of freedom. The chosen level of significance in this test is 5 percent (5%).

Econometrics Criteria: Auto-correlation was tested using the Durbin-Watson test for multico-linearity, normality and Heteroskedasticity.

Durbin-Watson test was determined by the theory of econometrics. It is used to test for the percentage of first auto-correlation. The level of significance used is 5 percent.

Decision Rule: Accept the null hypothesis if $du < d < (4-du)$ that is, there is no auto-correlation of first order. These are the guiding principles throughout this study.

Results and Discussion

In table 2 below, the average values of GDP, crop output, fish output, forest output and livestock output over the period between 1981 and 2014 were ₦465 billion, ₦167 billion, ₦6 billion, ₦3 billion and ₦13 billion respectively. The gross domestic product, crop output, fish output, forest output and livestock reached their peak values of ₦1 trillion, ₦380 billion, ₦13 billion, ₦5 billion and ₦25 billion respectively in the year 2014. However, gross domestic product and crop output had their minimum values of ₦227 billion and ₦68 billion respectively in the year 1984, while fish output, forest output and livestock output had their minimum values of ₦2 billion, ₦2 billion and ₦7 billion in the years 1987, 1989 and 1981 respectively. Gross domestic product had the highest variation as it deviated by 223 standard deviation point around its mean value, crop deviated by 84 standard deviation point around its mean value, fish by 3 standard deviation around its mean, forestry had 1 standard deviation point around its mean and livestock is by 5 standard deviation point around its mean. Gross domestic product had the highest deviation and forestry had the least deviation.

Table 2: Average value of variables between 1981 and 2014

Variable	Standard deviation	Mean	Median	Maximum	Minimum
GDP	222.9802	465.1329	383.1500	1009.230	227.2500
CROP	83.57245	166.7556	141.4050	380.3500	67.55000
FISH	3.227428	5.916471	4.620000	13.14000	1.730000
FORESTRY	0.805925	2.860588	2.560000	4.950000	1.990000
LIVESTOCK	7.060000	12.84088	10.74500	25.28000	5.104116

Correlation Analysis

GDP, crop output, fish output, forest output and livestock output were positively and strongly correlated with one another (Table 3). The correlation between any two of these variables exceeds 0.9, for example the correlation between GDP and crop output

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was approximately equal to one, GDP and others like fish output, forest output, livestock output was also approximately equal to one which shows a positive and strong relationship between the dependent variable GDP and the independent variables over the years. Therefore, a unit change in Crop production (CPP), Fishery (FIY), Forestry (FRY) and Livestock production (LIY) will change real GDP by 0.995033, 0.973790, 0.965423, 0.995804 respectively.

Table 3: Correlation Matrix

	GDP	Crop	Fish	Forestry	Livestock
GDP	1.000000				
CROP	0.995033	1.000000			
FISH	0.973790	0.967303	1.000000		
FORESTRY	0.965423	0.953471	0.923145	1.000000	
LIVESTOCK	0.995804	0.990471	0.965981	0.977145	1.000000

Unit Root Test

The test was conducted using Augmented Dickey, Fuller (1981) and Philip and Perron (1988).The unit root test (Table 4) shows that GDP, Fish and Forestry were differenced once before they attained stationarity, while Crop and Livestock had to be differenced twice before attaining stationarity. Agricultural crop and forestry were significant at one percent level and at the second difference.

As a preliminary step for testing for co-integration and error correction model, the stationarity of the variables was examined. The ADF Philip perron tests were carried out. The observed values (ADF values) were found to be lower than the tabulated critical- values in absolute terms at the 5 % level of significance. Thus, variables are non-stationary and there is the existence of a unit root (Table 4). This confirms the hypothesis which says that time series data is usually non-stationary.The first difference stationarity test is then attempted. The results show that the observed values are significantly greater than the critical-values in absolute terms at the 5% level of significance. This implies that the variables are I(1) series. That is integrated of order 1 (Table 4).

Table 4: Unit Root Test

	ADF			Philip-Perron			
Variable	**level**	**first**	**second**	**level**	**first**	**second**	**Remarks**
GDP	10.085	-3.458*	-	9.10	-3.428*	-	1(1)
CROP	5.359	-2.552	-4.553***	6.613	-2.593	-3.95***	1(2)
FISH	7.063	-8.925**	-	-1.507	-4.009**	-	1(1)
FORESTRY	2.553	-5.024***	-	1.003	-5.064***	-	1(1)
LIVESTOCK	2.849	-3.008	-13.209***	6.310	-2.876	-12.646***	1(2)

*** significant at 1 % level ** significant at 5 % level * significant at 10 % level

Decision Rule:

If ADFs > critical value- stationary

If ADFs < critical value- Non stationary

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Co-integration Test

In Table 5, the Trace and Maximum- Eigen statistics of the Johansen co-integration test shows that there exist three and two co-integrating equations respectively among GDP, Crop, Fish, Forestry and Livestock. The Trace test however suggests that the appropriate model is model 3 as the null hypothesis was not rejected for the first time using model 1. However, the Maximum-Eigen value suggests that the appropriate model is model 1, as the null hypothesis was not rejected for the first time with model 3. Thus, a long run relationship exists among GDP, Crop, Fish, Forestry and Livestock.

Table 5: Johansen Co-integration

Statistics	Rank	Model 1	Model 2	Model 3
Trace	0	111.95**	107.91*	130.46*
	1	69.36*	65.35*	82.81*
	2	37.16*	33.21*	48.42*
	3	14.60	13.91	27.62*
	4	5.870	5.25*	8.47
Maximum-Eigen	0	42.58*	42.56*	47.65*
	1	32.20*	32.14*	34.39*
	2	22.56*	19.29*	20.80
	3	8.73	8.66	19.14
	4	5.87	5.25*	8.47

*denotes rejection of null hypothesis at the 0.05 level

Error Correction Model (ECM)

Given that the residuals from the above co-integration regression are stationary, and that the variables are co-integrated, the third stage proceeds to estimate the error correction representation. The ECM, (Table 6) incorporates the full (short run) dynamics of the model. At this stage all the conventional statistical tests of significance are considered to be appropriate, including the diagnostic tests for the assessment of the adequacy of the model. The purpose of the ECM is to switch to a short run model. Allowance is made for any short run divergence, in a corrective mechanism by which previous disequilibria in the relationship between the agricultural sector and the gross domestic product are permitted to affect the current change in economic growth. Theory expects that the ECM be negative and highly significant implying that an error in the current period is being corrected in the previous period.

Crop output and Economic Growth: The coefficient of crop output shows that a one percent increase of change in the growth rate of crop output in period "t" will result in a 0.38 percent increase of change in the growth rate of GDP in period "t+1"; holding other variables fixed, this is statistically significant at one percent level. Similarly, a one percent increase of change in the growth rate of crop output in the period "t", will result in a decline of change in the growth rate of GDP by 0.09 percent in period "t+2", holding other variables fixed. This is however not statistically significant.

Forest output and Economic growth: The coefficient of forest output shows that a one percent increase of change in the growth rate of forest output in period "t" will result in a 0.06 percent decline in the change in the growth rate of GDP in period "t+1", holding other variables fixed, this is not statistically significant. Similarly, a one percent increase of change in the growth rate of forest output

in the period "t", will lead to increase in the change in the growth rate of GDP by 0.09 percent on the average in period "t+2", holding other variables fixed ,this is statistically significant at one percent level.

***Fish output and Economic growth**:*The coefficient of fish output shows that there exists a negative relationship between the change in the growth rate of fish output and the growth rate of the economy. A one percent increase in the change in the growth rate fish output in period "t" will result in a 0.04 percent decline in the change in the growth rate of GDP in period "t+2", holding other variables fixed, this is not statistically significant.

***Livestock output and Economic growth**:*The coefficient of livestock output shows that there exists a positive but insignificant relationship between the change in the growth rate of livestock output and the growth rate of the economy. A one percent increase in the change in the growth rate fish output in period "t" will result in a 0.18 percent increase in the change in the growth rate of GDP in period "t+2", holding other variables fixed.

***Economic growth and its previous values**:*the change is economic growth in the previous years positively affect the change in the growth rate of economy in the future. However, only the coefficient of output in the period "t-1" statistically affects the growth of output in period "t". A one percent increase in the change in the growth rate of GDP in period "t", holding other variables constant will in the average increase the change in the growth rate of GDP by 0.05 percent in "t+1".

***The error correction coefficient**:* The error correction coefficient is negative and statistically significant. It shows that about 40% adjustment is made each period toward equilibrium in the occurrence of disequilibrium, further buttressing the existence of a long run relationship between agriculture and economic growth.

R^2 is 0.764277 which implies that 76.4% of the variation in real GDP is explained by the independent variables. The model is statistically significant at 1% level as shown by the probability value of the F-statistic.

Table 6: Error Correction Model (ECM)

Variable	Coefficient	Std. Error	T-Statistics	Prob.
Constant	0.014220	0.006753	2.105676	0.0481
LOG(CROP)	0.368356	0.064836	5.681384	0.0000
LOG(CROP) $_{-2}$	-0.089700	0.056134	-1.597952	0.1257
LOG(FOREST) $_{-1}$	-0.058813	0.056526	-1.040451	0.3062
LOG(FOREST) $_{-2}$	0.202752	0.052091	3.892250	0.0009
LOG(FISH) $_{-2}$	-0.036692	0.025414	-1.443766	0.1643
LOG(LIVESTOCK) $_{-2}$	0.175169	0.115083	1.522114	0.1436
LOG(GDP) $_{-1}$	0.464167	0.105005	4.420448	0.0003
LOG(GDP) $_{-2}$	0.292320	0.111351	1.522114	0.1436
ECT $_{-1}$	-0.397252	0.102579	-3.872661	0.0009
Adjusted R-squared	0.764277			
S.E. of regression	0.014412			
Durbin-Watson stat	2.186440			
F-stat	11.44730			
Prob > (F-stat)	0.000004			

Conclusion

Forestry, Crop production, Livestock production, and Fisherysectors have positive impact on the economic growth in Nigeria using Gross Domestic Product as a proxy. But to a large extent forestry and crop production contributed immensely and greatly to the economic growth within the period investigated. As the sectors increase, the rate at which the economy will also increase will be high especially if attention is given to forestry and crop production. Hence, the development of forestry, crop sectors are a sine qua non for economic growth and should be given adequate attention.The functioning of these sectors should be held as a corporate social responsibility. They should not be left to the peasant practitioners who are mostly the rural dwellers alone.

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