



CONTRIBUTIONS OF FORESTRY SUB-SECTOR TO NIGERIAN ECONOMY: A CO-INTEGRATION APPROACH

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ABSTRACT: Nigeria is endowed with enormous forest resources. These resources have contributed immensely to the livelihood of a vast majority of the people especially the rural dwellers that are heavily dependent on the forest resources as well as to the Gross Domestic Products (GDP). This paper was therefore prepared to appraise the contribution of the forestry subsector to the nation's GDP. Vector Auto Regression (VAR), Augment Dickey Fuller (ADF) and Granger-Causality tests were carried out to ascertain the contribution or otherwise of forest sub-sector to the country's GDP for the period from 1960 to 2011. All the analysis revealed that forest sub-sector contributed to the country's GDP during the period under investigation and not vice-versa. Therefore, it becomes important that governments at all levels and stakeholders in the forestry sub-sector should put in place policy trust that would encourage investment in forestry and also ensure the sustainable management of the forest resources for the well being of the people and overall development of the Nigerian economy.

Keywords: Forestry, investment, Augment Dickey Fuller, Granger- causality test, Vector Auto Regression, economic development

1.0 INTRODUCTION

Forest is a complex ecological system dominated with trees which grow tall and usually very close to one another covering many lower plants like shrubs and spines and animal species in the same environment (Alao and Ugwona 2011). FAO defined forest as land with trees crown cover or equivalent stocking level of more than 10% and area of more than 0.5ha (FAO 2001). Forest is an ecosystem characterized by a more or less dense and extensive tree cover, often consisting of stands varying in characteristics such as species composition, structure, age class, and associated processes, and commonly including meadows, streams, fish, and wildlife. Forest is a highly complex constantly changing environment made up of a variety of living things (trees, wildlife, shrubs, wild flowers, ferns etc) and non-living things (water, nutrients, rocks, sunlight and air). Forest plays a major role in our daily life. From the air we breathe to the wood we use, forest plays a role.

Summarily, forest provides habitats to diverse animal species; they form the source of livelihood especially for the rural people. World Bank (2008)

noted that about 1.6 billion rural people live on the forest. Forests also offer watershed protection thereby ensures the purity of water. They also provide timber and non-timber products and various recreational options. Forest prevents soil erosion, helps in maintaining the water cycle and checks global warming through the process of carbon sequestration. Forests are major sources of raw materials like fruits, wood that go into the manufacturing of everyday items like medicine, cosmetics, detergents etc. Many rural people depend on forest for shelter, medicine, food, cash income domestic energy like fuel-wood and charcoal. The chief economic product of the forest is timber but the economic benefits, in terms of climate change control and mitigation, pollution abatement, wild life maintenance and other intangible services of the forests have rarely been captured in the calculation of Gross Domestic Products (GDP).

1.1. *Historical perspective of Forestry Development in Nigeria*

Nigeria is richly endowed with abundant forest resources and over 10% of the land area is under forest cover (FAO, 2010) although this estimate has

reduced over the years due to deforestation and other environmental factors. The distribution of forest in Nigeria spreads from the rainforest zone in the south and decreases in density and structure as one moves up north which is predominantly of savanna nature characterized by grasses and sparsely populated tree cover. Forestry in Nigeria is believed to have started at the turn of the 19th century. According to Beak (1999), the first Forestry Department was formed in 1899 with jurisdiction over what is now southern Nigeria. This was followed with the issuance of Forestry Proclamation No 28 in 1901 which was an attempt by the authorities at that time to administer logging concession and regulate the exploitation of valuable timber species. The Forestry Ordinance of 1908 later led to the establishment of Nigeria's first reserve areas. The revision of the Ordinance in 1916 extending jurisdiction to the northern protectorate of the time was the first attempt at the coordination of forestry management activities in Nigeria. Forestry contribution to the Nigerian economy has been in the area of timber export. The value of Nigerian timber began to be widely recognized in the 1930s and 1950s. This period witnessed a rapid expansion of logging activities with large concession granted mainly foreign-owned timber companies like African Timber and Plywood (AT&P). The exploitation of forest resources continued to grow in the ensuing years driven both by increasing domestic demands and export market. The export of forest derived products peaked in the 1970s and according to Adeyoku (1975), Nigeria ranked second in 1966 as exporter of African tropical wood. However, despite a doubling in the production of industrial round wood from 1962 to 1971, the value of exports annually decreased over the period (Umeh, 1981 cited in Beak 1999). By the mid 1970s, a number of factors were beginning to impact on the ability of Nigeria's forest estate to sustain these levels of export and meet the needs of a rapidly growing population- a population whose demand for forest products became so high that wood exportation was finally banned in 1976 (Beak 1999).

Several studies have examined the contribution of the agricultural sector to the Nigerian GDP, but only few have looked into the contribution of each subsector in the agricultural sector to the GDP. Still very limited studies have been carried out to examine the contribution of the forestry subsector to the economic growth of the Nigerian economy. Alabi, et.al (2006) reported a decline in percentage share of forestry to total Agricultural GDP from 2.08% in 1986 to 0.62% in 2004 and attributed the cause to neglect of the subsector. Kalu and Okojie (2009)

examined the economic contribution of forest to the Nigerian economy from 1970 and 2000. The findings revealed that timber export and price index of timber actually contributed to economic growth and development. This is attributed to increase in price index of timber as a major cause for increase in GDP. Faleyimu (2013) reported a decline of the contribution of forestry to the GDP in Nigeria. He attributed the declining export role of forest produce in the national economy partly due to the over-exploitation of the high quality timbers in the previous decades and partly to the inability of the forest departments and the timber trade to develop the secondary species which now constitute the main timber contents of the forest estate. The objective of the paper is to carry out an overview of the contribution of forestry subsector to the Nigerian GDP from 1960 to 2011 with a view to determining a causal relationship between forestry and GDP.

1.2. Overview of the contribution of the Forestry subsector to the Nigerian Economy

Before the discovery of oil in the late 50s and early 60s, agriculture sector (forestry inclusive) was the mainstay of the Nigerian economy contributing over 80 percent of the GDP. Over the years, the level of contribution has dwindled due to the undue reliance on oil. Among the subsectors within the agricultural sector, forestry made the smallest contribution amounting to an average of only 3.0% of the GDP (between 1960 and 2011) as shown in Figure 1 below; notwithstanding, the subsector played and continues to play a major role in providing industrial raw materials (timber), providing incomes as well as preserving biodiversity, among others (Odetola and Etumnu 2013). Usually, people look at the contribution of forestry only in monetary terms thereby undermining the overall importance of forests. Forest is not only limited to timber production; there are numerous resources and functions that forests perform that cannot be quantified. For example, forests play a significant role in carbon sequestration thereby reducing the quantity of green house gases (GHGs) released into the atmosphere which is common cause of ozone layer depletion and global warming. Thus, apart from acting as a carbon sink, forests also play an equally important role of acting as a sink for pollution among others. Forests purify the air and ameliorate the hot weather condition. Unfortunately, almost all of these services are un-priced and unaccounted for because forests are usually classified as public goods. In analyzing the contribution of the forestry subsector to the economy

therefore, one is constrained to employ the only measuring rod, that is, its monetary value addition to the GDP along side with the other subsectors in the agricultural sector namely: crop, livestock and fishery.

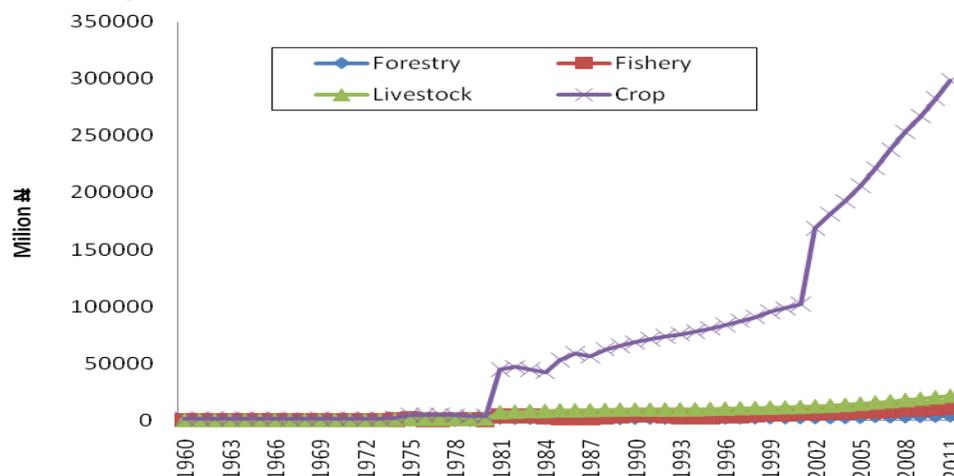


Fig. 1: Contributions of the Agricultural sectors to GDP(1960 -2011)

1.3. Deforestation and the Status of the Nigerian Forest

One of the problems confronting the forestry sub-sector that tends to undermine its contribution to the Nigerian economy is deforestation arising from the competition from other land users especially agriculture and infrastructural development. The need to produce food to feed the teeming and ever increasing population of the country has resulted in the destruction of once forested areas in almost all parts of the country. According to UNEP (2006), annual deforestation rate in Nigeria is estimated at 0.76% which amount to 663,000 ha of forest covers. Sanginga (2011) posited that Nigeria has lost about 400,000 hectares of forest land to deforestation, leading to her ranking as the most dubious country in

terms of deforestation. The increasing global demand for tropical hardwoods has made many hardwood species to be recklessly exploited from large areas of natural forests and sold in both local and international markets leading to an uncontrolled decimation of our forest resources. The table below showed the expansion of land for both intensive and extensive agriculture from about 53.8% in 1976/78 period to 60.8% in 1993/95 period, and of course, there is no doubt that this would have increased after about 25 years. In short, the most recent Forest Resources Assessment(FRA) carried out in 2010 showed that Nigeria's forest estate is now less than 10 percent of the country's land area which is a far cry from the minimum requirement of 25 percent recommended by FAO (Akindele 2012).

Table 1: Dominant vegetation and Land Use classes for 1976/78 and 1993/95 in Nigeria

Land Use Category	1976/78		1993/95		Changes in Km
	% of country	Km ²	% of country	Km ²	
Intensive(crop)agriculture	35.5	322794	40.2	365491	42779
Extensive(grazing) agriculture	18.3	166326	20.6	187236	20910
Sudan savannah	12.5	113880	9.0	81694	-32186
Guinea savannah	16.6	151293	9.0	81356	-69907
Flood plain agriculture	1.0	9451	2.3	20918	11467
Disturbed forest	1.6	14573	2.1	18990	4417
Shrub swamp	1.9	16899	1.0	9278	-7651
Fresh water swamp	2.0	18316	1.8	16499	-1817
Undisturbed forest	2.9	25951	1.3	12114	-13837
Sahel savannah	1.4	12549	1.3	11983	-566
Discontinuous grassland	0.7	6137	1.2	11248	5111
Mangrove forest	1.1	994	1.1	9977	-17

Agriculture/ derived	0.4	3518	1.0	9206	5688
Continuous grassland	0.1	1034	0.9	7989	6955
Agricultural project	0.0	16	0.1	485	469

Source: BEAK/UNILAG Consult Geomatics (1997).

2.0. Methodology

2.1. Data Collection

Data for this study were obtained from the various editions of Central Bank of Nigeria (CBN) statistical bulletin and the National Bureau of Statistics from 1960 to 2011 and its components.

2.1. Data Analysis

To be able to examine the contribution of the forestry subsector to the GDP, both descriptive and econometrics tools were employed in the analysis. Descriptive statistics was used to examine the trend of forestry and GDP from 1960 to 2011. Inferential statistics such as Augmented Dickey Fuller (ADF) test, Unrestricted Vector Auto-regression (VAR) and

pair-wise Granger Causality test were also employed. The ADF test was used to ascertain the time series properties of the variables to avoid spurious regression which results from the regression of two or more non-stationary time series data. Unrestricted VAR was employed to generate the criteria (likelihood ratio final prediction error, akaike information criterion and schwaiz information criterion) which formed the basis for selecting the optional lag length used in the granger causality test was used to determine the causal links between forestry and GDP.

The model of the Augmented Dickey Fuller (ADF) with the constant term and trend is as follows:

$$\Delta Y_t = \alpha_1 + \alpha_2 t + \beta \gamma_{t-i} \sum_{i=1}^n \gamma_i \Delta Y_{t-i} + \epsilon_i \quad 1$$

The null hypothesis ($H_0: B=0$) of the ADF test indicates that the series is not stationary and the alternative hypothesis ($H_1: B < 0$) indicates that the series is stationary. If the absolute value of the calculated ADF statistics (t) is higher than the absolute value of the critical values we reject the hypothesis that the series is stationary. Conversely, if

the value is lower than the critical values, the time series is not stationary (Gujaraati, 2004). The Granger causality test assumes that the information relevant to the prediction of the respective variables X and Y is contained solely in the time series data on the variables. The test involves estimating the following pairs of regression:

$$X_t = \beta_0 + \sum_{i=1}^p a_t \beta_i X_{t-i} + \sum_{j=1}^p a_j Y_{t-j} + \mu_{1t} \quad 2$$

$$Y_t = \gamma_0 + \sum_{i=1}^p a_t \gamma_i Y_{t-i} + \sum_{j=1}^p \delta_j X_{t-j} + \mu_{2t} \quad 3$$

It is assumed that the disturbances μ_{1t} and μ_{2t} are uncorrelated. Thus, there is unidirectional causality from X to Y if $a_i = 0$

2.2. Empirical Model Specification

The pair-wise granger causality test was modeled as a multivariate vector auto regression (VAR) model as follows:

$$FOR_t = \alpha_0 + \sum_{i=1}^p a_t ForP_{t-i} + \sum_{j=1}^p \omega_j GDP_{t-j} + \epsilon_{1t} \quad 4$$

$$GDP_t = \beta_0 + \sum_{i=1}^p \beta_i GDP_{t-i} + \sum_{j=1}^p \varphi_j For_{t-i} + \epsilon_{2t} \quad 5$$

Where

FOR_t = Forestry (N)

GDP_t = Gross Domestic Products (N)

α_0, β_0 = constant terms

$\alpha_t, \omega_j, \beta_i, \varphi_j$ = estimated coefficients

$\epsilon_{1t}, \epsilon_{2t}$ = Gaussian white noise error terms

p = optimal lag length

3.0. RESULTS AND DISCUSSION

3.1. Growth of the Forestry subsector

The growth of the forestry subsector is far from being impressive when compared with other subsectors within the agriculture sector namely: crop, livestock and fisheries (see Table 1). Consistent with the literature, growth in the crop production sector has impacted the most on

agriculture sector growth as shown earlier. The livestock production sector according to literature is the second largest subsector followed by fishery and forestry in that order as the table below showing the summary statistics of the agricultural sectors indicates. From Figure 2 below the growth pattern of the contribution of the forestry sub-sector had been a fluctuating one from negative value in the 1960s, rising a little thereafter only to drop again. Although the growth rate seemed to have stabilized from the 1980s, there were occasional drops probably due to fluctuation in volume of export, exchange rate and prices.

Table 1: Summary statistics of the Agricultural subsectors and the GDP (1960 -2011)

Variable	Observations	Mean	Std. Dev.	Min	Max
Forestry	51	1682.181	1337.911	68	4244.8
Fishery	51	3269.573	3166.158	44	11014.2
Livestock	51	7208.79	6334.446	129	21506.9
Crop	51	73792.69	86226.57	1034.4	298414.3
Agric	51	85953.24	96490.84	1338	335180
GDP	51	224512.7	234880.5	2489	834000.8

Source: CBN (Various editions)

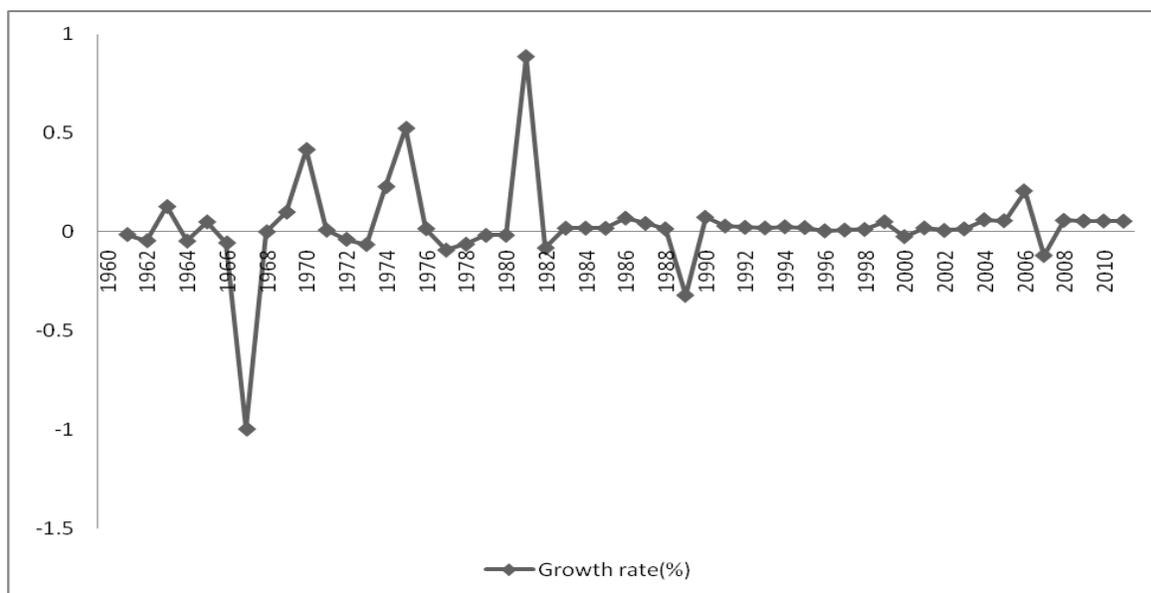


Fig. 2: Growth rate of the forestry sub-sector (1960-2011)

3.2. Forestry Growth and GDP Growth: Causal Relationship

Using Augmented Dickey-Fuller (ADF) unit root test, we examined the data for univariate time series properties. ADF tested for the null hypothesis of non-stationarity among the variables. The result of the unit root test from the ADF test is presented in

Table 3. Forestry and GDP were found to be non stationary at level zero. However, after differencing once both variables became stationary. Differencing was necessary so as to avoid the phenomenon of spurious regression where series are used in their non-stationary form (Oyinbo et. al, 2014). We confirmed that the variables are co-integrated then conducted Granger causality test as specified in

equations (4) and (5) to examine the variables for bidirectional causality tests. Using lag length 4 we tested two hypotheses: (a) forestry growth does not Granger-cause GDP growth and (b) GDP growth does not Granger-cause forestry sub-sector growth. It is important to explore this two way relationship because, according to literature, forestry growth may lead to GDP growth through its roles in the economy and GDP growth, as well as through the influx of investment into forestry which may cause growth in the sector.

3.3. Granger Causality Test

The pair-wise granger causality test was carried out to determine the presence as well as the direction of causal link between forestry and GDP and the result is given in Table 4. The F-statistics of 30.800 was significant at 1% probability level and this showed that there is unidirectional causality from forestry to

GDP leading to the rejection that forestry does not influence GDP. This implies that forestry growth Granger-causes GDP growth but GDP growth does not Granger-cause forestry growth. This empirical evidence suggests that in Nigeria, the forestry sub-sector contributes to economic growth. This is consistent with the results summarized previously; growth in agriculture generally has resulted in economic growth. However, there is no evidence for reverse causal flow from GDP growth to forestry subsector suggesting that even though resources from the forest are utilized for economic growth there is little or no effort to add value to the sector from the returns of economic growth. This is consistent with literature that highlights little attention and investment in the agriculture sector generally (forestry inclusive) in spite of its proven potentials (Awokuse 2008; Anyanwu *et al.* 2010; Popoola 2014).

Table 3: Result of Augmented Dickey- Fuller test

Variable	ADF statistic	Test Critical value			Inference
		1%	5%	10%	
lnForestry	-0.9602	-3.5654	-2.919	-2.5879	Non-stationary
lnGDP	-1.021195	-3.5654	-2.919	-2.5879	Non-stationary
First difference					
ΔForestry	-7.1530	-3.5683	-2.9199	-2.5979	Stationary
ΔGDP	-7.9704	-3.5654	-2.9211	-2.5985	Stationary

Δ = difference factor

Lag length factor was based on Schwarz information criterion (SIC)

Table 4: Granger Causality Test

Null hypothesis	Observations	-statistics	Prob.	Decision
GDP does not cause Granger Forestry	50	1.34501	0.2708	Accept
Forestry does not cause Granger GDP	50	30.8000	4.E-09	Reject

Source: Computed from CBN Statistical bulletin 2012

4.0. CONCLUSION AND RECOMMENDATIONS

1. Forestry is an important sub-sector of the Nigerian economy. Apart from its contribution to the GDP, it also provides other direct and indirect benefits to the people. The findings of this study show that while forestry contributes to the country's GDP the reverse is not the case. Here are some suggested measures that need to be taken.
2. Government's expenditure in forestry whether at the national, state and local level in Nigeria is infinitesimally low or nonexistent (Famuyide et al 2005, 2010) hence, there is need for government at all levels to invest more in the subsector.
3. The involvement of the private sector is presently low due to some impediments especially in the area of land acquisition and the long gestation period of forest business (Idumah et al 2006). Policies that could stimulate investment in forestry by private investors should be formulated by the government. This will go a long way to increase the contributions of the forestry sub-sector to the economy.

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