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Analyzing the Impact of the Oil Sector and Agricultural Sector on the Growth of Gross Domestic Product (GDP) in Nigeria (2000-2022)

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Abstract

The contribution of the oil and agricultural sectors to the Gross Domestic Product (GDP) of Nigeria is important and of significant interest. Understanding the contributions of these sectors can provide valuable insight into the overall economic performance and development of the country. The aim of this paper is to fit a regression model that will predict future GDP growth in Nigeria. It will help determine the extent to which each sector influence the overall economic growth in Nigeria. The statistical tool employed include the multiple regression analysis and the reliability of the model was tested using ANOVA test for joint significance and t- test for individual significance of the parameters of the model. It was revealed that both the oil and agricultural sectors contributes significantly to GDP growth. The oil sector has traditionally been the main driver of economic growth in Nigeria, while the agricultural sector plays a critical role in providing employment and food security. Attention should be given to both sectors in the economy to promote sustainable economic growth and contribution to the GDP of Nigeria. This analysis helps policymakers, researchers, and stakeholders make informed decisions regarding resource allocation, investment strategies and economic diversification.

Keywords: Gross Domestic Product (GDP), Variance Inflation Factor (VIF), Oil sector, Agricultural sector, Economic Growth.

1. Introduction

The oil sector has been the mainstay of the Nigeria's economy, accounting for a significant portion of its Gross Domestic Product (GDP). Nigeria is one of the largest oil-producing countries in Africa, and its oil reserves have attracted significant foreign investment. However, the volatility of oil prices in the global market has made the country susceptible to economic shocks and fluctuations. On the other hand, agriculture has been a traditional sector in Nigeria, employing a large portion of the population and contributing to food security. The agricultural sector encompasses various sub-sectors, including crop production, livestock, farming, and fisheries. Understanding the role of agriculture in Nigeria's GDP will provide insights into the country's food production capabilities and rural development. It has also been acknowledged that without proper sustainable development of this sector, the levels of growth and development the country aims for will continue to be an illusion (Emeh & Chigbu, 2014). The weakness of the Nigerian economy in the past three decades is not unrelated to its dependence

on oil sector. It has been observed that our dependence on crude oil has had other negative effects on the psyche of our leaders. Oil, rather than be a blessing, has been a curse to the nation. Nigeria is both an exporting (crude oil) and importing (refined petroleum products) economy (Oriakhi & Osaze, 2013). Our dependence on it seems to be increasingly threatening not only to the security of the nation, but also its very existence as a corporate entity. The reported activities of the youths in the oil producing areas and the urge for resource control by the political class are all syndrome & complication arising from this dependence on a mono-product economy. (Alhassan & Kilishi, (2016), Ahmed (2010), Ogbonna & Appah, (2012)) submitted that the economy is susceptible to both external shocks (oil price and exchange rate), and internal dynamics (GDP volatility, interest rate unemployment, Inflation rate). Most acclaimed economies like Japan, Malaysia, Indonesia, Denmark, South Korea and Botswana have high rates of growth and they consequently dominate the export markets today despite the fact that they are not oil driven. Rather, they derive their earnings from non- oil sectors of which agriculture is one. Yet those countries are not comparable in terms of potentials with which Nigeria is endowed. (Awe & Ajayi, (2009), Adeleke & Oladejo, (2019).)

In the last several years, the Gross domestic product (GDP), which is the monetary value of all goods and services performed in a nation in one year, has gained favour as a more accurate barometer of the state of the economy. GDP measures the economic strength of a nation. The contribution of the oil and agricultural sectors to the GDP of Nigeria is important and of significant interest. Understanding the statistical analysis of these sectors contributions can provide valuable insight into the overall economic performance and development of the country. This analysis helps policymakers, researchers, and stakeholders make informed decisions regarding resource allocation, investment strategies, and economic diversification. It is essential to consider the value- added contributions of the oil and agricultural sectors. Value – added refers to the increase in value that occurs at each stage of production. For example, in the oil sector, value-added can be measured by considering the difference between the value of crude oil extracted and the value of refined petroleum products. Similarly, in agriculture, value-added can be calculated by considering the difference between the value of raw agricultural products and the value of processed or packaged goods. (Afu, 1984). The Gross Domestic Product (GDP) is a measure of the total value of all final goods and services produced within a country's borders during a specific time period. It includes the income generated by both residents and non-residents within the country, it is often used as a key indicator of economic growth and is used to compare the economic performance of different countries, it measures

the overall economic activity within a country and reflects the production and consumption of goods and services by individuals, businesses, and the government. Gross domestic product (GDP) is the total value of goods and services produced within the country in a particular period usually a year. The Nigerian oil sector can be categorized into three main sub- sectors namely, upstream, downstream and gas. The most problematic over the years has been the downstream sector, which is the distribution arm and connection with final consumers of refined petroleum products in the domestic economy. In the first quarter of 2022, Nigeria recorded an average daily oil production of 1.49 million barrels per day (mbpd), accounting for 6.63% of total GDP. Nigeria is among the world's top five exporters of liquefied natural gas (LNG). (Odozi & Ogumike, 2017). In spite of the growing importance of oil, Nigeria has remained essentially an agrarian economy, with agriculture still accounting for significant shares in Gross Domestic Product (GDP) and total exports, as well as employing the bulk of the labour force. Agriculture contributed 22.35% of the total Gross Domestic Product. The Sustainable Development Goals in the Agriculture sector in Nigeria have had an impact on the export sector responsible for the consumption and production of agricultural products in Nigeria. The exportation sector's monthly earnings have improved in four years. In January 2016, agricultural exports raked in N4.1 billion, which then rose to N25 billion by January 2017. From April 2019 to March 2020, total agriculture exports hit N289 billion for Nigeria. Nigeria relies on $10 billion of imports to meet its food and agricultural production shortfalls (mostly wheat, rice, poultry, fish, food services, and consumer-oriented foods). Europe, Asia, the United States, South America, and South Africa are major sources for agricultural imports.

Adenomon & Oyejola (2013) reported that agriculture Contributed about 50% to GDP while industrial sector contributed 32% to GDP in Nigeria. Omorogiuwa et al (2014) reviewed the role of agriculture in the economic development of Nigeria. They reported that development in the agricultural sector is essential to the progress of the Nigerian economy. (Iganiga & Unemhilin (2011), Lawal (2011)) studied the effect of federal government agricultural expenditure and other determinants of agricultural output on the value of agricultural output in Nigeria. A Cobb Douglas Growth Model was specified that included commercial credits to agriculture, consumer price index, annual average rainfall, population growth rate, food importation and GDP growth rate. The study performed comprehensive analysis of data and estimated the Vector Error Correction model using time series data. (Adedokun, (2012), Kolawole et al. (2015), Baghebo & Atima, (2013))

2. Materials and Method

The data used for our analysis is obtained from government sources, international organizations, or research institutions. Example of such sources includes the central bank of Nigeria (CBN), National Bureau of Statistics (NBS) and the World Bank. The statistical tools used for the research work are as follows: Multiple Regression Analysis, ANOVA(Analysis of Variance), Student's T Test, The Coefficient Of Multiple Determination, Test For Multicollinearity.

The general linear model for a multiple regression analysis model can be written as

$$\hat{Y} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + , \ldots \ldots \ldots + \beta_K X_K + \varepsilon \ldots \ldots \ldots \ldots (1)$$

Where, $\hat{Y}$ Is the estimated value of the dependent variable; $\beta_0, \beta_1, \beta_2, \ldots\ldots\ldots\ldots \beta_K$ are the unknown regression coefficients; $X_1, X_2, \ldots\ldots\ldots\ldots\ldots X_K$ are the independent predictor or explanatory variable ε is the random error, which allows each response to deviate from the average value of $\hat{Y}$ by the amount ε. Assumptions about the Error term ε includes ; independence, Having a mean of zero and a constant variance of σ^2 for any set $X_1, X_2, X_3, \ldots \ldots \ldots \ldots X_K$; and normality. When there assumptions about ε are met, the average value $\hat{Y}$ of for a given set of values $X_1, X_2, X_3, \ldots \ldots \ldots \ldots X_K$ is equal to the deterministic part of the model;

$$E(\hat{Y}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + , \ldots \ldots \ldots + \beta_K X_K \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The calculations involved in the estimation of the parameters were implemented with a regression program from SPSS version 23. In multiple linear regression, the researcher frequently wishes to test hypothesis about the model parameters $H_{0:} = \beta_1 = \beta_2 \ldots \ldots \ldots \ldots = \beta_P$ $H_{1:} \neq \beta_1 \neq \beta_2 \ldots \ldots \ldots \ldots \neq \beta_P$ for at least one $j, j = 1, \ldots . . p$; Rejection of $H_{0:}$ implies that at least one of the regressors $X_1, X_2, \ldots . . X_P$ contributes significantly to the model. We will use a generalization of the F-test in simple linear regression to test this hypothesis. Under the null hypothesis$\frac{\text{SSR}}{\sigma 2} \sim \chi^2 \text{p}$, and $\frac{\text{SSR}}{\sigma 2} \sim \chi^2 \text{p n} - (\text{p} + 1)$ are independent. Therefore, we have $\frac{\text{SSR}}{\text{p}} \sim \chi^2 \text{p} \frac{\text{SSE}}{(\text{n}-\text{p}-1)} \sim \chi^2 \text{p}$ = MSR, MSE $\sim F_P, n - p - 1$ Note: as in simple linear regression, we are assuming that i $\sim N(0, \sigma^2)$ or relying on large sample theory.

The required test statistics for testing the individual Regression Coefficients is $t_{cal} = \frac{B_i - B_{i0}}{\sqrt{V(Bi)}}$

And we reject H_0 if $| t_{cal} | > t_{\frac{\propto}{2}}, (n - k - 1)$otherwise do not reject H_0

The overall test for significance of the regression is carried out using ANOVA, where $F_{0=} \frac{MSR}{MSE}$

And we reject H_0if $F_0 > F_{\propto,k,\ (n-k-1)}$ of 0.05 level of significance otherwise do not reject.

$$R^2 = \frac{Regression\ sum\ of\ Squares}{Total\ sum\ of\ Squares}$$

Since R^2can be artificially inflated by the inclusion more explanatory variables. The adjusted R^2 is mostly preferable to $R^2$and it is given by, $R^2\ (adj)\ =\ 1 - \frac{MSE}{SST/(n-1)}$. The adjusted value of R^2 is mainly used to compare two or more regression models that use different number of independent predictor variables.

3. Results and Discussion

REGRESSION ANALYSIS

Let, Y = Gross Domestic Product; X_1= Oil Sector growth ; X_2= Agricultural Sector growth then

from the SPSS result/ output we have the following tables.

Showing SPSS Output Results for Regression Analysis

Coefficients						
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics
	B	Std. Error	Beta			VIF
(Constant)	0.687	1.237		0.556	0.584	
Oil sector	0.113	0.051	0.347	2.207	0.039	1.072
Agric Sector	0.888	0.248	0.562	3.572	0.002	1.072
Dependent Variable: Real GDP						

The required model can therefore be written as; $\hat{Y} = 0.687 + 0.113_{X1} + 0.888_{X2}$

The regression equation above can be used to estimate or predict the real GDP (Y) based on known oil sector (X_1) and agricultural sector (X_2) growth rate values.

The above regression equation shows that when there are no values of X_1 & X_2 (oil and agricultural sector growth), the value of real GDP growth is 0.687%, which is as a result of other sectors not considered. In the oil sector there was increase of 0.113% to the GDP, also for every percentage increase in agricultural sector growth there was an increase to the GDP of 0.888%.

Table 2. Showing SPSS Output Results for ANOVA

ANOVA					
Model	*Sum of Squares*	*d.f.*	*Mean Square*	*F*	*Sig.*
Regression	102.323	2	51.16	11.653	0.001
Residual	87.811	20	4.391		
Total	190.134	22			
Dependent Variable: Real GDP					
Predictors: (Constant), Agric Sector, Oil sector					

F_C= 11.653 , F_{tab}= $F_{2,20,(0.05)}$= 3.49. Since F_C > F_{tab}(11.653 > 3.49) we therefore reject. H_0 and conclude that at least one of the explanatory variables of the model is contributing significantly to the GDP. **In testing for individual significance of the Coefficients ($\boldsymbol{\beta_0}$,$\boldsymbol{\beta_1}$,$\boldsymbol{\beta_2}$), we use ,** t_c= $\frac{B_i - B_{i0}}{\sqrt{V(Bi)}}$

And reject $H_{0:}$ if $|t_{cal}| > t_{\frac{\propto}{2}}$, (n − k − 1)otherwise do not reject H_0 . For $\boldsymbol{\beta_0}$, t_c= 0.556 and $t_{0.025,20}$= 2.086. Since $|t_c| < t_{0.025,20}$ (0.556 < 2.086), we cannot reject $H_0$and conclude that $\beta_0 = 0$

FOR $\boldsymbol{\beta_1}$, t_c= 2.207 AND $t_{0.025,20}$= 2.086. SINCE $|t_c| > t_{0.025,20}$ (2.207 > 2.086), WE THEREFORE REJECT H_0AND CONCLUDE THAT $\beta_1 \neq 0$. FOR $\boldsymbol{\beta_2}$, t_c= 3.574 AND t_{tab}= $t_{0.025,20}$= 2.086 . SINCE $|t_c| > t_{0.025,20}$ (3.574 > 2.086), WE THEREFORE REJECT H_0AND CONCLUDE THAT $\beta_2 \neq 0$.

FROM THE INDIVIDUAL TEST OF THE COEFFICIENT OF THE MODEL BASED ON THE DATA FOR THE PERIOD UNDER CONSIDERATION, IT WAS FOUND THAT BOTH OIL SECTOR AND AGRICULTURAL SECTOR CONTRIBUTES SIGNIFICANTLY TO GDP GROWTH RATE IN NIGERIA.

COEFFICIENT OF MULTIPLE DETERMINATION $\boldsymbol{R^2}$

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
	0.734	0.538	0.492	2.095

Predictors: (Constant), Agricultural Sector, Oil sector

R^2 = 0.734 or 73.4%

From the table above, it is observed that 73.4% of GDP growth in Nigeria is jointly explained by changes or variation in the growth of the oil and agricultural sector while the remaining 26.6% is due to other sectors which are not considered. The Adjusted R^2 = 0.492 or 49.2% implies that 50.8% of GDP growth is jointly explained by changes or variation in the growth of oil and agricultural sectors in Nigeria while the remaining 66.6% is due to other sectors not considered.

THE VARIANCE INFLATION FACTOR (VIF) IS USED TO TEST FOR EXISTENCE OF MULTICOLLINEARITY OR OTHERWISE IN THE DATA. HERE, $H_{0:}$**: THE TWO EXPLANATORY VARIABLE** X_1 **&** X_2 **ARE COLLINEAR (THERE IS NO MULTICOLLINEARITY IN THE DATA) AND** $H_{1:}$ **: THE TWO EXPLANATORY VARIABLES** X_1 **&** X_2 **ARE COLLINEAR (THERE IS MULTICOLLINEARITY IN THE DATA).**

The table below shows the SPSS output.

Collinearity Statistics	
Tolerance	VIF
0.932	1.072
0.932	1.072

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Based on the coefficient output- collinearity statistics, obtained VIF value of 1.072, meaning that the VIF value obtained is between 1 to 10, it can be concluded that there is no multicollinearity .

4. Conclusions

Based on the analysis carried out and the years under consideration, it was found out that, the model fitted is reliable and can be used to predict future values of GDP growth. The oil sector contributes more than this agricultural sector to the GDP growth in Nigeria since it has a standard coefficient (Beta) of 0.347 against that of the agricultural sector that is 0.562. The agricultural sector has suffered a lot of neglect which has made it remain under used or exploited and hence its low contribution to the GDP of Nigeria. Based on the analysis carried out and the years under consideration, a regression model was fitted that could be used to estimate or predict the Gross Domestic Product (GDP) growth rate in Nigeria, that is $\hat{Y}$ =0.687 + 0.113$_{X1}$ + 0.888$_{X2}$. From the ANOVA test of joint significance of X_1&X_2 (that is oil and agricultural sector growth) it was established that at least one of the explanatory variable contribute significantly to the fit and t – test of individual significance confirms that both oil & agricultural sector contributes to the fitted model.

The fitted model can be used to predict the GDP growth in Nigeria using figures gotten for oil and agricultural sector growth and the predicted values can be used to check the validity of the figures gotten from the conventional methods used for estimating the GDP growth.

Economic policy should be designed in such manner that Government intervenes in the market with crude oil reserves (for domestic refining) to keep prices of refined petroleum product within the bands that will enhance growth of the domestic economy. So that better equipped refineries can be built and the cost of refining crude oil will reduce. Security should be boosted on the high sea where crude oil products are being smuggled. This will help reduce the loss from illegal export of crude oil products. Government should give immediate attention to the indigenes of the region where crude oil is being extracted from.

Measures should be put in place to increase the agricultural sector contribution to GDP since it used to be the main stay of the economy before the era of oil boom. This does not however imply a neglect of the oil sector. Other sector of the economy such as manufacturing and communication should be given more attention. This will be a form of diversification and the

returns gotten from these long neglected sectors will inevitably increase the GDP and the economics of the country as a whole.

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