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Crude Oil and Economic Performance in Nigeria in the Presence of Multicollinearity Using Cobb-Douglass Model

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ABSTRACT

Nigeria's major source of revenue, energy and foreign exchange is crude oil for over three decades. There is need to identify business activities surrounding crude oil that impact the real gross domestic product of Nigeria. This research project models the impact of crude oil on Nigeria economic growth using non-linear econometric model, namely, Cobb-Douglas production function. Crude oil data was obtained from National Bureau of Statistics covering 1981-2021, exploratory data analysis on Nigeria's crude oil data and diagnostic tests as multicollinearity and autocorrelation tests were carried out on the data then the data was fitted to Cobb-Douglas production function model. The results showed that real gross domestic product has a positive relationship with crude oil revenue and crude oil consumption. Based on the findings of this project work, it is recommended that the government should implement policies and take steps to preserve and manage the oil sector effectively.

Keywords: Crude Oil, Cobb-Douglas, Real Gross Domestic Product, Nigeria
JEL Classifications: C51, C52, Q43, Q32, O13, O55

1. INTRODUCTION

Crude oil is a word used to describe the combination of naturally occurring hydrocarbons that are liquid in underground reservoirs and remain liquid at atmospheric pressure following passage through surface separation machinery. Although it also includes some nitrogen, sulphur, and oxygen, crude oil is mainly made up of a combination of relatively flammable liquid hydrocarbons. Crude oil is commonly classified as one of three types of hydrocarbon compounds: Paraffins, Naphthene, and Aromatic hydrocarbon. The most frequent hydrocarbons in crude oil are paraffin, also found in all liquid refinery products and part of the process's heavy asphalt-like by-products. Aromatics normally make up a relatively tiny fraction of most crudes (Melissa, 2023).

Crude oil is also classified as sweet or sour depending on the amount of sulphur present as sulfur elements or in substances like hydrogen sulfide. Nigeria oil is usually classified as light and sweet since it contains little sulfur. Nigeria produces the sweetest oil in OPEC. The chemical makeup of this sweet oil is comparable to that of North Sea Oil. In addition to petroleum, Nigeria has natural gas, tin, iron ore, coal, lead, limestone, niobium, and fertile land (OPEC, 2022).

Crude oil is a significant source of energy for Nigeria and the rest of the world. Oil is the mainstay of Nigeria's economy, which is essential in establishing the country's economic and political standing. Owing to the oil boom in the 1970s, manufacturing, and other sectors of the economy were neglected for a harmful dependency on crude oil. Nigeria is believed to have thirty-five billion barrels of proven oil reserves, over one hundred trillion barrels of proven natural gas reserves that have been independently verified, and 2,2,000,000 barrels per day average crude oil production. Petroleum's contribution to the gross domestic product prices was only 0.007% between 1958 and 1969, according to data records from the Nigerian National Bureau of Statistics. On the other hand, agriculture was the nation's economic backbone because it accounted for a more significant proportion of the country's GDP at the time However, the petroleum industry in Nigeria overtook all others once significant quantities of oil were discovered. In the middle of the 1970s, crude oil had become the primary resource, contributing over 90% of the country's foreign exchange earnings and 80% of its revenue, making a significant impact on the GDP (Akinleye et al., 2021).

Organization of Petroleum Exporting Countries is a cross-government organization of some developing countries comprising Venezuela, Qatar, Algeria, Angola, Iran, Iraq, Ecuador, Kuwait, Libya, Saudi Arabia, Arab Emirates, United Arab Emirates, and Nigeria. Venezuela and Iran were the first nations to contact Iraq, Kuwait, and Saudi Arabia in 1949, suggesting that they share ideas and look into opportunities for more frequent and close communication among petroleum-producing countries which led to the formation of OPEC in the 1960s; Iran, Kuwait, Iraq, Venezuela, and Saudi Arabia were the original members; Gabon, Libya, Indonesia, Qatar, Nigeria, Ecuador, Algeria, and the United Arab Emirates were the later members; it was established to synchronize and harmonize member countries petroleum policies. OPEC's choices on production quotas served as signals to the market about the desired range of prices; however, the strength of the signals depended on the market's perception of OPEC's ability to alter production in response to market circumstances (Fattouh, 2007).

Historically, a significant source of income has been crude oil for the Nigerian government and earnings in foreign currencies. Positive and negative effects have resulted from this reliance on the oil industry. The oil and gas industry contributes almost 10% to the gross domestic product (GDP), and almost 86% of all export earnings come from the sale of petroleum (OPEC, 2018). On the other hand, in 2016, the economy experienced its first economic decline in 25 years due to a combination of falling oil prices worldwide, which hit a 13-year low, and a decline in oil production brought on by militant attacks and vandalism in the Niger Delta. This led to a sharp contraction in the GDP from the oil sector. Through the channels of money and currency rates, this underperformance in the oil sector spread to the non-oil economy (World Bank, 2018).

The oil industry is Nigeria's most prominent economic driver; it produces the tenth most oil in the world and is the third largest producer in Africa. The country's foreign exchange revenue is 95% derived from its oil reserves ranging from 24 to 31.5 billion dollars. They each year manufacture 90,000,000 tons, furthermore with a centralized economy so firmly when just one, it is virtually impossible for Nigeria's political system and cultural traditions to remain unaffected (Uwakonye et al., 2006; Oyewole et al., 2023).

The early 1980s saw a glut in the global oil market, which reduced export profits in foreign currency and rendered the nation's import-dependent structure unsustainable; this resulted in the adoption of several policy initiatives, comprised of the Stabilization Act of 1982, a strict monetary policy and strict exchange control measures in 1984, all of which proved ineffectual. The Structural Adjustment Programme was then implemented in 1986. Its component was the export promotion industrialization policy it contained; the policy tended to encourage both agricultural and industrial output for exports. Nevertheless, non-oil exports performed poorly following that, although the country's overall output, as measured by its gross domestic product (GDP), had been steadily rising Ighosewe (2021). A significant positive long run relationship between the oil sector, GDP and unemployment was established by (Onakoya and Agunbiade, 2020), and exports serve as a foundation and the driver for economic growth (Abou-Strait, 2005). Without a doubt, crude oil exports have been a notable source of income for the economy over the years, and their influence on the economic growth and development of oil-producing nations, particularly Nigeria, which is the subject of this research effort, cannot be overstated.

Despite the massive earnings from oil, the Nigerian economy continues to face some problems, including a high rising number of unemployed, declining production output, neglect of the agricultural sector, low earnings, the economy's dismal performance in the face of massive oil rent and weak infrastructure have revived interest in oil revenue and the nation's development process (Akinleye et al., 2021). Although the oil industry and the revenue it generates, the query of our location is raised, what will our future be given the vast potential of the oil industry and its sources of income? Does oil play a role in the success or failure of the economy? Additionally, 40% of Nigeria's crude oil imports go to the United States, the nation's overall oil export, contributing roughly 10% of the country's total imports and ranking among the fifty most outstanding oil suppliers to the USA (Odularu, 2008).

Historically, crude oil was discovered first in Bayelsa state by Shell Darcy on Sunday, 15th January 1956.

Federal office of statistics (FOS) and the National Data Bank (NDB) were combined to form the National Bureau of Statistics (NBS). The formation was a component of the Federal Government of Nigeria's Statistical Master Plan (SMP) program paper (FGN); the Agency is tasked with gathering, assembling, analyzing, interpreting, publishing, and disseminating statistics data about the socio-economic conditions and life of the Nigerian people. Nigeria oil firm Nigeria National Petroleum Corporation (NNPC) is a for-profit organization; it changed from being a corporation controlled by the government, converting in July 2022 to a limited liability company; only NNPC Limited possesses a permit to work in the country's petroleum industry it collaborates with international oil firms to utilize Nigeria's fossil fuel reserves. The 1991, 1993, 1997, 1998, 1999, and 2007 revisions to the 1958 Act of Parliament serve as the foundation for the Central Bank of Nigeria's (CBN) mandate. The Federal Republic of Nigeria's CBN Act of 2007 mandates financial sector policies on behalf of the Federal Government.

The Nigerian economy has been impacted in several ways by crude oil; the question of whether the extraction of crude oil contributes to economic growth has long been a contentious point of disagreement and a pressing concern for some people. The oil sector has received so much attention in the past decade it is important to know which has been a source of revenue generation. However, there are activity mitigating against revenue maximization at the same time impacting on the Real Gross Domestic Product which is a metric for economic growth. The current study further investigates the variable used by Odularu (2008) and additional variables to determine if those variables impact economic growth to provide current relationship of interest and Real Gross Domestic Product. Compared to what other authors have done, this study proposes Cobb-Douglas Production Function to investigate the link between crude oil and Nigeria's economic performance. No recent Literature has been found that determines the impact of crude oil on Nigeria economy, hence the need to conduct this study, considering various changes that had taken place in recent times. Therefore, this study considered variables such as Crude Oil Revenue, Consumption, Export, and Petroleum to GDP of Nigeria Crude Oil data from 1981 to 2021. The current study aims to advance the existing body of literature in the area of crude oil and the Nigerian Economy.

2. LITERATURE REVIEW

The section aims to review the literature on using the non-linear model approach on Cobbs Douglas production function.

2.1. Linear Model and Non-Linear Model

Linear models are the most widely used data analysis and prediction method in economics and other fields. It uses the method of ordinary least square technique (OLS) to estimate the parameters of the model. Linear model is a frequently utilized form of predictive analysis. Regression analysis seeks to identify which variables are important predictors to predict the response variable, whether a set of predictor variables is successful, and what direction and magnitude of information they provide by way of beta estimates. The link between one or more dependent variables can be explained using these regression estimates. The most basic regression equation is

$$f(x) = \beta_o ++\beta_1 x_{11}+\cdots+\beta_j x_{ij} \quad (1)$$

Where β is the regression coefficient, x is the independent variable, and $f(x)$ is the predicted response variable. Eq. (1) can be simply expressed in another form as:

$$f\left(x\right) = \beta_0 - \sum_{j=1}^{p}\beta_j x_{ij}$$

It can also be used to first gauge the size of the impact that independent variables have on dependent variables. Second, forecasting is made feasible by the effects of regression in such a manner that it may be utilized to calculate how much change in one or more dependent variables affects the dependent variable under consideration. Thirdly, regression analysis helps forecast future trends and values. Some studies where the linear regression approach was adopted include Sianipar (2021) aims to determine the disagreement and concomitant, a trial termination of employment substantially impact staff morale. A multiple linear regression equation was produced based on the outcomes. Another study is that of Huy and Nhut, (2022) measure the factors affecting employees job Satisfaction at Vinh Long Radio and Television Station, the study aims to identify variables that affect staff members' job satisfaction at the Radio and TV station, data on employees working at the company. The study shows that leadership, education, career development, pay, friends and colleagues, work autonomy, work environment, and nature of the work all contribute favorably to job satisfaction.

Another approach is the non-linear model approach, like the linear model, non-linear regression helps to connect a variable Y acting as a reaction to a vector of predictors $Y = (X_1 \ldots\ldots X_2)^T$.

The dependent variables represent a non-linear function of the parameters and one or more independent factors in non-linear regression. It is used when there are physical reasons to believe that the connection between the response and the predictors adopts a particular functional form. Models with non-linear parameters are referred to as non-linear models; the major goals of the non-linear analysis are response prediction, statistical inferences about parameter estimations, and non-linear model goodness of fit (Huang and He, 2024). A linear regression model is a model which is formed by a linear combination of model parameters which means that linear regression models can, regarding the model functions can, be non-linear. Non-linear regression models can be divided into three non-separable models, separable models, and intrinsically linear models.

A study where non-linear model was adopted was that of (Neslihanoglu, 2021), it was used to model the case of confirmed cased COVID-19 rate in the top 8 worst-affected countries. This research analyses the linear association between the confirmed COVID-19 cases count around the world and the individual countries.

2.2. Cobb-Douglas Production Function

The bases for the Cobb-Douglas output function are research done by Douglas and Cobb using data from the American manufacturing sector. A non-linear model can either be Intrinsically Linear Model or Intrinsically Nonlinear Model. An X and Y relating function is Intrinsically Linear; whenever a possible transformation is made on X or Y, X will equal the transformed independent variable and Y the transformed dependent variable. Probabilistic models can be obtained directly from Intrinsically linear functions. Though they are not linear in X as a function, they have parameters whose values are easily estimated using ordinary least squares. When the data set is not linear, but a transformation is performed to make the data look or change linear, it is referred to as Intrinsically Linear Regression (Gregory and Daniel, 2015), such model was adopted by Nwabueze and Nworuh (2009).

A random non-linear function substitutes one or more of the variables in an intrinsically non-linear regression model. Since there is no perfect solution for this non-linear function, its parameters must be guessed; non-linear estimation is a better name for this Model. Intrinsic nonlinearity refers to a property that causes non-linear models' prediction to be inaccurate, the Model and data decide how much intrinsic nonlinearity there is, and this amount is unaffected by re-parametrization (Huang and He, 2024).

Cobb-Douglas model is a linear homogenous output at the degree level function that considers the inputs such as labor, and capital. Using Cobb Douglas, productivity and growth are examined theoretically and empirically. Empirical estimates of aggregate production functions and vital theoretical concepts like potential outcomes, technological change, or the demand for labor are the foundation of a critical macroeconomic analytical technique. Here is their specification:

$$Y = AK^{\alpha} N^{1-\alpha}\ 0 < \alpha < 1 \tag{2}$$

Y represents the aggregate output, K is the capital input, and N is the labor input (Capital and Labour are the two "factors of production" in this function). In order to comprehend and interpret the data gathered, Douglas needed a theory of production.

A statistical occurrence known as Multicollinearity occurs when a predictive variable in a multiple regression model can be correctly predicted linearly from the others. The multiple regression correlation coefficient estimates in this situation may vary erratically due to slight modifications to the Model or data. Multicollinearity only impacts calculations about specific predictors; it has no impact on the predictive capability or reliability of the Model within the data set. Multicollinearity is the term used to denote between two linear explanatory variables. Numerous economic sectors have adopted the Cobb Douglas Model. According to the economic Model's assumptions, the inputs should be multilinear, underlining the classic Cobb-Douglas Production function analysis. The Cobb-Douglas Model's multicollinearity problem first surfaced with the Model itself; it needs to be updated.

Cheng (2023) Outline Douglas's research strategy while highlighting a few aspects of its development. One is Douglas's selection of the marginal productivity theory of distribution as a lens through which to view his statistical finding. As a result, the regression, which he first suggested as a method of quantifying the influence of the law of diminishing returns, was eventually offered to analyze the veracity of the marginal productivity theory and the level of market competition. The paper examines the efforts of agricultural economists as a group who successfully established the Cobb- Douglas regression as a research instrument for their field of research. They saw the regression as a way to respond to several pending issues unique to agricultural economics.

Cobb-Douglas Production Function: The case of a converging Economy, (Hájková and Hurník 2007) conducted 10-year research from 1995 to 2005 in the Czech Republic. This study examines whether its fact makes it unreliable to apply Cobb-Douglas Production Function to the Czeh Economy and analyzes the impact of the shifting labor share of income in more depth. The Dybczak et al. (2006) data was used to study supply-side dynamics. Analysis was based on the findings of Dybczak et al. 2006, who assessed supply-side performance and computed the potential product utilizing the Cobb-Douglas Production Function. In Conclusion, previous 10 years, the Czech economy has averaged relatively moderate yearly growth in potential output of roughly 205-3.0% with a tendency to pick up speed after 2001. Therefore, this may be read as proof of blatant inefficiency in supply-side functioning, with only data from 2001 onwards indicating a certain degree of improvement.

In restricted least squares: The Cobb-Douglas Production Function by Nigerian Economy, Halid (2015) analyze the Nigerian economy using the information on the entire labor, capital, and gross domestic product (GDP) of Nigeria from 1990 to 2009 using the Cobb Douglas production function and optimization approach for parameters estimation. The ensuing Conclusion is that utilizing the restricted regression as prescribed by the Cobb-Douglas function may be safe due to the constant returns to scale in the Nigerian economy over the study period. Therefore, if the capital/labor ratio grew by 1%, the average gain in labor productivity over the sample period was 1%.

An application of Non-Linear Cobb- Douglas Production Function to Selected Manufacturing Industries in Bangladesh, Majumder et al. (2012) analyzed secondary data for 16 major manufacturing sectors of Bangladesh from 1978 through 2002. To measure the procedure for making a few chosen manufacturing sectors in Bangladesh, they resolved to choose the right Cobb-Douglas Production Model. The study is to contrast the Cobb-Douglas Production Function with an additive term; various model selection criteria were applied. Finally, optimization to estimate the production function parameters was used. In Conclusion, using the various model selection criteria covered in the work, the following estimates for Cobb-Douglas Production Function, when the error terms are multiplicative for fundamentally linear models and additive for intrinsically non-linear models, were obtained. Based on the data collected during the study period, The Cobb-Douglas Production Function with additive error (2.2) performs better for the chosen manufacturing sectors. As a result, strictly non-linear models are superior to inherently linear models (which have additive non-linear mistake components, non-linear with multiplicative error terms); using an optimization subroutine, they calculated the Cobb-Douglas Production function's parameter using additive errors.

Impact of using the Cobb-Douglas Production function to determine the structure of production factors and the sustainability of the agricultural industries in Romania, Manta and Dimitriu (2018) aim to understand the capacity participation of soil, labor, and other patterns in the phenomenon of weather change, in order to find monetary, material, informational, and personnel resources to modify action in response to risks that might result based on climate change. The study aims to evaluate the standard of economic growth in the context of the degree to which labor and capital elements are used as determinants of production level and structure and GDP and efficiency of the factors of production. The data for the businesses in certain sections of Romanian agriculture from 2008 to 2016 were explicitly used to calculate the elements of the Cobb-Douglas Production Function for the economy. In Conclusion, the most significant finding from the Model's application relates to the unique significance of capital that must be provided for economic progress in Romania when labor becomes scarce.

Cobb- Douglas Production Function: The Case of Poland's Economy, Dritsaki and Stamatiou (2018) The goal of the research is to examine the connection between global commerce and Poland's economic and financial development from 1990 to 2016. The research uses the Cobb-Douglas Production function developed by Mankiw et al. (1992) to examine the deep-rooted effects of market transparency on economic growth. The Model's annual time series span the years 1990 through 2016. The OECD, UNCTAD, and world growth indices are the data sources. The variable trade openness represents per capita, real exports and imports. Authentic domestic reputation to the personal groups per capita is a gauge of financial development. The study's findings indicate that while labor and financial development are negatively correlated with Poland's economic growth, future market opening and assets favorably impact the country's economic expansion. The beginning of the market and, in particular, finances have been the primary drivers of Poland's economic growth over the time under consideration, both in the short and long term.

Crude Oil and the Nigerian Economic Performance, Odularu (2008) This essay examines the connection between Nigeria's economic performance and the crude oil Industry. The study analyzed data on capital, labour, real gross, crude oil export, domestic product, and crude oil consumption in Nigeria from 1970 to 2005. It was demonstrated through the use of the ordinary least square regression technique that the consumption and export of crude oil have helped to strengthen the Nigerian economy. As a result, a Cobb-Douglas Production function model was developed following the human capital growth model proposed by Solow, using the labour force, domestic consumption, and export of crude oil production as the explanatory variables and RGDP as the dependent variable. Despite having a favorable impact on the economy's expansion, the research concludes that crude oil production (for consumption and export) has not greatly enhanced economic growth due to administrative shortcomings and malfeasance using public cash.

A model for technical and economic efficiency of cement production in Nigeria in the presence of multicollinearity, Adesina et al. (2011) In the research work Cobb- Douglas Production function was used to examine Lafarge WAMPCO Cement's production processes. The study aims to examine the production function of the production factors and the long-term viability of factors to help Lafarge Cement Production company make the appropriate decision regarding the factors: labor, capital, and raw materials. The study demonstrated that the Cobb-Douglas Production function was suitable for modeling the data and identified significant relationships among the variables.

Gender Analysis of sweet potato production in Osun State, Olagunju et al. (2013) The study looked into what factors contributed to the differences in output between male and female sweet potato growers based on gender, socioeconomic traits of farmers of sweet potatoes, the gender distribution of produced potato, farmer efficacy estimation and the variables influencing gender outputs in the study. Data between April 2010 and September 2011 was used and conducted by Osun State Agricultural Development Programs (OSADEP). A total of 80 people were included in the sample of 16 respondents, chosen randomly from the Osun State Agricultural Development Programme (ADP) zones. Structured questionnaires and in-person interviews were used to obtain primary data. Descriptive statistics and the Cobb-Douglas Production Function were utilized to examine the data. The efficiency distribution demonstrates that male and female sweet potato farmers show differences in average production, demonstrating that men have a similar operating range to women. According to the study, women are more committed to and interested in growing sweet potatoes.

The Applied of Cobb-Douglas Production Function with Determinants Estimation of Smale-scale Fishermen's Catches Productions, Rahim et al. (2019) the goal of this research is to estimate the variables affecting the catch productivity of small-scale fishermen. Cobb Douglas equation with qualitative independent regression variable estimate model and cross-sectional data is the analytical approach employed. The respondents were 69 small-scale outboard motorized fishers who used longlines, and the Barru District subdistricts comprised the sample area—the production of small-scale catches along the district's western part. The study's findings showed that factors such as the size of the ocean, the power of the outboard motors, and geographical variations positively impacted small-scale fisherman's catch production. In contrast, factors such as gasoline, recent educational attainment, and family responsibilities had a negative impact. However, factors like fishing equipment, kerosine, and fisherman's age had no discernible influence.

Total Factor Productivity and Nigerian Banking Industry: Cobb Douglas Production Approach, Temidayo and Peter (2017) The research aim is to examine the recent level of component productivity in the Banking Sector; Cobb Douglas Production Function was used as its structure to determine the short and long-term connection between explanatory and response variable. The outcome shows that the banking sector is distinguished by a declining scale on return, with possessing capital having a substantial impact on commercial bank production. In contrast, the quantity of labor contribution has minimal short-term impact and a negligible long-term impact. Total factor productivity is lower in the short term than in the long run.

Assessment of the Impact of Oil Prices on Nigeria's Economy using Cobb Douglas Production Function. Garba and Sikiru (2022) this study uses Nigeria as a case study to explore how susceptible the economy of an oil-producing nation is to change oil prices, using Nigeria being an OPEC member as a case study. The proper Model connecting oil prices with Nigeria's economy was created using Cobb Douglas Production Function. The study seeks to confirm the degree to which Nigeria's economy is susceptible to oil price changes. It takes into account economic indicators, including the Real GDP, National Income, Physical capital, and the population of working age. The analysis's findings support that oil has played a significant role in Nigeria's economic growth, which is still primarily determined by oil prices and money. As a result, they advised that the government focus more on economic diversification and ensure that oil revenue is invested back into the economy through the construction of refineries, sustainable infrastructure, and the growth of other economic sectors.

2.3. Background to the Study of Crude Oil

2.3.1. A brief history of the Nigerian economy

Nigeria's economy has fluctuated; Nigeria is one of the countries generating fossil fuel, despite its economic issues, making it a significant country in terms of global energy policy. Nigerian Economy History began in October 1960, before the country's independence. Colonialism has significantly impacted Nigeria's economic development. Before the emergence of fossil fuels, Nigeria was based on the basics of tax generated from companies Established by the Europeans, including the British this was during the slave trade. Nigeria's vital agricultural and light manufacturing industries were neglected in favor of dependency on crude oil during the 1970s energy boom. In 2000 export of oil and gas was >98% of total export revenue and roughly 83% of total funding for the federal government. Since the early 1980s, the trend has been accompanied by the breakdown of social services and fundamental infrastructure.

Nigeria's per-capital income climbed to a level below that of independence in 2000, or approximately one-quarter of its mid-1970s high. Due to the persistent problems in Nigeria's non-oil industries, the informal sector of the economy, which some estimate to account for as much as 75% of the overall economy, continues to develop rapidly. Nigeria is thought to have estimated gas deposits to be more than a hundred trillion cubic feet. In the middle of 2001, the country produced crude oil at an average rate of about 2.2 million barrels per day.

2.3.2. Crude oil in Nigeria: A brief history

After 50 years of exploration, Shell-BP discovered Crude Oil in Niger Delta at Oloibiri now, the only concessionaire. In 1958, Nigeria's first oil field hit a production capacity of 5,100 bpd and started producing crude oil. When adjacent to the Niger Delta, inland and offshore regions were given drilling rights by additional overseas nations. The EA field was discovered by a shell in 1965 in the shallow sea southeast of Warri. Nigeria immediately benefited from its oil output in 1970 after the Biafran war ended and the international oil price rose. Nigeria joined OPEC in 1971, and Nigerian National Petroleum Company (NNPC), a state-owned and operated business founded in 1977, is an essential participant in the primary and downstream markets.

Production at Shell D'Arcy Petroleum's field in Oloibiri began in 1958 following the discovery of crude oil by the company's pioneers. By the late 1960s and the beginning of the 1970s, Nigeria's production figure was at more than 2 million barrels of oil daily. Even though the economic downturn caused the production figure to decline in the 1980s, oil production wholly recovered in 2004 and reached a record high of 2.5 million barrels per day. By 2010, current development activities hope to increase by 4 million barrels daily. Production and export, about 90% of Nigeria's GDP, dominate the nation's finances. Due to its disproportionate importance, the economy drives away from agriculture in the early 1950s and 1960s.

3. MATERIALS AND METHODS

In this section, the methods adopted to obtain results are highlighted. It describes the stages or approaches used to determine, analyze, and assess content related to a particular topic.

3.1. The Data and Description

The data for the Real GDP and activities surrounding crude oil obtained from National Bureau of Statistics, such as Real Gross Domestic Product, Crude Oil Revenue, Crude Oil Consumption, and Crude oil Export and, Petroleum to GDP was obtained from 1981 to 2021 see Appendix Table 1. As of 21st April, 2024, the real GDP of 2022 (₦74,639.47'000 billion) was the latest available data, so the analyses utilized data from 1981 to 2021. The data is provided as supplementary material. SPSS version 24 was used to analyze the data set obtained. SPSS is a statistical software developed by IBM for data management and analysis.

Table 1 represents the summary statistics of the crude oil variables to be used, the mean values simply tell the average values for each of the variables, a significant standard error indicates a broad range between the mean, the median explains the medium values for each variable, range explains the differences between the highest and the lowest value, the values of the variance explains how widely the observations vary from one another, the maximum and minimum values tell the highest and the lowest figures in each of the variables, the standard deviation explains the deviation from the sample mean with respect to each of the variables, the value of an average skewness is 0 so we can say that the values crude oil revenue (0.6950), crude oil export (0.8377), Petroleum to GDP (0.1463), Real GDP (0.5973) mirrors a normal distribution, Kurtosis value for crude oil consumption is leptokurtic because 13.5324 is >3 and it is a positive excess kurtosis, −0.7843, −0.6721, −0.8300, −1.3066 values for crude oil revenue, export, Petroleum to GDP, Real GDP respectively is platykurtic.

Table 1: Summary statistics of Nigeria crude oil data

Summary	Crude oil revenue	crude oil consumption	Crude oil export	Petroleum to GDP	Real GDP
Mean	2533.518621	14505647	6321011	6640.521	37710.48
Median	1591.6758	9099562	2077052	6552.69	26658.62
Standard Dev.	2694.56187	15319427	7229394	1428.187	20309.83
Variance	7260663.671	2.347	5.23	2039719	4.12
Kurtosis	−0.7843976	13.532471	−0.67215	−0.83008	−1.30661
Skewness	0.695061659	3.636302	0.837776	0.146368	0.597393

GDP: Gross domestic product

3.1.1. The cobb-Douglass model

The four parameter Cobb-Douglass model can be expressed as

$$RGDP = AR^{\beta 1}\ C^{\beta 2}\ E^{\beta 3}\ P^{\beta 4} \quad (3)$$

Where,

RGDP = Real gross domestic product

A = Constant term

R = Crude oil revenue

C = Crude oil consumption

E = Export and

P = Petroleum to GDP

and β_1, β_2, β_3, and β_4 are model parameters.

Taking the log of both sides, and the assumption that the variables are linearly related gives;

$$log\ RGDP = \beta_0 + \beta_1\ log_e R + \beta_2\ log_e C + \beta_3\ log_e E + \beta_4\ log_e P + U \quad (4)$$

$$\beta_0 = log_e A \quad (5)$$

Where U is the stochastic disturbance or random error (with normal zero mean and non-serial correlation characteristics).

The expected signs of the explanatory variable's coefficients are

$$\beta_1, \beta_2, \beta_3, \beta_4 > 0 \quad (6)$$

3.2. Diagnostic Test

3.2.1. Autocorrelation

Most regression problems involving time series data often exhibit positive autocorrelation, to test for the presence of autocorrelation we use the Durbin Watson test specified as follows:

Let y_i and $\hat{}$ be observed and predicted values of the response variable

H_0: $\rho = 0$

H_1: $\rho > 0$ (7)

The test statistics is

$$d = \frac{\sum_{i=2}^{n}(e_i - e_{i-1})^2}{\sum_{i=2}^{n} e_i^2} \quad (8)$$

Where $e_i = y_i - \hat{y}_i$, $i = 1,2,3\ldots$

As serial correlation increase approaches zero (becomes smaller). The d_U and d_L

Which represents upper and lower critical value can be found in statistical table with different values of k. The decision for the autocorrelation test is as follows:

If $d < d_L$ reject H_0: $\rho = 0$

If $d > d_U$ fail to reject H_0: $\rho = 0$

If $d_L < d < d_U$ test is inconclusive

3.3. Multicollinearity

Multicollinearity is used to examine the type and significance of the relationships between the explanatory or predictor factor and the response variable. It helps with the relative significance of the impact of the effects of the various predictor factors.

3.3.1. Chi-square test for multicollinearity

If the correlation coefficients between the variables L and V be r_{12} and L and V represented by r_{13} and L, and V be r_{23} respectively.

$$R = \begin{bmatrix} 1 & r_{12} & r_{13} \\ r_{12} & 1 & r_{23} \\ r_{13} & r_{23} & 1 \end{bmatrix} \quad (9)$$

Where R is the determinant

Chi squared calculated is given as

$$\chi^2 = \left[n - 1 - \frac{1}{6}(2k - 5)\right] log_e\left(determinant\ \ R\right) \quad (10)$$

If Calculated is < χ^2 tabulated; accept H_0 and reject H_1

If $\chi^2_{(0.05)} < \chi^2$ reject H_0 and accept H_1

3.3.2. F-test for multicollinearity

After determining whether Multicollinearity is present, we use the F-Test to determine its location. Using the formula below, it is calculated

$$F^* = \frac{\left(R^2 x_i.x_1 x_2.x_k \middle/ k-2\right)}{\left(1 - R^2 x_i x_1.x_2.x_k\right) \middle/ (n-k+1)} \quad (11)$$

Where

$$Rx_1.x_2x_3 = \frac{b_2 X^{'X_2} + b_3 X'X_3}{X'_1 X_1} \quad (12)$$

$$R^2 x_{3.}x_1x_2 = \frac{b_2\left(X'_3 X_1\right) + b_3\left(X'_3 X_2\right)}{X'_3 X_3} \quad (13)$$

And

$$R^2 x_{2..}x_1x_3 = \frac{b_2\left(X'_2 X_1\right) + b_3\left(X'_2 X_3\right)}{X'_2 X_2} \quad (14)$$

(a) If $F^* > F$ we accept that the variable X_i is multilinear, rejects the null hypothesis

(b) If $F^* < F$ we accept that the variable X_i, is not multilinear, accept the null hypothesis

3.3.3. T-test pattern of multicollinearity

The T-test indicates the multicollinearity pattern or the variables that cause it. The formula listed below can be used to calculate it.

$$t^{*} = \frac{\left(rx_i x_j .x_1 x_2 \ldots\ldots x_k\right)\left(\sqrt{n}-k\right)}{\sqrt{\left(1-rx_i x_j .x_1 x_2 \ldots .x_k\right)}} \quad (15)$$

Where

$$r^2 x_1 x_2 \ldots .x_3 = \frac{\left(r_{12-}r_{13}r_{23}\right)^2}{\left(1-r_{23}^2\right)\left(1-r_{13}^2\right)} \quad (16)$$

$$r^2 x_1 x_3 \ldots .x_1 = \frac{\left(r_{13}-r_{12}r_{13}\right)^2}{\left(1-r_{23}^2\right)\left(1-r_{12}^2\right)} \quad (17)$$

$$r^2 x_2 x_3 \ldots .x_1 = \frac{\left(r_{23}-r_{12}r_{13}\right)^2}{\left(1-r_{23}^2\right)\left(1-r_{12}^2\right)} \quad (18)$$

4. RESULTS

In this session, the results of the analyses carried out are presented accordingly. Table 2 contains the correlation matrix of the raw data.

The econometric method in this research considers crude oil export, crude oil consumption, crude oil revenue, and petroleum to GDP as the independent variable and real gross domestic product as the dependent variable. They are used to obtain a reliable estimate in the regression.

The model to be used are as follows:

The Table 2 shows the correlation coefficient on the raw data, which suggests a strong positive correlation between crude oil revenue and crude oil export (0.894); as Crude Oil export increases, the revenue generated from crude oil tends to increase. Crude oil revenue positively correlates with petroleum GDP (0.556). This suggests a moderate positive relationship between crude oil revenue and the contribution of petroleum to the country's GDP. Crude oilrevenue also negatively correlates with crude oil consumption (0.265). The correlation coefficient suggests that there is no strong linear correlation.

Crude oil consumption has a weak positive correlation with crude oil revenue (0.265). The correlation coefficient suggests that the relationship is not strong; crude oil consumption has a weak crude oil export (0.258) and a very weak positive correlation with petroleum to GDP (0.097); the correlation coefficient suggests that there is no strong linear relationship between crude oil consumption and crude oil exports or the contribution of petroleum to GDP.

Crude oil exports strongly correlate with crude oil revenue (0.894). This indicates a strong positive relationship between crude oil export and crude oil revenue; an increase in exports equates to an increase in revenue. Crude oil export also has a weak positive correlation with petroleum to GDP (0.282) and the contribution of petroleum to GDP. Crude oil export also has a weak positive correlation with crude oil consumption (0.258), showing no strong linear relationship between crude oil export and Consumption. Petroleum to GDP has a moderate positive correlation with crude oil revenue (0.556), suggesting that crude oil revenue tends to increase as the share of petroleum to GDP increases. Petroleum to GDP negatively correlates with crude oil export (0.282). The correlation coefficient suggests that the relationship could be more robust. It also has a weak positive correlation with crude oil consumption (0.097), suggesting that there is no strong linear relationship between the contribution of petroleum to GDP and crude oil consumption.The data in the Figure 1 Shows a steady Real Gross Domestic Product from 1980 to 2000, followed by a consistent increase from 2005 to 2015 and then a plateau from 2015 to 2020, the consistent increase between 2005 and 2015 could be attributed to some factors such as Economic growth, Consumer spending, Employment opportunities and Increased investments.The data in the Figure 2 shows variations in the Petroleum to GDP over time, with both increases, decreases and the changing nature of the data points, indicating the ratio is not constant and experiences changes over the years. Here is some possible cause for the increase and decrease; Oil Prices, Production levels, Demand for Petroleum products and Economic conditions.The data in Figure 3 suggests that there was a period of no exports, followed by a significant growth, then a more dynamic trend with fluctuations in the amount of crude oil exports (barrels) in the later years, the reasons for this fluctuation could be related to market conditions, production levels and government policies, among others.The data in the plot shows that from 1980 to 1990 Crude oil consumption remained around 1.5 million barrels per day, there was a significant spike and consumption increased to 80 million barrels per day, it came down to 10 million barrel per day in 1999, the consumption was relatively stable until 2010 that there was another increase and the consumption rose back to 70 million barrels per day, in 2014 there was a decrease and it remained stable and normal (Figure 4). The period of stable consumption, significant spike and declines could be influenced by shifts in global demand for petroleum products, technological factors or changes in energy policies.In 1980, 1985, 1990 and 1995 crude oil revenue were constant at 0, there was a significant increase and crude oil revenue

Table 2: Correlation coefficient of Nigerian crude oil data

Model	Crude Oil revenue	crude oil consumption	Crude oil export	Petroleum to GDP
Crude oil revenue	1			
Crude oil consumption	0.264904022	1		
Crude oil export	0.894211115	0.257796085	1	
Petroleum to GDP	0.555515504	0.096876865	0.282389339	1

GDP: Gross domestic product

Figure 1: Plot of real gross domestic product

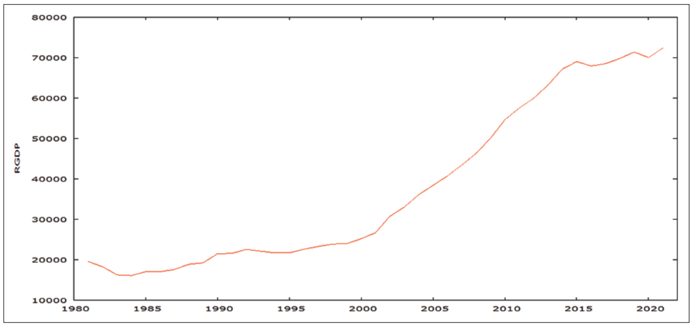


Figure 2: Plot of petroleum to gross domestic product

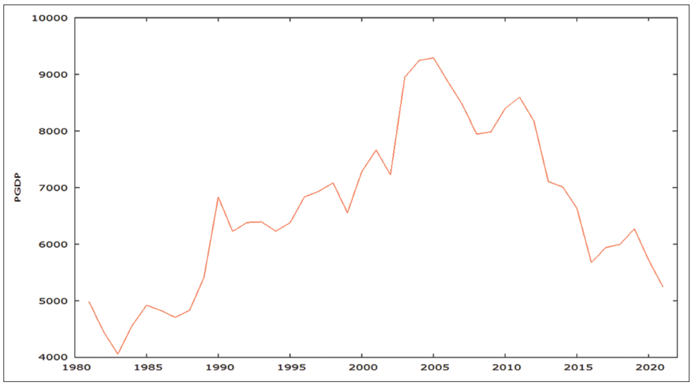


Figure 3: Plot of crude oil export

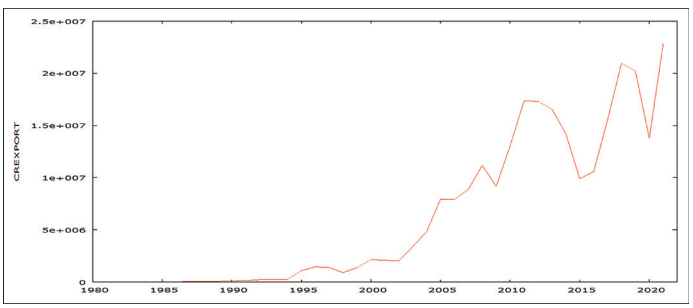
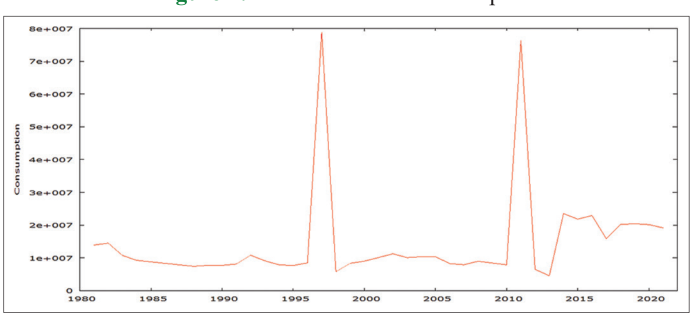


Figure 4: Plot of crude oil consumption



reached 2000 billion between the year 2000, in 2010 there was a substantial surge in revenue and it rose above 8000 billion, in 2015 the revenue decreased but went up again in 2020. This Figure 5 demonstrates how Crude oil revenue fluctuated throughout time with periods of little revenue, slow growth, large growth and finally normalization. It also indicates that crude oil revenue showed irregular variations, both increase and decrease over the years. Table 3 contains the matrix of the log of the data.

Figure 5: Plot of crude oil revenue

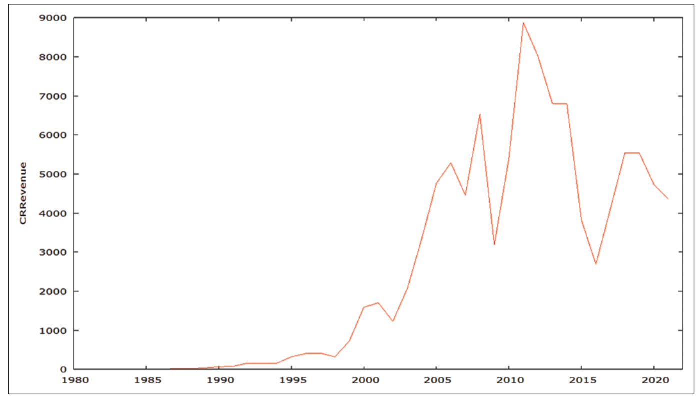


Table 3 reveals a strong positive correlation (0.992083) between Export and COR, which suggests that these two variables are highly correlated; Log PGDP has a moderate positive correlation (0.768435) with COR, COC has a weak positive correlation (0.248973) with COR and a weak negative correlation (−0.00257) with PGDP. Export and PGDP are suspected to be responsible for high correlation. Table 4 contains the results of the coefficient obtained using Cobb-Douglas production function.

Table 4 shows that the constant coefficient (B=8.522) when all the independent variables are zero the estimated values of the dependent variable are 8.552, and the COR coefficient (*B*=0.302) means the production output's sensitivity to labor input. This specifies that a one-unit increase in COR leads to a 0.302 increase in output, and an increase of one standard deviation in COR leads to a 1.392 standard deviation increase in output. COC has a coefficient of 0.039 and a positive standardized coefficient of 0.44, indicating that it has a lesser effect on output than COR. Export coefficient ($B = -0.21$) and a negative standardized coefficient of−0.107 shows the relationship between production outputs and export; a negative output suggests that an increase in export may lead to a decrease in production output, PGDP coefficient ($B = -1.309$) also shows that an increase PGDP may also lead to decrease in output. The t-values show the significance of each coefficient; the higher the t-value, the more significant the coefficient affects the output. The constant, COR, and COC coefficients show significant t-values, while the Export and PGDP coefficients do not show significant t-values.

$$Log\ RGDP = \beta_0 + \beta_1 \log_e R + \beta_2 \log_e C + \beta_3 \log_e E + \beta_4 \log_e P + U$$

$$Log\ RGDP = 8.522 + 0.302\ Log\ R + 0.039\ Log C - 0.21\ Log\ E - 1.309 Log\ P$$

R-squared is 0.953, which shows that 95.3% variation in the response variable results from the independent variables included in the model. The F Statistics is 89.193 and its significant at 1% and its shows that all the variables do have effect on the dependent variable. Table 5 shows the multicollinearity test on the data with full variables.

Table 5 shows the multicollinearity test on the data. The unstandardized coefficient *B*, trepresents the estimated regression coefficients and the relationship between the dependent and independent variables and indicates the change in the dependent variable for a one-unit change in the corresponding independent variable. For constant, when all the independent variables are zero, the estimated values of the dependent variable are 17588.98, COR is −0.660, which means for every one unit increase in the variable, the dependent variable *Y* will decrease by 0.660 units, assuming all the dependent variables are constant, COC is −6.991 it indicates that for every one unit increase in the variable, the dependent variable *Y* is estimated to decrease by 6.961 units assuming all the independent variables are constant, Export is 0.003 this indicates that for every one unit increase in the export variable, the dependent variable will increase by 0.003, for every one unit of PGDP it will also increase by 0.574.

For Unstandardized Coefficient Standard Error, when independent variables are zero, the estimated value of the dependent variable of a constant is 6663.23, and COR is 1.232. It means that for every one-unit increase in the variable, the dependent variable *Y* will increase by 1.2232 units, assuming all the dependent variables are held constant; COC is 0.000. A coefficient of 0 indicates that the variable COC does not affect the dependent variable *Y* in the given model. In other words, changes in COC do not contribute to the changes in the dependent variable regardless of its value; Exports 0.000 a coefficient of 0 for Export implies that this variable has no effect on the dependent variable *Y* changes in Export do not influence changes in the dependent Variable, PGDP is 1.082 it means for every one unit increase in the variable the dependent variable *Y* will increase by 1.082 unit assuming all the dependent variables are constant.

For sandardized coefficients (Beta) the coefficient for the independent variable COR is −0.088 which indicates that a one standard deviation increase in COR variable corresponds to a decrease of 0.088 standard deviations in the dependent variables, the negative sign indicates an inverse relationship as COR increases the dependent variable is estimated to decrease and vice versa, COC is −0.005 which indicates that a one standard deviation increase in COC variable corresponds to a decrease of 0.005 standard deviations in the dependent variables, the coefficient is very close to zero indicating that COC has a negligible impact on the dependent variable in the standardized form, Export is 1.019 it means that a one standard deviation increase in Export variable corresponds to an increase of 1.019 standard deviations in the dependent variables, the positive sign indicates an inverse relationship as Export increases the dependent variable is estimated to increase as well, PGDP is 0.040 it suggests that a one standard deviation increase in PGDP variable corresponds to an increase of 0.040 standard deviations in the dependent variables, this coefficient is relatively small indicating that PGDP has a modest impact on the dependent variable in the standardized form.

To assess multicollinearity, one of the standard metric used in the Variance Inflation Factor (VIF), a VIF of 10.013 for the COR variables suggest that there is a strong correlation between COR and the other predictor variables in the model, VIF for COC 1.080 which indicates that there is little or no correlation between COC and the other predictor variables in the model a VIF value close to suggests that this variable does not contribute to the multicollinearity concerns, VIF for Export 7.468 suggests that a moderate level of collinearity between Export and another predictor variable in the model, VIF for PGDP is 2.168 indicates a relatively low correlation between PGDP and other predictor variables.

In summary, the VIF values indicate potential muticollinearity between COR and Export variables, while the COC and PGDP variables have lower VIF values suggesting less collinearity. To obtain reliable results, it is essential to address multicollinearity issues in regression models. We can do that by removing the variables. Table 6 shows the Multicollinearity test on the data after removing the variables causing multicollinearity.

Table 6 shows the multicollinearity test on the data. The unstandardized coefficient *B* for when all the independent variables are zero is 19914.232, COC is −1.025, which means for every one unit increase in the variable, the dependent variable *Y* will decrease by 1.025 unit assuming all the dependent variables are constant, Export is 0.003 this indicates that for every one unit increase in the export variable, the dependent variable will increase by 0.003, for every one unit of PGDP it will also increase by 0.165.

For unstandardized coefficient standard error when independent variables are zero, the estimated value of the dependent variable of a constant is 5003.970, COC is 0.000, a coefficient of 0 indicates that the variable COC has no effect on the dependent variable Y in the given model; in other words, changes in COC do not contribute to

Table 3: Correlation coefficient of log data

Model	LogCOR	LogCOC	LogExport	LogPGDP
LogCOR	1			
LogCOC	0.248973	1		
LogExport	0.992083	0.278256	1	
LogPGDP	0.768435	−0.00257	0.717954	1

Table 4: Model summary for cobb Douglas production function

Model	B	Std. error	Beta	T	Sig.
(Constant)	8.522	1.111	-	7.671	0.000
Log COR	0.302	0.112	1.392	2.694	0.011
Log COC	0.039	0.050	0.044	0.792	0.433
Log export	−0.021	0.093	−0.107	−0.223	0.825
Log PGDP	−1.309	0.231	−0.541	−5.674	0.000

Table 5: Multicollinearity test on the data with full variables

Model	B	Std. error	Beta	T	Sig.	Tolerance	VIF
Constant	17588.084	6663.229		2.640	0.012		
COR	−0.660	1.232	−0.088	−0.536	0.596	0.100	10.013
COC	−6.961	0.000	−0.005	−0.098	0.923	0.926	1.080
Export	0.003	0.000	1.019	7.215	0.000	0.134	7.468
PGDP	0.574	1.082	0.040	0.530	0.599	0.461	2.168

the changes in the dependent variable regardless of its value, Exports is 0.000 a coefficient of 0 for Export implies that this variable has no effect on the dependent variable Y changes in Export do not influence changes in the dependent Variable, PGDP is 0.759 it means for every one unit increase in the variable the dependent variable *Y* will increase by 0.759 unit assuming all the dependent variables are constant.

For standardized coefficients (Beta), the coefficient for the independent variable COC is −0.088, which indicates that a one standard deviation increase in the COC variable corresponds to a decrease of 0.088 standard deviations in the dependent variables, Export is 0.949, which means that a one standard deviation increase in Export variable corresponds to an increase of 0.949 standard deviations in the dependent variables, PGDP is 0.012 it suggests that a one standard deviation increase in PGDP variable corresponds to an increase of 0.012 standard deviations in the dependent variables.

For the variance inflation factor (VIF), VIF for COC 1.072 is close to 1, which indicates that the COC variable does not contribute to multicollinearity concerns, VIF for Export 1.087 indicate that there are no multicollinearity concerns for the variables, VIF for PGDP is 1.087 indicate that there is no multicollinearity concern for the variables.

In conclusion, the VIF values of the three predictor variables are close to 1, and there is no multicollinearity among COC, Export, and PGDP. Table 7 shows the Multicollinearity test on the data with full log transformed variables.

Table 7 shows the multicollinearity test on the Log transformation data, interpreting the result For Unstandardized Coefficient B, for constant when all the independent variables are zero, the estimated values of the dependent variable are 8.522, COR is 0.302, which means for every one unit increase in the variable, the dependent variable *Y* will decrease by 0.302 unit, COC is 0.039 it indicates that for every one unit increase in the variable, the dependent variable *Y* is estimated to increase by 0.039, Export is −0.021 this indicates that for every one unit increase in the export variable, the dependent variable will decrease by 0.021, also for every one unit increase of PGDP the dependent variable *Y* is estimated to decrease by 1.309.

For Unstandardized Coefficient Standard Error, when independent variables are zero, the estimated value of the dependent variable of a constant is 1.111, and COR is 0.112. For every one-unit increase in the variable, the dependent variable *Y* will increase by 1.112 units, assuming all the dependent variables are held constant, and COC is 0.050; this indicates that for every one-unit increase in the COC variable, the dependent variable will increase by 0.050, Export is 0.093, this indicates that for every one-unit increase in the export variable, the dependent variable will increase by 0.093, PGDP is 0.231 it means for every one unit increase in the variable the dependent variable *Y* will increase by 0.231 unit assuming all the dependent variables are constant.

For Standardized Coefficients (Beta) the coefficient for the independent variable COR is 1.329 which indicates that a one standard deviation increase in COR variable corresponds to an increase of 1.329 standard deviation in the dependent variables, the positive sign indicates a positive relationship as COR increases the dependent variable will also increase, COC is 0.044 which indicates that a one standard deviation increase in COC variable corresponds to an increase of 0.044 standard deviation in the dependent variables indicating that COC has a modest impact on the dependent variable, Export is −0.107 it means that a one standard deviation increase in Export variable corresponds to a decrease of 0.107 standard deviations in the dependent variables, the negative sign indicates an inverse relationship as Export increases the dependent variable will decrease, PGDP is −0.541 it suggests that a one standard deviation increase in PGDP variable corresponds to a decrease of 0.541 standard deviation in the dependent variables.

For the variance inflation factor (VIF), a VIF as high as 104.902 and 89.966 suggest a high degree of Multicollinearity, VIF for COC 1.197 the value is close to 1 which suggests that this variable does not contribute to the multicollinearity concerns.

In summary, the VIF values of COR and Export suggest multicollinearity issues in the variable. To obtain reliable results, it is essential to address multicollinearity issues in regression models. We can do that by removing the variables. Tables 8 shows the Multicollinearity test on the data with full log transformed variables when variables causing Multicollinearity has been removed.

For Unstandardized Coefficient B for constant −1.969, it shows that when COC and PGDP are set to zero, the predicted value variable will

Table 6: Multicollinearity test on the data

Model	B	Std. error	Beta	T	Sig.	Tolerance	VIF
Constant	19914.232	5003.970		3.980	0.000		
COC	−1.025	0.000	−0.008	−0.146	0.885	0.933	1.072
Export	0.003	0.000	0.949	17.270	0.000	0.867	1.154
PGDP	0.165	0.759	0.012	0.217	0.829	0.920	1.087

Table 7: Multicollinearity on test on the Log transformation

Model	B	Std. error	Beta	t	Sig.	Tolerance	VIF
Constant	8.522	1.111		7.671	0.000		
Log COR	0.302	0.112	1.392	2.694	0.011	0.010	104.902
Log COC	0.039	0.050	0.044	0.792	0.433	0.835	1.197
Log export	−0.021	0.093	−0.107	−0.223	0.825	0.011	89.966
Log PGDP	−1.309	0.231	−0.541	−5.674	0.000	0.281	3.564

Table 8: Multicollinearity on the log transformation

Model	B	Std. error	Beta	t	Sig.	Tolerance	VIF
(Constant)	−1.969	1.487	-	−1.324	0.194	-	-
Log COC	0.330	0.119	0.367	2.772	0.009	1.000	1.000
Log PGDP	1.089	0.320	0.450	3.400	0.002	1.000	1.000

Table 9: Autocorrelation on the log transformation data

Model	*R*	*R*-square	Adjusted *R* square	Std. error of the estimated	Durbin Watson
	0.953	0.908	0.898	0.07394	0.723

be −1.969; COC is 0.330, which means for every one unit increase in the variable, the dependent variable *Y* will increase by 0.330, for every one unit of PGDP the outcome will also increase by 1.089 unit.

For Unstandardized Coefficient Standard Error, when independent variables are zero, the estimated value of the dependent variable of a constant is 1.487. COC is 0.119, which indicates that for every increase in the unit, the dependent variable will increase by 1.487; PGDP is 0.320, which means for every one unit increase in the variable, the dependent variable *Y* will increase by a unit, assuming all the dependent variables are constant.

For Standardized Coefficients (Beta), COC is 0.367; this indicates that all the predictor variables are standardized, with one standard deviation increase in the COC variable corresponding to an increase of 0.367; PGDP of 0.450 suggests that a one standard deviation increase in the PGDP variable corresponds to an increase of 0.450 standard deviations in the outcome this variable has slightly more significant impact compared to COC 0.367.

For Variance Inflation Factor (VIF), VIF for COC 1.000 suggests that there is no multicollinearity between COC and other variables which means that COC does not share too much variance with other variables, VIF for PGDP is 1.000 suggests that there is no multicollinearity between COC and other variables which means that PGDP does not share too much variance with other variables.

In conclusion, the VIF values for COC and PGDP variables show that Multicollinearity is not a concern.

In Table 9, the R value of 0.953 indicates a strong positive linear relationship between the dependent and the independent variables; the R-squared value of 89.3% shows that the independent variables in the model account for the variability in the dependent variable, Durbin Watson value of 0.723 is lower than 2 indicating a strong positive autocorrelation in the residuals this suggests that the errors in the model are systematically correlated with each other over time.

4. CONCLUSION AND RECOMMENDATIONS

The study explored the relationship between crude oil and economic growth in Nigeria. The results have showed that crude oil revenue and consumption can lead to economic growth. Despite having a favorable impact on economic growth, Nigeria's oil export, Petroleum to GDP, and Real Gross Domestic Product have not expanded dramatically due to several reasons, including corruption and ineffective government management as identified by Odularu (2008).

Regardless of whether domestic Consumption and revenue positively impact the economy, the government must make investments, ensure cost reduction, increase production, wise commercial decision-making, and adhere to the Petroleum Industry Act's regulations may also help achieve the revenue target.

Studies on the effects of oil and economic growth have been undertaken in-depth throughout a wide range of literature and published works. As a result, a Cobb-Douglas Production Function model was employed regarding Crude Oil Revenue, Crude Oil Consumption, Crude Oil Export, and Petroleum to Gross Domestic Product as the independent variables. At the same time, Real Gross Domestic Product served as the dependent variable and was utilized to represent economic growth, and data range from 1981 to 2021 for each variable. The parameters were estimated using the multiple regression analysis method to derive the relative regression coefficients. Based on the findings of this study, the following are recommended.

i. Nigeria should promote greater involvement from private companies to lower the cost of processing crude oil and build more equipped refineries
ii. By increasing downstream output, the Nigerian National Petroleum Corporation (NNPC) can increase the amount of refined petroleum available for exports
iii. The natives of the area which crude oil is being extracted should receive urgent government attention; this will lessen the turmoil there
iv. Nigeria needs to expand her export markets, particularly the oil industry. African countries should be top priorities in export, rather than the United States and Europeans nations.

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APPENDIX

Table 1: Crude oil revenue, crude oil consumption, export, petroleum to gross domestic product and real gross domestic product in Nigeria 1981-2021

Year	COR b ('000)	COC (Metric tons)	Export b('000)	PGDP b('000)	RGDP b('000)
1981	8.6	13,912,523	10,800.30	4,977.42	19,549.56
1982	7.8	14,482,651	8,228.70	4,453.09	18,219.27
1983	7.3	10711335	7,372.80	4,052.98	16,228.81
1984	8.3	9224971	9,123.00	4,559.20	16,048.31
1985	10.9	8771863	11,275.50	4,918.27	16,997.52
1986	8.1	8318755	9,282.40	4,825.50	17,007.77
1987	19	7865647	31,378.70	4,704.42	17,552.10
1988	19.8	7412539	32,238.50	4,828.68	18,839.55
1989	39.1	7,696,962	59,688.40	5,407.01	19,201.16
1990	71.9	7,700,621	112,699.60	6,831.77	21,462.73
1991	82.7	8,108,101	124,630.30	6,224.45	21,539.61
1992	164.1	10,791,505	220,945.40	6,381.26	22,537.10
1993	162.1	9,099,562	254,914.90	6,394.60	22,078.07
1994	160.2	7,869,641	243,059.80	6,229.46	21,676.85
1995	324.5	7,670,234.00	1,083,391.20	6,375.97	21,660.49
1996	408.8	8,456,736.00	1,448,394.60	6,832.84	22,568.87
1997	416.8	78,886,122.00	1,379,401.90	6,933.58	23,231.12
1998	324.3	5,758,233.00	893,640.70	7,083.99	23,829.76
1999	724.4	8,337,602.00	1,381,138.70	6,552.69	23,967.59
2000	1,591.70	8,976,870.00	2,141,718.09	7,281.94	25,169.54
2001	1,707.60	10,096,318.75	2,077,052.08	7,662.98	26,658.62
2002	1,230.90	11,235,322.69	2,011,155.83	7,225.68	30,745.19
2003	2,074.30	10,066,245.17	3,392,032.26	8,952.62	33,004.80
2004	3,354.80	10,337,435.82	4,807,586.91	9,248.05	36,057.74
2005	4,762.40	10,347,445.79	7,937,877.86	9,294.05	38,378.80
2006	5,287.60	8,225,868.22	7,901,768.64	8,874.70	40,703.68
2007	4,462.90	7,889,058.12	8,878,727.22	8,471.95	43,385.88
2008	6,530.60	8,952,572.10	11,177,365.98	7,947.72	46,320.01
2009	3,191.90	8,408,421.80	9,174,200.04	7,983.63	50,042.36
2010	5,396.10	7,869,870.20	13,057,662.52	8,402.68	54,612.26
2011	8,879.00	76,265,882.70	17,366,751.38	8,598.64	57,511.04
2012	8,026.00	6,484,724.30	17,324,246.83	8,173.26	59,929.89
2013	6,809.20	4,521,532.87	16,561,219.19	7,105.28	63,218.72
2014	6,793.80	23,502,762.46	14,222,131.08	7,011.81	67,152.79
2015	3,830.10	21,816,292.92	9,909,705.44	6,629.96	69,023.93
2016	2,693.90	22,898,666.79	10,563,230.42	5,672.21	67,931.24
2017	4,109.70	15,874,925.31	15,528,695.64	5,938.05	68,490.98
2018	5,545.80	20,189,420.53	20,968,131.07	5,995.88	69,799.94
2019	5,536.70	20,410,904	20,238,224.32	6,270.86	71,387.83
2020	4,732.50	20,133,249	13,775,162.11	5,713.20	70,014.37
2021	4,358.30	19,152,124.70	22,825,184.53	5,239.05	72,393.67