Effect of Selected Macroeconomic Variables on Oil Refining Industry Output in Nigeria.

***Abimbola Makanjuola – Agbola, Assoc. Prof. Abayomi Awujola, Dr. Obumneke Ezie**
Bingham University Karu, Nasarawa State
***Corresponding Author**

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ABSTRACT

Nigeria runs a single-product economy where the major source of revenue for the country is crude oil exploration and exportation. The economy has over the years relied heavily on crude oil export for government revenues and its foreign exchange earnings. This dependence on the oil sector has had both salutary and deleterious impacts. Oil production crashed by vandalism and militant attacks in the Niger Delta, resulting in underperformance of the oil sector leading to poverty and a lack of infrastructural development across multiple sectors of the economy. This is why this paper seeks to investigate the impact of four key selected macroeconomic variables on Nigeria's oil refining industry output. Autoregressive distributed lag model (ARDL) was adopted for data analysis. ADF Unit root tests revealed mixed order of integration while Co-integration Bounds test revealed the existence of long-run relationship between the dependent and independent variables. Findings revealed that there is a long-run relationship among the variables and all the variables have a positive relationship with oil refining industry output. The probability values indicate that Interest rate (INTR), Exchange rate (EXCR) and Net export (NEXP) do not have significant impact on oil refining industry output while Government capital expenditure (GCEXP) has significant impact on oil refining industry output. The paper recommends that favourable interest rate should be maintained, government should stabilize exchange rate and prioritize strategic investments in infrastructure development.

Keywords: Oil refining industry, Interest rate, Exchange Rate, Net Export, Government Capital Expenditure

JEL Classification Q43 E23, E66, L72

INTRODUCTION

In Nigeria, the position of crude oil as the mainstay of the economy cannot be over emphasized. Oil plays a vital role in shaping the economic and political destiny of the country thus; Nigeria economy is basically an open economy. Crude oil was first discovered in Nigeria in 1956 by Shell-BP at Oloibiri in Bayelsa State in Nigeria's Niger Delta region. The field was first produced in 1958 placing Nigeria among the group of oil producing countries in the world. The economy, over the years relied heavily on crude oil export for government revenues and its foreign exchange. The oil and gas sector accounts for about 10% of gross domestic product, and petroleum exports revenue represents almost 86% of total exports revenue (OPEC, 2018).

Nigerian crude is classified as light-sweet grade and is mostly traded as Bonny Light, Forcados blend and Qua Iboe Light. These grades of oil are highly desirable to refineries all over the world and are sold at premium prices compared to heavier crudes. This is because of their less impurity-containing sulphur properties as well as their desirable American Petroleum Institute (API) gravity which yields higher-value refined petroleum products. The export of crude oil from Nigeria created a major economic shift by

displacing agriculture as the traditional mainstay and foreign exchange earner for the nation's economy. The production and export of crude oil usually accounts for more than 80% of government revenue and more than 90% of its foreign exchange earnings (DPR, 2017).

Nigeria has four state-owned oil refineries operated by its National Oil Company, the Nigerian National Petroleum Corporation (NNPC), with a combined installed capacity of 445,000 barrels per stream day (bpsd). The refineries are strategically located across the country and have sufficient installed capacity to meet at least 60% of Nigeria's 630,000–700,000 b/d demand for refined petroleum products (RPPs). Unfortunately, ratio of actual production to installed capacity across the refineries dropped to 20% levels across the period of 2015-2020 due to gross neglect, mismanagement, poor maintenance, theft, and fire resulting in Nigeria becoming significantly reliant on imports of Refined Petroleum Products (RPPS) for its domestic energy needs. This is particularly worrisome as Nigeria's downstream sector; mainly the refining sector consistently generates less than 1% of the country's Gross Domestic Product (GDP) unlike the upstream sector, which contributes up to 10% of the nation's GPD (National Bureau of Statistics, 2020). In May 2023, the Dangote refinery was launched and is expected to produce 650,000bpd.

Also, macroeconomic variables refer to factors that are pertinent to the broad economy at the regional or national level and affect a large number or population rather than a few individuals. They are factors affecting an organization in which its management has no control over it, this include political conditions, government regulations policies, etc. (Egbunike & Okerekeoti, 2018). Also, it must be noted that both internal and external factors are considered when measuring or ascertaining manufacturing performance. In view of this, Peace (2019) remarks that the interaction of these internal factors and macroeconomic variables is what determine the performance of an industry. This could be attributed to the fact that macroeconomic indices set the pace of how well an industry will thrive. A stable macroeconomic environment favours growth of the oil refining industry by reducing uncertainty (Olorunfemi, Tomola, Felix, & Ogunleye, 2013). The macroeconomic variables highlighted in this paper include interest rate, exchange rate, net exports and government capital expenditure based on monetary, fiscal and trade policies.

In 2016, the economy recorded its first recession in twenty-five years when the combined effect of global oil prices, which reached a 13-year low and oil production crashed by vandalism and militant attacks in the Niger Delta, resulting in severe contraction of oil. This underperformance in the oil sector spilled over to the non-oil sector through the monetary and exchange rate channels (World Bank, 2017). Unfortunately, despite the significant earnings accruing from Nigeria's sale of crude oil since the late 1950s, the country still grapples with poverty and a lack of infrastructural development across both the public sector and the processing downstream oil sector. This is in sharp contrast from what is obtainable from some oil producing states in the Middle East such as Saudi Arabia, Oman and Kuwait with better infrastructure development and welfare programme for their citizens. It can be argued that these countries have relatively smaller populations compared to Nigeria whose 200+ million persons is at least three times the combined population of these countries, the scale of infrastructural development, as well as poverty eradication in these nations evidences a long-term commitment to growth from their efficient resource use (World Bank, 2020).The regular injection of resources from crude oil sales has not contributed as much to Nigeria's infrastructure development. This can be evidenced across multiple sectors of the economy from power sector, through roads and highways, hospitals, and schools, and even the oil sector, especially the downstream refining sector, all of which have suffered from gross infrastructural decay as evidenced by the current state of the NNPC refineries.

The Nigerian government has made some efforts to address the problems of the refining sector to ensure the steady availability of petroleum products in the country. Unfortunately, these efforts which involve several strategies by multiple administrations have not yet proven effective. Iheukwumere, Moore and Omotayo (2020) identified some of these steps as the commencement of issuance of licenses in 2002 to private organisations to construct refineries in Nigeria, awards of contracts for the refurbishment of existing

refineries in Nigeria in 2003, attempted sale of the NNPC refineries to private organisations in 2007, the attempted removal of petroleum subsidy in Nigeria in 2011 as well as the enactment of the National Petroleum Policy (NPP) in 2017. Other policies put in place by the Nigerian government includes; the establishment of the Nigerian Oil and Gas Industry Content Development Act (NOGICDA) in 2010 to ensure the utmost level of involvement by Nigerian citizens in business activities related to the oil and gas industry. The Petroleum Industry Governance Bill (PIGB) an act passed in 2019 to create a more transparent and consistent approach to the governance of the oil and gas sector in Nigeria. The Downstream Petroleum Regulatory Agency (DPRA) was created in 2006 in order to establish regulatory standards and to ensure more efficient cost management and safety standards in the oil industry. The DPRA is also responsible for the control and management of subsidized refined fuel prices. The Gas Flare Commercialization Program (GFCP) is an initiative set up in 2020 by the Nigerian government to invest in projects aimed at utilizing the natural gas, and the deregulation and Liberalization of the downstream oil sector which includes removal of fuel subsidies.

The oil refining industry is a crucial component of the Nigerian economy, and its output is influenced by various macroeconomic variables. Understanding the impact of the variables on the industry is essential for policy makers, investors and other stakeholders in the industry can make informed decisions to enhance the industry's productivity and resilience. Hence, this paper seeks to examine the impact of macroeconomic variables on the oil refining industry in Nigeria. the hypothesis stem from the above objective.

The rest of the paper is structured into sections: section 2 covered materials and method which explains the conceptual review, as well as the theoretical framework and review of empirical findings. Section 3 focused on results, analysis and discussion of the findings while section 4 dwelt on conclusion and policy recommendations.

MATERIAL AND METHOD

Conceptual Review

Interest Rate is the amount a lender charges a borrower and is a percentage of the principal on the amount loaned. Crowley (2007) defined interest rate as the price a borrower pays for the use of money they borrow from a lender or fee paid on borrowed assets. Ngugi (2011) describes interest rate as a price of money that reflects market information regarding expected change in the purchasing power of money or future inflation. The Nigeria bank lending rate as at March 2023 is pegged at 18%. Interest rate affects the cost of borrowing for companies in the oil refining industry because when interest rate is low, it becomes cheaper for refineries to access credit and finance their investment projects and high interest rate increase the cost of capital making it more expensive for refineries to finance their operations.

Exchange Rate is the price of a country's money in relation to another country's money. It is the value of one currency for the purpose of conversion to another. Harvey (2012) describes exchange rate as the value of two currencies relations to each other. It is the price at which the currency of one country can be converted to the currency of another. The exchange rate in Nigeria as at May 2023 was ₦462.50 =$1. Exchange rate plays a critical role in shaping the oil refining industry output in Nigeria by influencing input costs, export profitability, investment decisions, government policies and domestic market dynamics.

Net Export is a measure of a nation's total trade. The formula for net exports is the value of a nation's total export goods and services minus the value of all goods and services it imports equal its net export which is also called balance of trade. A nation that has a positive net export enjoys a trade surplus, while negative net exports means the nation has a trade deficit. (Hayes, 2021). If net exports are high, it implies that a larger proportion of the country's crude oil is being sold to foreign markets rather than being utilized for domestic refining thereby reducing the availability of crude oil for domestic refineries and impacting their output

levels. If net export is low, it indicates a higher reliance on imported petroleum products which can potentially limit output and growth of domestic oil refining industry.

Government Capital Expenditure refers to government spending on building, road construction, land, and housing among others. It is an important instrument which the government can influence to achieve its macroeconomic objectives. The benefits of expenditures on capital projects are more durable and impactful as compared to those of recurrent expenditure. (Mansouri,2008). Government capital expenditure can play a crucial role in shaping the oil refining industry output in Nigeria by supporting infrastructure development, encouraging upgrades and expansion, promoting research and development, implementing favourable policies etc. These initiatives can have a positive impact on the output of oil refining industry in Nigeria.

Theoretical Framework

The main adaptive theory is the Dutch disease theory which identified the apparent causal relationship between the rise in the economic development of a specific natural resources sector (in this case the oil sector revenue) and concomitant decline in other sectors (Auty and Mikesell, 1998). The Dutch Disease was coined by the Economist magazine in 1977 to describe the economic phenomenon observed in Netherlands. The theory states that when a country experiences significant economic growth in a certain sector or industry, it causes real exchange rate appreciation and a decline in other sectors. This typically happens when the proceeds from the export of a primary good such as mineral resources (diamonds, metals, oil, etc.) are spent inside the country. The influx of money leads to inflation in non-dependent sectors and an increase in imports, reducing competitiveness of the local industries. As a result, certain sectors (such as agriculture, fishing, manufacturing, etc.) start to decline. Dutch disease is an economic phenomenon in which an increase in a nation's wealth from the discovery of natural resources is accompanied by a decrease in the competitiveness of its other industries. This typically happens when a country's currency appreciates as a result of a large influx of foreign income, making its other goods and services less competitive on the international market.

Dutch disease became widely used in economic circles as a shorthand way of describing the paradoxical situation in which seemingly good news, such as the discovery of large oil reserves, negatively impacts a country's broader economy. It is usually associated with natural resource discovery and endowments; it also denotes "any development that results in a large inflow of foreign currency, including a sharp surge in natural resource prices, foreign assistance, and foreign direct investment. For example, in the 1970s, Dutch Disease hit Great Britain when the price of oil quadrupled, making it economically viable to drill for North Sea Oil off the coast of Scotland. By the late 1970s, Britain had become a net exporter of oil, though it had previously been a net importer. However, Budina, Pangand and Van Wijnbergen (2007) and Mehlum, Moene and Torvik (2006) contend that this Dutch disease phenomenon is unlikely to happen in developing countries because of the imperfect market structure. However, where the dependence on oil revenue is high as is in the case of Nigeria, such country is easily afflicted by this disease.

Empirical Review

There exists a lot of empirical evidence of studies carried out on the impact of selected macroeconomic variables on oil refining industry output. However, the major issue is that these studies used different variables and modelling techniques in their analysis, thereby leading to variations in their findings.

Gbadamosi, Ayoola and Adeosun (2022) investigated crude oil and macroeconomic variables nexus: impact on Nigeria's economic growth. The study investigated the impact of four key variables (crude oil price, real exchange rate, inflation and population) on Nigeria's economic growth. Johansen Cointegration test and Vector Error Correction Model (VECM) were carried out to determine the co-integration and relationships existing among the variables. The findings show that the explanatory variables used in this study are all

significant on the response variable (GDP) in both long-run and short-run. The rise and fall in the prices of crude oil have negatively affected Nigeria's economic growth, real exchange rate and are equally responsible for the inflationary increase in the country in the long run.

Oil production – GDP nexus: empirical insights from the Nigerian economy was examined by Ishioro, (2022) annual time series data on oil production and its growth rate represented the oil production side of the nexus while GDP and its growth rate represented the GDP side of the nexus. Three different econometric techniques were applied: unit root test, cointegration test, vector error correction and the granger causality estimation techniques. results largely suggest that there exists a long-run joint and simultaneous (bilateral performance) between GDPg and oilprodg , and between GDP and oilprodg; growth rate of GDP (gdpg) has negative coefficients in relation to its contribution to the growth of oil production (oilprodg); and negative but statistically insignificant impact of the dependence of the growth rate of current oilprodg on GDP.

Onakoya and Agunbiade (2020) assessed the impact of the Nigerian oil sector performance on the macroeconomic variables between 1980 and 2017. The long-run co-integration test was conducted after determining the optimal lag. The Error Correction model technique was applied to determine the possible existence of short-run relationship among the variables. The Toda Yamamoto modified Wald's test was employed in order to know the direction of causality. The Impulse Response Function together with other post-estimation tests was also used. The result showed a uni-causality direction from oil revenue in the direction of all the macroeconomic variables. It also revealed significant positive long run relationship between the oil sector and both GDP and unemployment.

Macroeconomic variables and the oil sector on the performance of the agricultural sector between 1981 and 2017 in Nigeria (2020) was analysed by Onakoya and Alayande. The study the Auto regressive distributed lag (ARDL) technique for model estimation. The results indicated that contrary to the Dutch disease postulation the oil sector positively impacted the output of the agricultural sector. The influence of exchange rate was also positive. Interest and unemployment rates on the other hand, had negative effects. The rate of inflation and the national output had no impact.

Onwuegbuchunam, Aponjolosun, Buhari and Ojo (2020) assessed analysis of operational performance of crude oil fining and petrochemical jetties in Nigeria. The paper assessed the performance of jetty operations in Warri Refining and Petrochemical Company (WRPC). Primary data for the study consisted of ship turn round times, volume of cargo and number of vessels handled at the jetties for years 2004 to 2018. These variables served as key performance assessment criteria. Findings showed that the jetties were being operated at less than optimum level. Trend analysis of the key performance indicators showed existence of continuous decline in operational performance of WRPC over the years covered in the study. Significant factors accounting for this performance outcome were found to include: inadequate berthing facilities, shortage of manpower supply, pipeline vandalization, inadequate maintenance of jetty facilities and poor documentation.

An investigation on the current challenges of refinery construction in Nigeria examined by Iheukwumere, Moore and Omotayo (2020) was done with a view of comparing the drivers and enablers of productivity in construction in this sector during the period of 1965 – 1989 and how they differ from the current period of 2000 – 2019 in Nigeria. The study reveals that change of ownership structures from the government sector to the private sector between the two eras, present additional challenges. These challenges cut across availability of capital, inconsistent government priorities and access to land for construction. Others include cronyism and corruption, weak political will, unstructured refinery licensing scheme, security challenges and economic factors regarding the regulated downstream market in Nigeria.

Furthermore, Nebo, (2019) analyzed the impact of oil production on macroeconomic variables of selected

oil producing countries in oil producing countries in sub Saharan Africa namely; Nigeria, Angola, Gabon, the Republic of Congo and Equatorial Guinea. It estimated the impact of oil production in the real effective exchange rate, human capital development, government expenditure on final consumption and the real gross domestic product. Using panel fixed-analysis effect model and KAO co-integration test, the analysis was done using panel data from 1990-2017.

Akpan, Obi and Udo. (2018) examined the Effect of Importation of Refined Petroleum Products on Exchange Rate in Nigeria: 1990-2015. The study adopted secondary time series data and employed econometric tools (unit root test, Johansen cointegration technique and error correlation model analysis) to estimate the data. The variable of interest are exchange rate (EXR), gross domestic product growth rate (GDPg), inflation rate (INFR), import of refined kerosene (RKSM), import of refined motor spirit (RMSM), total import of petroleum product (IMP) GDPg The study reveals that all the variables are positive and statistically significance on exchange rate except GDPg, which shows a negative impact on exchange rate in Nigeria. It was evidence that importation of refined petroleum products is as a result of poor refineries, poor turn around maintenance, obsolete technology, low capacity and lack of government will to invest in oil sector, shortages of the petroleum products for domestic use.

Effect of deregulation of downstream oil sector on selected macroeconomic variables in Nigeria was investigated by Sani, (2014). The paper employed a Vector Autoregressive (VAR) model on quarterly data over the period 1980q1 to 2012q4 using Variance Decomposition, Impulse Response Function and Granger Causality tests to examine the effect of deregulation of downstream oil sector on four macroeconomic variables, namely; GDP, Inflation, Unemployment and Minimum wage. This paper finds evidence that deregulation is the major source of variation in GDP, Inflation and Unemployment, while it is not found to be a significant source of variation in Minimum wage. The paper also discovered that there is positive impact of oil price changes on GDP and Inflation but negative impact on Unemployment and Minimum wage in the short run which became positive in the long run.

METHODOLOGY

Research Design: *Expost-facto* research design was employed for this study. An expost-facto research design is very appropriate for this study because it describes the statistical association between two or more variables. The use of this design allows for the testing of expected relationships between selected macroeconomic variables and textiles industry output in Nigeria and making impact predictions regarding these relationships.

Sources of Data Collection: Determining the cause–effect relationships among the selected variables are the major aim of this study and hence, the data used primarily consist of secondary (annual) data collected from the publications of the Central Bank of Nigeria (CBN) Statistical Bulletin for a period of 36 years (1986-2021). The data generated are data on Oil refining industry (Billion Naira) Interest rate (%); Exchange rate (Naira to dollar); Net export (export minus import in Billion Naira) and Government capital expenditure (Billion Naira).

Method of Analysis: The paper conducted unit root tests (pre-estimation diagnostics tests) using Augmented Dickey Fuller (ADF) test to ascertain the stationarity of the data before carrying out the cointegration test. Dickey and Fuller (1979) have also stressed the importance of investigating time series data whether they exhibit random walks that needed to be white-noised before using them for estimation purposes. Failure to do this, according to them could result to spurious regression analysis that would not permit us to obtain a robust estimate of the parameters. After conducting the stationarity test on the times series, it is imperative to ascertain if they have long-run relationship. The use of cointegration technique allowed the study to capture the equilibrium relationship between non–stationary series within a stationary model. It permitted

the combination of the long-run and short-run information in the same model and overcame the problem of losing information which could have occurred when attempting to address non stationary series through differencing. Autoregressive Distributed Lagged (ARDL) was used for the estimation and this procedure was developed by Pesaran and Shin (1999) which was later expanded by Pesaran, Shin, and Smith (2001) and the procedure allows the researcher to use variables that are not integrated in the same order. Also, the error correction model (ECM) was used to establish the short-run and long-run causal relations between selected macroeconomic variables and oil refining industry output in Nigeria.

Model Specification: The paper assumed that oil refining industry (OILR) is a function of selected macroeconomic variables (interest rate, exchange rate, net export and government capital expenditure). Mathematically, this implies that:

OILR =(INTR, EXCR, NEXP, G CEXP)————————- (*Eqn 1*).

Justification of the Variables in the Model: Interest rate, Exchange rate, Net export and Government capital expenditure were included in the model to achieve the stated objectives. Also, they are the selected macroeconomic variables based on monetary policies, trade policies and fiscal policies.

Transforming Eqn 1 into econometrics form leads to:

$OILR = \alpha_0 + \alpha_1 INTR + \alpha_2 EXCR + \alpha_3 NEXP + \alpha_4 GCEXP + \mu_t$---------- *(Eqn 2)*

Where; OILR= Oil refining Industry, INTR= Interest rate, EXCR= Exchange Rate, NEXP =Net Export, GCEXP= Government Capital Expenditure. = α_1- α_4 = the coefficients of interest rates, exchange rate, net export and government capital expenditure. α_0 = intercept and μ_t = error term

Equation (2) is the baseline model for determining the impact of selected macroeconomic variables on oil refining industry output in Nigeria.

The ARDL model cointegrating vector is re-parameterized into ECM, which result gives short run dynamics and long run relationship of the variables of a single model.

Therefore, below are the specified Autoregressive Distributed Lagged (ARDL) and the Error Correction Model (ECM) according to the specific objectives of the paper which is as follows:

$$\Delta OILR = \beta_0 + \sum_{l=i}^{P} \beta_1 \Delta OILR_{t-i} + \sum_{l=i}^{Q} \beta_2 \Delta \mathrm{INTR}_{t-i} + \sum_{l=i}^{R} \beta_3 \Delta EXCR_{t-i} + \sum_{l=i}^{S} \beta_4 \Delta NEXP_{t-i} + \sum_{l=i}^{t} \beta_5 \Delta GCEXP_{t-i} + \varphi_1 OILR_{t-1} + \varphi_2 INTR_{t-1} + \varphi_3 EXCR_{t-1} + \varphi_4 \Delta NEXP_{t-1} + \varphi_5 \Delta GCEXP_{t-1} + \varepsilon_t - - - - - (\text{Eqn } 3)$$

Where Δ is the difference operator, while φ is the parameter for textile industry output.β_1 -β_5 represent the short run parameters, the terms with the summation signs represent the error correction dynamics, and φ_1 – φ_5 are the long run parameters. The cointegration test requires setting up the two hypotheses (null hypotheses against the alternative hypothesis as follows:

$H_0 = \varphi = \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5$ …… Null hypothesis

$H_1 \neq \varphi \neq \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5$……..... Alternative hypothesis

If the F-statistic is greater than the upper critical bound value, the null hypothesis is rejected confirming the existence of the long run relationship and vice versa. After establishing the long run relationship, the next step is to estimate the long run model stated as follows:

$\Delta OILR=\beta_0+\varphi_1 OILR_{t-i}+\varphi_2 \Delta INTR_{t-i}+\varphi_3 \Delta EXCR_{t-i}+\varphi_4 \Delta NEXP_{t-i}+\varphi_5 \Delta GCEXP_{t-i}+\mu$—-(Eqn 4)

After estimating the ARDL long run specification and the connected long run multipliers, the error correction model need to be estimated too. Thus, the error correction model mainly formulated to estimate the short run dynamics is stated as follows:

$$\Delta OILR = \beta_0 + \sum_{l=i}^{P} \beta_1 \Delta \text{OILR}_{t-i} + \sum_{l=i}^{Q} \beta_2 \Delta \text{lNTR}_{t-i} + \sum_{l=i}^{R} \beta_3 \Delta EXCR_{t-i} + \sum_{l=i}^{S} \beta_4 \Delta NEXP_{t-i} + \sum_{l=i}^{S} \beta_5 \Delta GCEXP_{t-i} + \varphi_1 ECM_{t-i} - - - -(5)$$

Where β_1 -β_5 represent the short run parameters and φ_1 is the speed of adjustment parameter which is expected to be less than zero. ECM is the lagged error correction term obtained from the estimated.

RESULT AND DISCUSSIONS

This section presents the empirical results of the paper.

Table 1: Summary of Descriptive Statistics of the Study Variables

Variable	Mean	Std. Dev.	Skewness	Kurtosis	JarqueBera	Probability	Obs
OILR	111.3100	122.0579	0.826697	2.565304	4.384009	0.111693	36
INTR	18.33250	3.927990	0.772914	4.323483	6.211785	0.044785	36
EXCR	124.1294	111.7269	0.967264	3.388038	5.839458	0.053948	36
NEXP	9.837500	19.09722	1.806522	7.891411	55.46998	0.000000	36
GCEXP	627.6461	635.9739	1.320059	4.374181	13.28789	0.001302	36

Source: Authors Computation, 2023 (from Eview-10)

Table 1 is the summary of the descriptive statistics which show. The mean which measures the average value of the series, and the standard deviation measures the dispersion or spread of the series. Table 1 revealed that the GCEXP has the highest mean value of 627.6461, while NEXP has the lowest mean value. The standard deviation indicates that GCEXP has the highest spread of 635.9739 while INTR has the lowest deviation of 3.927990. The Kurtosis shows that INTR, EXCR, NEXP and GCEXP are peaked relative to the normal distribution, while OILR is flat relative to the normal distribution. The probability values of the Jarque Bera indicate that OILR and EXCR are normally distributed while INTR, NEXP and GCEXP are not normally distributed because their probability values are less than 0.05%.

Unit Root Test Result

In order to estimate the trend of series and its direction so as to ensure that the data for the variables used in the model do not fluctuate unnecessarily, unit root test was conducted to ascertain the stationary status of the variables using Augmented Dicker-Fuller technique. The results of the unit root tests are presented in Table 2.

Table 2: Summary of ADF Unit Root Test Results

Variables	**ADF Test Statistics**	**Critical Values**	**Order of Integration**
OILR	-5.591871	-2.951125	I(1)

INTR	-4.696762	-2.967767	I(1)
EXCR	-3.004330	-2.951125	I(1)
NEXP	-9.527928	-2.951125	I(1)
GCEXP	3.755800	-2.981038	I(0)

Source: Authors Computation, 2023 (from Eview-10)

Several macroeconomics time series are trended and therefore in most cases non-stationary. This problem can easily lead to spurious or incorrect conclusion. For a series to be stationary, the absolute value of the Augmented Dicker Fuller test statistics must be greater than the critical value. Also, the probability values must be significant (less than 0.05). Table 2 is the unit root test for the paper. Table 2 revealed that OILR, INTR, EXCR and NEXP were found to be stationary at first difference [I (1)] while GCEXP is stationary at level [I (0)] consequently, the ARDL bounds approach was used due to the mixed in order of integration.

The ARDL Bounds Cointegration

The hypothesis for bound test for the existence of long run relationship is H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = 0$, and was tested against the alternative hypothesis H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq 0$. The result of the ARDL Bounds Cointegration Test is presented at Table 3.

Table 3: Summary of Bounds Test Results

F-Bounds Test	Null Hypothesis: No Levels Relationship			
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
F—statistic	6.414309	10%	2.45	3.52
K	4	5%	2.86	4.01
		1%	3.74	5.06

Source: Authors Computation, 2023 (from Eviews-10)

For cointegration to exist, the value of the F-statistics must be greater than the value of the upper and lower bounds at 5 percent critical level. The cointegration test result in Table 3 shows that, the F-statistic's value of 6.414309 is greater than the lower (I (0)) and upper bound (I (1)) critical values of 2.86 and 4.01 respectively at 5% significance level. Thus, the null hypothesis of no long-run equilibrium relationship is rejected and the alternative hypothesis of existence of long-run equilibrium relationship is accepted. It can therefore be said that the variables are co-integrated.

Table 4: ARDL Long-Run Results

Variables	**Coefficient**	**Std error**	**t-Statistics**	**Prob**
INTR	3.774817	3.604915	1.047131	0.3128
EXCR	0.371302	0.410717	0.904035	0.3813
NEXP	2.162270	1.507898	1.433963	0.1735
GCEXP	0.213014	0.097550	2.183632	0.0465

Source: Authors Computation, 2023 (from Eviews-10)

In Table 4, the coefficients of the variables showed that the INTR, EXCR, NEXP and GCEXP have positive

relationship with OILR. The probability values shows that in the long run, only GCEXP has a significant impact on OILR due to its value of 0.0465 less than 0.05 while the remaining variables have insignificant impacts of OILR because their probabilities values are greater than 0.05%.

ARDL – Error Correction Model (ECM)

The ARDL – ECM shows the long and short run relationship between the dependent variable and the independent variables, as well as the coefficient of the Error Correction Term (ECT), which must be negative, less than unity and statistically significance at 5 percent level. The results of the ARDL – ECM regression result is presented at Table 4.

$$\Delta OILRt = \alpha_0 + \sum_{i=1}^{p} \alpha_1 \Delta INTR_{t-i} + \sum_{i=1}^{q} \alpha_2 \Delta EXCR_{t-i} + \sum_{i=1}^{q} \alpha_3 \Delta NEXP_{t-i} + \sum_{i=1}^{q} \alpha_4 \Delta GCEXP_{t-i} + \lambda ECT_{t-1} + \varepsilon_t --1$$

λi = speed of adjustment parameter with a negative

sign. ECT_{t-1} = the error correction term,

μit = residuals or stochastic

Table 4: ARDL – ECM

Dependent Variable: D (OILR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-52.91811	14.17396	-3.733473	0.0022
D(OILR(-1))	0.227272	0.144377	1.574157	0.1378
D(OILR(-2))	0.147701	0.148739	0.993017	0.3376
D(OILR(-3))	0.427025	0.136033	3.139123	0.0072
D(EXCR)	-0.477569	0.292915	-1.630402	0.1253
D(EXCR(-1))	-0.270930	0.305520	-0.886784	0.3902
D(EXCR(-2))	0.489007	0.311431	1.570194	0.1387
D(EXCR(-3))	-1.828198	0.346076	-5.282653	0.0001
D(NEXP)	-0.148295	0.316849	-0.468031	0.6470
D(GCEXP)	-0.002122	0.023227	-0.091350	0.9285
D(GCEXP(-1))	-0.009256	0.027489	-0.336716	0.7413
D(GCEXP(-2))	-0.184968	0.033143	-5.580963	0.0001
D(GCEXP(-3))	-0.097996	0.039891	-2.456583	0.0277
CointEq(-1)*	-0.608653	0.094785	-6.421436	0.0000

R-square	0.808906
Adjusted R-square	0.681510
F-statistics	6.349531
Prob(F-statistics)	0.000792

Durbin-Watson stat 1.968735

Source: Authors Computation, 2023 (from Eviews-10)

Table 4 revealed the lagged value of the Error Correction Term (ECT) met the necessary conditions of being negative, less than unity and statistically significance. The ECT coefficient value of -0.608653 indicates that once there is disequilibrium in the system, it will take an average speed of 60.87 % to adjust from short run to long run equilibrium. The coefficient of determination (R-square) with value of 0.808906 indicates that INTR, EXCR, NEXP and GCEXP collectively accounted for about 80.89% variation or changes in OILR in Nigeria during the period under review, while the remaining 19.11% was captured by the error term. Furthermore, the value of the F-statistics (6.349531) with

its corresponding probability value of 0.000792 indicates that the parameters of the estimated model are jointly or simultaneously statistically significant at 5% level.

Test of Hypotheses

The Wald test is used to test the causality of the independent variables on the dependent variable. The Wald test for individual hypothesis is presented in table 5.

Table 5: Wald Test Results

Test Statistic	F-statistics Value	D.F	Probability
C(4)=C(4)=(6)=C(7)=0	7.617624	(4, 14)	0.1471
C(8)=0	7.982769	(1, 14)	0.2008
C(9)=C(10)=(11)=C(12)=0	5.508538	(4, 14)	0.0023

Source: Authors Computation, 2023 (from Eviews-10)

The decision rule is that if the probability value of the F-statistic is less than 0.05, it implies that the variable is statistically significant; hence we reject the null hypothesis that there is no significant impact and accept the alternative. Hypothesis 1 ($H0_1$) states that EXCR has no significant impact on OILR. From Table 5, the probability value of 0.1471 is less than 0.05, implying that EXCR has no significance impact on oil refining hence the null hypothesis is accepted while the alternative is rejected. Likewise, hypothesis two ($H0_2$), states that NEXP has no significant impact on OILR. Since the probability value of $H0_2$ which is 0.2008 is greater than 0.05 then $H0_2$ is accepted and the alternative hypothesis rejected that NEXP has significant influence on the OILR. Furthermore, Hypothesis three ($H0_3$), states that GCEXP has no significant impact on OILR. Its probability value of 0.0023 indicated that the null hypothesis is conveniently rejected while the alternate hypothesis is accepted that GCEXP has a significant impact on OILR.

DISCUSSION OF FINDINGS

The coefficient of interest rate in Table 4 which is 3.774817 shows that there is a positive relationship between interest rate and oil refining industry output. A percentage increase in interest rate will leads to increase in approximately N377 billion in value of oil refining. The corresponding probability value of 0.3128 indicates that interest rate has insignificant impact on oil refining in Nigeria at 5% significant level. Exchange rate has coefficient of 0.371302, indicating a positive relationship with oil refining. This implies that for every 1 percent increase in exchange rate, value of oil refining will also increase by N37.13 billion. Its corresponding probability value of 0.3813 indicates that exchange rate has insignificant impact on oil

refining at 5% significant level.

The coefficient of net export (2.162270) revealed a positive relationship between net export and oil refining. When net export increases by N1 billion, oil refining will also increase by approximately N216.22 billion. The probability value of 0.1735 revealed that net export has insignificant impact on oil refining during the period under review. Furthermore, the coefficient of government capital expenditure which is 0.213014 shows that there is a positive relationship between government capital expenditure and oil refining. When government capital expenditure increases by N1 billion, keeping other variables constant, oil refining will increase by N21.30 billion, while its probability value of 0.0465 indicates that government capital expenditure has a significant impact on oil refining.

Post Estimation Tests

Table 6: Summary of Serial Correlation Test, Heteroskedasticity Test and Normality Test

Type of Test	F-Statistics	Probability
Serial Correlation LM Test(Breusch-Godfrey)	0.1237	0.1237
Heteroskedasticity Test (Breusch-Godfrey-Pagan)	0.0135	0.0802
Jarque Bera	0.795890	0.671699

Source: Authors Computation, 2023 (from Eviews-10)

The null hypothesis for serial correlation states that there is no serial correlation in the model provided the probability value is greater than 5%. Table 6 indicates that the residuals of the model are not serially correlated because the probability value of the F-statistic is greater than 5%, even though the value of the observed R* square is less than 5%. The F-statistic of the heteroskedasticity shows that there is a presence of heteroskedasticity in the model due to its value been less than 5%. Therefore, the model is homoscedasticity. The probability value of the Jarque Bera indicates that the residuals are normally distributed.

The Cumulative Sum (CUSUM)

Figure 1: CUSUM Stability Test

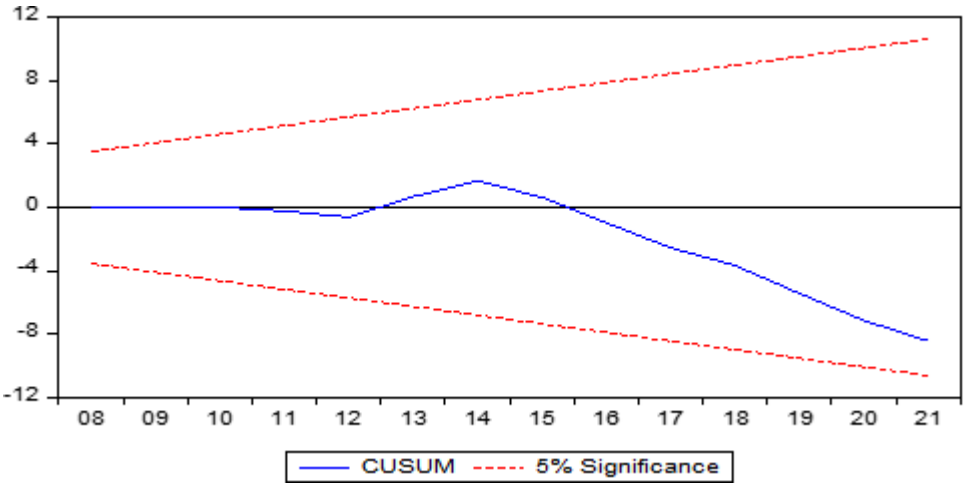

Figure 1, shows that the CUSUM series lie between the upper and the lower critical boundaries at 5%. This is an indication that the estimated model is stable. So, it can be concluded that the model is stable and the estimated results are reliable, and can therefore be used for further analysis and prediction as

well as for policy.

CONCLUSION AND POLICY RECOMMENDATIONS

The study examined the impact of selected macroeconomics variables on the oil refining industry in Nigeria from 1986 to 2021. OILR was used as the dependent variable while the INTR, EXCR, NEXP and GCEXP were used as the independent variables. The ARDL and ECM method of analysis was employed for the paper. The results of the paper showed that there is a long-run relationship among the variables and all the variables have a positive relationship with OILR. Result also indicated that INTR, EXCR and NEXP do not have significant impact on oil refining industry output, while GCEXP has a significant impact on oil refining industry output. Hence, this paper concludes that the selected macroeconomics variables INTR, EXCR and NEXP do not have significant impact on the oil refining industry during the period under review while GCEXP has significant impact on oil refining industry for the period under review.

Based on the objectives of the paper, the following recommendations were made:

1. The central Bank of Nigeria should strive to maintain a favourable interest rate environment, ensuring access to affordable financing for refineries. Lower interest rate can stimulate investment in the oil refining industry.
2. The central Bank of Nigeria should adopt measures to stabilize the exchange rate, promote export diversification to mitigate the potential negative impacts of exchange rates. Changes in the exchange rate can lead to an appreciation or depreciation of a currency as compared to other currencies, which can affect the output of oil refining industry in Nigeria.
3. The government should focus on improving the competitiveness and quality of Nigerian refined products to facilitate exports and pursue strategic partnerships to enhance market access for exports.
4. The Government should prioritize strategic investments in infrastructure development and allocate sufficient capital expenditure to support the growth of oil refining industry in Nigeria.

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