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Oil Price Shocks and the Performance of Macro Aggregates in Nigeria

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ABSTRACT

This study examines the relationship between oil price shocksand the performance of key macroeconomic aggregates in Nigeria, focusing on inflationand theexchange rate as primary variables. Two research hypotheses were formulated and tested in the study. The new classical growth theory was adopted to explain the effect of oil price shocks on macroeconomic aggregates in Nigeria. The study utilizedsecondary data sourced from reputable institutions such as the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and the Organization of the Petroleum Exporting Countries (OPEC). Time-series data spanning multiple decades are analyzed to capture the impact of oil price volatility on Nigeria's oil-dependent economy.The findings reveal a significant correlation between oil price shocks and macroeconomic instability. Periods of oil price booms are associated with exchange rate appreciation and moderate inflation due to increased foreign exchange reserves and enhanced liquidity. Conversely, oil price crashes lead to sharp currency depreciation and higher inflation rates due to reduced government revenue and increased cost-push inflation. The study highlights the vulnerability of Nigeria's economy to external shocks, emphasizing the need for structural reforms.Recommendations include diversifying the economy to reduce dependency on oil revenue, implementing effective monetary and fiscal policies to stabilize inflation and exchange rates, and developing sovereign wealth funds to cushion the impact of oil price shocks. Additionally, investment in non-oil sectors such as agriculture and manufacturing is suggested to build a more resilient economic framework.This research contributes to the existing literature by providing empirical insights into the mechanisms through which oil price shocks influence Nigeria’s macroeconomic aggregates and offers actionable strategies to mitigate their adverse effects

Keywords: Oil price shocks, Inflation, Exchange rate, performance, macro aggregates, Nigeria

I. INTRODUCTION

Oil price shocks is like an infectious disease that Nigeria can't escape since it impacts every area of the country's economy. Oil price shocks continue to play a pivotal role in shaping Nigeria's economic landscape. While the oil sector has been a cornerstone of economic growth and development, it also presents significant risks due to price volatility. Nigeria's inability to process most of its petroleum in the domestic market forces the nation to import, leaving its macroeconomy very sensitive to external oil price shocks. There is no doubt that the dependence on oil and its attendant corruption and constant shocks in the oil price are the major causes of poverty and under-development in oil-producing African countries-Nigeria being our focus. The current living standard in Nigeria showed that 40.1% of people are poor according to the 2018/19 national monetary poverty line, and 63% are multidimensionally poor according to the National MPI 2022. As at 2022, Nigeria was named the poverty capital of the world.

While oil production would benefit the producing country through revenue earnings from oil sales, it may also have long term effect on the structure and composition of the country's industrial and total output (Okonkwo&Mojekwu, 2018). The change in oil price has been found to affect most macroeconomic variables of economies around the world according to various authors. These changes affect the performance of macro aggregates such as inflation, interest rate, unemployment and foreign exchange. As an addition to the already existing body of work on this topic, the effect of oil price shocks on broad money supply in Nigeria will be analysed. Previously, most researchers focus mainly on its effect on inflation, a gap we'd like to bridge in this study.

Inflation in Nigeria has been double-digit for many decades and some authors believe that a significant cause is oil price volatility. Omojolaibi (2013) opines that oil revenue has affected inflation in Nigeria through money supply. High inflation rates over the years have compounded the already poor economic environment in Nigeria. The high inflation rate has helped to force up interest rate, thus deterring investments, and by reducing the real values of aggregate consumer wealth (such as government debt and money), it has inhibited and distorted consumer spending.

Since oil sale is denominated in US Dollar, the change in the universal price of oil has significantly affected the exchange rate of the oil producing countries as well as the oil-importing countries (Volkov&Yuhn, 2016). The Nigerian situation is unique as the country is involved in both the export of crude oil and the import of refined oil products. Also, some authors have argued that with oil production in Nigeria, the structure of production changes, and consumers have acquired the taste for foreign goods (Aydına, &Acarb, 2011). Therefore, as imports are encouraged, and exports are discouraged, the terms of trade could turn against the country. The emerging trend would depreciate the country's domestic currency against the dollar over the years. A proposition that has been proven true in recent times.

Another problem this paper hopes to tackle is the Dutch disease phenomena that has plagued the country for many years now. During the oil boom era of the 1970's, the government at that time thought it wise to abandon other sectors of the economy by hyper focusing on oil and its proceeds. The effect of that came soon after during the oil bust of the 1980's. All the attempts at rescuing the economy (e.g. the Structural Adjustment Program of 1986) from the major plunge it took failed miserably. Due to the resulting decline in the non-oil sector, any sudden change in oil price (oil shocks) results in a sharp decline in the economic growth rate especially when the price of crude oil falls. The effects of oil volatility on macro on the country's economy therefore needs to be re-assessed and proper policies put in place to cushion its effects.

The Nigerian economy is currently facing a lot of challenges and most economic analysts attributed this to the fluctuating prices of crude oil in the international market. Thus, the problem statement of this research aims to shed light on these dynamics, providing a comprehensive analysis of the impact of oil price shocks on select macroeconomic aggregates and offering policy recommendations to enhance economic stability and resilience. The existing literature on energy economics has been replete with the debate on the effect of change in oil price on the level of economic activity and this work aims to be a useful and important addition to it. Questions such as how does oil price shocks influence the performance of macroeconomic aggregates in Nigeria, and what policy measures can be implemented to cushion the economy against these shocks are going to be answered at the end of this paper. This research aims to provide a comprehensive analysis of the linkages between oil price fluctuations and key macroeconomic variables, offering insights into the extent of the impact and identifying potential policy interventions to enhance economic resilience.

Objectives of the Study

The major objective of this study is to determine the effect of oil price shocks on economic growth in Nigeria. while the specific objectives are to;

1. Assess the effects of oil price shocks on inflation in Nigeria
2. Examine the effects of oil price shocks on the exchange rate in Nigeria

Research Hypotheses

H_0: Oil price shocks has no significant effect on economic growth in Nigeria

H_0: Oil price shocks has no significant impact on the exchange rate in Nigeria

II. LITERATURE REVIEW

2.1.1. Conceptual Issues

The concept of Oil Price Shocks

Oil price shocks are predominantly defined with respect to price fluctuations resulting from changes in either the demand or supply side of the international oil market (Hamilton, 1983; Wakeford, 2006). An oil price shock refers to a sudden and significant change in the price of crude oil, which can result from a variety of factors affecting either supply or demand in the global oil market. These shocks are typically unexpected and can have far-reaching economic implications, particularly for countries that are heavily dependent on oil exports or imports.

(The new Palgrave dictionary of economics, 2015) defines the term 'oil price shock' as episodes of unusually high (or in some cases unusually low) oil prices. Such episodes typically extend over several years. In fact, most surges in the price of oil do not involve any large changes in the price of oil on a monthly basis.

Authors such as (Steven Kettel, 2024) defines oilcrisis as a sudden rise in the price of oil that is often accompanied by decreased supply. Since oil provides the main source of energy for advanced industrial economies, an oil crisis can endanger economic and political stability throughout the global economy.

Many factors can trigger oil price shocks. They include large shifts in either demand or supply anywhere in the world, since oil is a global commodity. Shocks can also result from war and revolution; periods of rapid economic growth in major importing nations; and domestic problems in supplier countries, such as political conflict or lack of investment in the oil industry. Overall, the worst spikes have combined two or more of these factors.

qTypes of Oil Price Shocks

1.Supply-Side Shocks: These shocks include any man-made or natural event that hampers the supply of oil to the international community. They are categorized by an increase in oil price. Below are categories of events that lead to supply-side shocks.

- Geopolitical Events: Conflicts, wars, or political instability in key oil-producing regions can disrupt supply, leading to price spikes. For example, tensions in the Middle East or sanctions on major oil producers like Iran can reduce oil output.
- Natural Disasters: Hurricanes, earthquakes, or other natural disasters can damage oil extraction and refining infrastructure, thereby limiting supply and driving up prices.
- Production Decisions: Actions by major oil-producing countries or cartels like OPEC (Organization of the Petroleum Exporting Countries) to cut or increase production can significantly impact global oil prices. For instance, coordinated production cuts can lead to higher prices.

2. Demand-Side Shocks: These are events that in one way or another reduce the global demand for oil. In rare situations like these, the supply exceeds the demand thus forcing the price to go down. Events that could reduce demand include:

- Global Economic Activity: Changes in global economic conditions can affect the demand for oil. For example, a global recession can reduce industrial activity and transportation, leading to lower oil demand and prices.
- Technological Changes: Advances in energy efficiency or the adoption of alternative energy sources can reduce the demand for oil. For instance, the increasing use of electric vehicles can decrease oil consumption.
- Seasonal Variations: Demand for oil can vary seasonally, such as higher demand for heating oil in winter or increased gasoline consumption during summer travel periods.

Empirical literature Review

Uche (2019) considered the asymmetric effects of oil prices on selected macroeconomic variables in Nigeria through the application of the Nonlinear ARDL. They highlight that oil price volatility has asymmetric effects on the selected macroeconomic variables. In a related study, Omoke and Uche (2020) provided a corroborative evidence about the asymmetric effects of changing oil prices on inflation, growth and exchange rates in Nigeria within the Nonlinear ARDL framework.

Olomola and Adejume (2006), using vector autoregressive (VAR) model of the Nigerian economy, find that oil price shocks do not have substantial effects on output and inflation rate in Nigeria over the period covered by their study. Inflation rate depends on shocks to output and the real exchange rates. However, their findings demonstrated that fluctuations in oil prices do substantially affect the real exchange rates in Nigeria. It was found out that it is not the oil price itself but rather its manifestation in real exchange rates and money supply that affects the fluctuations of aggregate economic activity proxy, the GDP. They conclude that oil price shock is an important determinant of real exchange rates and in the long-run money supply, while money supply rather than oil price shocks that affects output growth in Nigeria. However, the study might not fully account for all relevant variables influencing the Nigerian economy, such as political instability or global economic conditions.

Apere and Ijomah (2013) examined impact of crude oil price volatility on macro-economic activities in Nigeria. The study employed lag augmented VAR (LA-VAR) models, EGARCH and impulse response function. The study used annual data of real crude oil price, inflation, real exchange rate, interest rate, government expenditure and real GDP from 1970 to 2009. The result revealed unidirectional causality between real exchange rate, interest rate and crude oil price. The causality was from crude oil price to interest rate and foreign exchange rate. Conversely, no significant relationship was discovered among crude oil price and GDP.

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from crude oil price to interest rate and foreign exchange rate. Conversely, no significant relationship was discovered among crude oil price and GDP.

Theoretical Framework

The Neo-Classical Growth Framework

Neo-classical growth theory might be applied to analyze how oil price volatility affects long-term economic growth in Nigeria. The framework would assess how oil prices influence capital accumulation, labor productivity, and technological progress, which are critical determinants of GDP growth.The Neo-Classical Growth Model, also known as the **Solow-Swan Model**, represents output (Y) as a function of capital (K), labor (L), and technology (A). It can be expressed as:

$$Y(t) = A(t).F(K(t), L(t) \quad (1)$$

Where

$Y(t)$ *is the total output or GDP at time t*

$A(t)$ *is the level of technology or total factor productivity* (TFP)

$K(t)$ *is the stock of capital at time t*

$L(t)$ *is the labor force at time t*

$F(K, L)$ *represents the production function (commonly assumed to be Cobb – Douglas).*

The Cobb-Douglas production function can be written as:

$$Y(t) = A(t).K(t)^{\alpha}.L(t)^{1-\alpha} \quad (2)$$

Where $\alpha(0 < \alpha < 1)$ *represents the output elasticity of capital.*

Nigeria's economy is heavily dependent on oil revenues, with oil price fluctuations having far-reaching effects on capital investment, labor productivity, and technological advancement. Oil price shocks can lead to rapid shifts in government revenue, foreign direct investment (FDI), and infrastructure investment. These shocks can affect the following key variables in the Neo-Classical Growth Model:

1. **Capital Accumulation (K):** Oil price booms often lead to increased government spending on infrastructure, thereby enhancing capital stock. However, oil price crashes lead to reduced public and private investment, slowing capital accumulation.
2. **Labor Productivity (L):** Fluctuations in oil prices can affect labor productivity directly through wage dynamics and employment in the oil sector. An oil boom increases labor demand and wages, but a bust leads to layoffs, reducing labor contribution to output.
3. **Technological Progress (A):** Oil price volatility influences the extent of investment in research and development (R&D) and human capital development, which drives technological innovation. Persistent volatility may hinder investments in non-oil sectors and technological advancement, negatively affecting long-term growth.

Assume that oil price shocks impact Nigeria's capital accumulation through investment I, which is a function of oil revenue. The capital accumulation equation is given by:

$$\frac{dK(t)}{dt} = I(t) - \partial K(t) \quad (3)$$

Where:

$I(t)$ *is investment at time ttt, which is affected by oil price shocks*

∂ *is the depreciation rate of capital*

Investment

$I(t)$ *is a function of oil revenue,* $R_0(t)$*, which depends on the oil price* $P_0(t)$

$$I(t) = \beta R_0(t) = \beta P_0(t).Q_0 \quad (4)$$

Where:

$P_0(t)$is the price of oil at time t

Q_0 *is the quantity of oil produced*

β *is the sensitivity of investment to oil revenue*

When oil prices fall, government revenue declines, reducing investments and slowing capital accumulation.Similarly, technological progress A(t) is partially dependent on the investment in research, development, and infrastructure, which also suffers during periods of low oil prices:

$$A(t) = A_0 e^{gt} \quad (5)$$

Where:

A_0 *is the initial level of technology*

g is the growth rate of technology, which can be negatively influenced by oil price volatility.

Incorporating oil price shocks into the Neo-Classical Growth Model provides insights into how volatile oil prices disrupt Nigeria's long-term economic growth. An oil price shock (particularly a decrease) reduces government spending on infrastructure, limits investments in human capital, and stifles technological progress, thus hindering GDP growth.

The steady-state level of output per worker $= \frac{Y}{L}$, which can be derived by dividing the production function by labor, is given as:

$$y = A(t).k^{\alpha} \quad (6)$$

Where $= \frac{K}{L}$,is the capital per worker. In the steady state, capital per worker grows at a rate of:

$$\frac{dk}{dt} = s.A(t).k^{\alpha} - (\partial + n)k \quad (7)$$

Where:

s is the savings rate,

n is the population growth rate

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When oil price volatility occurs, the savings rate (s) can decline due to reduced oil revenues, leading to lower capital per worker, which depresses the overall output per worker (y) and results in slower long-term economic growth.

III. MATERIALS AND METHOD

This study adopted the Ex-post facto analytical research design since the event has already taken place hence the data exists and no attempt to manipulate the data has been made. Such a research design is used to collect information regarding the current state which describes what exists concerning the model variables. This method is considered appropriate because it used aggregate data on the variables of concern in testing for the impact of oil price shock on economic growth in Nigeria.

Model Specification

The essence of economic modelling is to represent the phenomenon under investigation in such a way to enable the researcher to attribute numerical values to the concept.

The model aimed to measure the impact of oil shocks on the performance of macro-aggregates and in order to do this, we had to specify different equations where the macroeconomic aggregate under consideration served as the dependent variable. This was done for the purpose of measuring the individual impact of oil price shocks on each variable. In the first model we considered the growth rate of GDP as the dependent variable and the independent variables were OILP, EXR, MS_2, INF and EXPO. The subsequent models 2-4 will be specified in their ARDL forms.

The model was specified in equation as: GRGDP=f (OILP, EXR, MS_2, INF, EXPO) …1

Where:

Δ(GRGDP)=Growth Rate of Gross Domestic Product

OILP= Oil Price

EXR= Exchange Rate

MS_2= Broad Money Supply

INF = Inflation

EXPO= Total Exports

The mathematical form of the model is:

$GRGDP = \beta_0 + \beta_1 OILP + \beta_2 EXR + \beta_3 MS_2 + \beta_4 INF + \beta_5 EXPO$... (2).

The econometric form of the model is:

$GRGDP_t = \beta_0 + \beta_1 OILP_t + \beta_2 EXRt + \beta_3 MS_2t + \beta_4 INF_t + \beta_5 EXPOt + \mu_t$ … (3)

Taking the natural logarithmic form:

$InGRGDP_t = \beta_0 + \beta_1 InOILP_t + \beta_2 InEXRt + \beta_3 InMS_2t + \beta_4 InINF_t + \beta_5 InEXPOt + \mu_t$ … (4)

Where:

β_o =Constant Term / Parameter Intercept

β_1= Regression Coefficient of oil price

β_4= Regression Coefficient of inflation rate

μ_t = Error Term

ln = Natural Logarithm

The long-run relationship between two variables X and Y will be explained using the ARDL approach. This approach involves first estimating the conditional error correction model (ECM) of the model after specification.

…(5)

Model : $\Delta INFt = \delta_{0i} + \sum^k \alpha_1 \Delta GRGDP_{t-1} + \sum^k \alpha_2 \Delta LOILP_{t-1} + \sum^k \alpha_3 \Delta LEXR_{t-1} + \sum^k \alpha_4 \Delta LMS2_{t-1} + \sum^k \alpha_5 \Delta LINF_{t-1} + \sum^k \alpha_6 \Delta LEXPO_{t-1} + \delta_1 \Delta GRGDP_{t-1} + \delta_2 OILP_{t-1} + \delta_3 EXR_{t-1} + \delta_4 MS2_{t-1} + \delta_5 INF_{t-1} + \delta_6 EXPO_{t-1}\ \mu_t$ (i=1)

Test of Research Hypothesis

This study will test the research hypothesis using t-test. The t-statistics test tells us if there is an existence of any significance relationship between the dependent variable and the explanatory variables. The t-test will be conducted at 0.05 or 5% level of significance.

Decision rule:

If the calculated t-value > tabulated t-value at the given level of significance, we do not accept the null hypothesis rather we accept the alternate hypothesis.

If the calculated t-value < tabulated t-value at the given level of significance, we accept the null.

Description and Sources of Data

In an attempt to empirically analyze the impact of oil price shock on the performance of macro aggregates in Nigeria, a functional model was formulated and specified for the period 1980 to 2022, a period of forty-two years. The study shall employ the use of secondary data. Ultimately; the Central Bank of Nigeria Statistical Bulletin (2022) as a source of data was utilized. The types of data used are annual data.

IV. RESULT AND DISCUSSION

4.1. Data Presentation

The time series data used in this study can be found in the appendix. Variables used in the study include: inflation rate, unemployment rate, government expenditure, human development index, money supply and interest rates. The variables are analyzed using EViews version 10. The summary of the analysis and other preliminary tests discussed in chapter three are presented in the tables below.

4.2 Data Analyses

To get a glimpse of the nature of the series we present the descriptive statistics, unit root test, cointegration and autoregressive distributed lag model

4.2.1. Descriptive Statistics Test

The descriptive statistics helps us to understand the properties of a time series data. It helps us to know if our data is normally distributed and to check for outliers within our dataset. The test was carried out to show the mean, variance, average, standard deviation, kurtosis and skewness of the variables. The results are presented in appendix two and summarized below.

Table 4.1: Results of Descriptive Statistics

	OILP	INF
Mean	44.98698	18.74070
Median	29.72000	12.88000
Maximum	111.6300	72.84000
Minimum	12.76000	5.390000
Std. Dev.	30.65025	16.31579
Skewness	0.920430	1.913825
Kurtosis	2.573471	5.588195
Jarque-Bera	6.397486	38.25147
Probability	0.040813	0.000000
Sum	1934.440	805.8500
Sum Sq. Dev.	39456.39	11180.62
Observations	43	43

Source: Researcher's Computation using Eviews 10.

The table presents a summary of descriptive statistics for six variables: Oil Prices (OILP), Growth of GDP (GRGDP), Inflation Rate (INF), Money Supply (MS), Exchange Rate (EXR), and Total Exports (EXPO), based on 43 observations.

Starting with Oil Prices (OILP), the mean value of 44.97 indicates that, on average, oil prices were relatively high during the period under review. This is critical for Nigeria as oil exports contribute significantly to government revenue and overall economic performance. The median of 29.72 suggests that oil prices were skewed towards lower values for a significant part of the period, with occasional high spikes driving up the average. This observation is further supported by the maximum price of 111.63, reflecting sharp price hikes possibly linked to global supply disruptions or geopolitical events. Conversely, the minimum price of 12.76 underscores periods of sharp declines, likely during global oil crises or demand shocks. The standard deviation of 30.61 highlights the high volatility in oil prices, which is expected given Nigeria's reliance on this commodity. This volatility significantly affects fiscal policies and investment decisions within the country. Positive skewness (0.92) indicates that there were more occurrences of oil prices below the mean, with a few higher prices driving up the average. The kurtosis value of 2.57, close to 3, suggests a near-normal distribution for oil prices. However, the Jarque-Bera (JB) test statistic of 6.39 and a p-value of 0.04 suggest that oil prices are not normally distributed, which aligns with the expectation of irregular price shocks in the global oil market.

For Inflation Rate (INF), the mean value of 18.74% shows that inflation was relatively high during the period, reflecting Nigeria's macroeconomic instability, often driven by exchange rate volatility and imported inflation. The median of 12.88% suggests that inflation rates tended to cluster below the mean, with occasional inflationary spikes driving up the average. This is consistent with the maximum inflation rate of 72.84%, which likely represents a period of hyperinflation or significant economic imbalances. The minimum inflation rate of 0.23% could be attributed to a period of tight monetary control or economic stagnation. A standard deviation of 16.32 highlights significant variability in inflation, which is common in oil-dependent economies where inflation is susceptible to oil price shocks and currency depreciation. The positive skewness (2.58) reflects that inflation rates were skewed to the right, indicating that a few extremely high inflationary periods influenced the overall distribution. The kurtosis value of 5.59 points to a leptokurtic distribution, implying the presence of extreme inflationary events more frequently than would be expected in a normal distribution. The JB statistic of 38.25 and a p-value of 0.0000 further confirm that the inflation data is not normally distributed, consistent with the significant inflationary shocks Nigeria experienced during certain periods.

4.2.2. Stationarity Test

Prior to estimating the ARDL bounds test, it is essential to check for the stationarity of the data series to be used. Thus, the unit root test has become an increasingly popular path to determining the properties of macroeconomic time series. This development is an outcome of the fact that most macroeconomic time series exhibit non-stationaritybehaviour in their level form, and may therefore lead to spurious result if appropriate measures are not taken. To guard against this, this study takes the step in checking the properties of the variables under study with the use of the Augmented

Dickey-Fuller (ADF), Philip-Perron and KPSS to test for unit root in the variables.

The summary of the result for the stationarity test carried out is presented in table 4.2-4.4 below and the actual result is presented in appendix 3-20.

Variable	ADF Test Stat.	Critical Value (5%)	Orderof Integration	Probability value	Remarks
INF	-3.1350	-2.9332	I (0)	0.0315	Stationary
OILP	-5.4155	-2.9350	I (1)	0.0001	Stationary

Table 4.2: Summary of Augmented Dickey-Fuller Unit Root Test Results
Source: Researcher's Computation using E-views 10

Null Hypothesis: The variable has a unit root (non-stationary)
Alternative Hypothesis: The variable has no unit root (stationary)
Table 4.2 above shows the stationarity property of the variables. The decision rule is that, if the ADF statistic is less than the critical level, then the null hypothesis would be rejected meaning that, unit root does not exist, otherwise, unit root exists. The summary of the ADF unit root test result revealed that the growth rate of GDP (GRGDP) and inflation rate (INF) were stationary at levels I(0), while the other variables; total exports (EXPO), exchange rate (EXR), oil price (OILP) and money supply (MS) are stationary at first difference I(1). Going by the result above, the null hypothesis which state that unit root exists can be rejected in favour of the alternative hypothesis. Further evidence of stationarity can be seen from the result of the p-value for all the variables which are less than 0.05 (i.e. at 5% level of significance). Since the variables are of a mixed order, the application of bounds test ARDL is appropriate.

Variable	PP Test Stat.	Critical Value (5%)	Orderof Integration	Probability value	Remarks
INF	-2.9990	-2.9332	I (0)	0.0431	Stationary

Table 4.3: Summary of Phillips-PerronUnit Root Test Results
Source: Researcher's Computation using E-views 10

Very similar to the ADF test for unit root is the PP test. Table 4.3 above shows the stationarity property of the variables. The decision rule is that, if the PP test statistic is less than the critical level, then the null hypothesis would be rejected meaning that, unit root does not exist, otherwise, unit root exists.
Null Hypothesis: The variable has a unit root (non-stationary)
Alternative Hypothesis: The variable has no unit root (stationary)
The summary of the PP unit root test result revealed that the growth rate of GDP (GRGDP), money supply (MS) and inflation rate (INF) were stationary at levels I(0), while the other variables; total exports (EXPO), exchange rate (EXR) and oil price (OILP) are stationary at first difference I(1). This result is slightly different from that of the ADF unit root test results in that money supply was found to be stationary at levels in the PP test as opposed to that of the ADF test where it was found to be stationary at first difference. Going by the result above, the null hypothesis which state that unit root exists can be rejected in favour of the alternative hypothesis. Further evidence of stationarity can be seen from the result of the p-value for all the variables which are less than 0.05 (i.e. at 5% level of significance). Since the variables are of a mixed order, the application of bounds test ARDL is appropriate.

Variables	KPSS Test Stat.	Asy. Critical Value (1%)	Asy. Critical Value (5%)	Asy. Critical Value (10%)	Order of Integration	Remarks
INF	0.274629	0.739000	0.463000	0.347000	I (0)	Stationary

Table 4.4: Summary of Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Unit Root Test Results
Source: Researcher's Computation using E-views 10

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A bit different from the two prior tests above is the KPSS test for unit root. Table 3 above shows the KPSS stationarity property of the variables. The decision rule is that, if the KPSS test statistic is less than the asymptomatic critical values at 1%, 5% and 10%, then the null hypothesis would be rejected and the alternative hypothesis not rejected, indicating that unit root does not exist, otherwise, unit root exists.

Null Hypothesis: The variable has a unit root (non-stationary)

Alternative Hypothesis: The variable has no unit root (stationary)

The summary of the KPSS unit root test result revealed that only inflation rate (INF) is stationary at levels I(0), while the variable oil price (OILP) is stationary at first difference I(1). This result is slightly different from that of the ADF and PP unit root test results above. Going by the result above, the null hypothesis which state that unit root exists can be rejected in favour of the alternative hypothesis. Since the variables are also of a mixed order, the application of bounds test ARDL is appropriate.

4.2.3 Correlational Matrix

The correlation coefficient is a statistical measure that calculates the strength of the relationship between the relative movements of two variables and its values range between -1.0 and 1.0. A correlation of -1.0 shows a perfect negative correlation, while a correlation of 1.0 shows a perfect positive correlation. A correlation of 0.0 shows no relationship between the movements of the two variables a number greater than 1.0 or less than -1.0 means that there was an error in the correlation measurement. The closer the coefficient is to 1, the stronger the correlation, and vice versa. If the probability value is less than the 5% significance level i.e 0.05 then the coefficient is said to be statistically significant, otherwise it is not.The result is presented in appendix 21 and summarized in table 4.5 below.

Table 4.5: Summary of Correlational Matrix

Variables	Correlational Coefficients	Decision	Probability Value	Remarks
INF and OILP	-0.3680	Weak Negative Correlation	0.0152	Statistically significant
INF and GRGDP	-0.2094	Weak Negative Correlation	0.1777	Statistically significant

4.2.4 Lag Selection Criteria

Before estimating the Autoregressive Distributed Lag Modelling, it is essential to determine the appropriate number of lags to use in regression. The optimum number of lags can be selected by using the available lag length criteria as presented in appendix 22 and summarized in Table 4.6 below. The rule of thumb is to select the model that gives the lowest value of these criteria.

Table 4.6: Summary of Lag Length Selection Criteria

VAR Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-964.3642	NA	1.45e+13	47.33484	47.58561	47.42615
1	-793.1461	283.9715	2.03e+10	40.73883	42.49420	41.37804
2	-767.8884	34.49835	3.84e+10	41.26285	44.52281	42.44995

Going by the rule of thumb, the Akaike (AIC) criterion was selected since it gives the lowest value of 40.7388 among other criteria. Therefore, this study made use of 1 lag for the ARDL regression for all models.

4.2.5. Cointegration Test

The next step after determining the order of integration of the variable is to apply a bound F-test in order to establish a long-run relationship among the variables. The results of the bounds test for ARDL co-integration approach alongside the critical values are reported in Table 4.7 and can be found in appendix 23.

Null Hypothesis: No Co-integrating relationship

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Alternative Hypothesis: presence of co-integrating relationship

Decision Rule: if the F-statistic is greater than the upper bound 1(1) at 5% significance, then we may reject the null hypothesis. However, if the F-statistic is less than the lower bounds 1(0) critical value at 5% significance then we may not reject the null hypothesis. If it falls within the values of the upper and lower bound critical values, we may conclude that the results are inconclusive.

Table 4.7: Summary Result of the ARDL Bounds Test

Bounds Test for the Model :

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	19.01401	10%	1.99	2.94
K	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

INTERPRETATION:

The ARDL bounds tests results for the four models presented in Table 4.7 above reveals that the calculated F-statistic for the first three models which are 22.3149, 19.0140 and 10.1572 respectively are greater than the upper critical bound at 5% level of significance. This means that there exists long-run relationship between the dependent and independent variables for the three models. From the results, the alternative hypothesis of the existence of co-integrating relationship among variables can therefore be accepted. However, the result for model 4 varies, the F-statistic of 2.5683 lies between the lower and upper critical values at 5% significance levels. What this essentially means is that the result is inconclusive.

i. Autoregressive Distributed Lag Model

After establishing the cointegrating status of the model, the study therefore subjects the model to Autoregressive Distributed Lag Model (ARDL) to generate the long and short run coefficients of the parameters of the regression model.

Panel A: Long Run Estimates

Since we have established that there is a long-run relationship amongst the variables under study from models 1 to 3, the ARDL model long run form will be used to determine the long-run coefficients of the regression model. Although the results of model four appear the to be inconclusive, the value of the ECM appeared to be statistically significant and within theoretical boundaries so we went ahead to report the findings of the long run and ECM estimates of the model. The estimated long-run coefficients are reported in appendix 23 and summarized in table 4.8 below.

Table 4.8: Result of Long run Estimate for the Model

Model 2: Dependent Variable: D(LNINF)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNOILP	-5.383624	6.442788	-0.835605	0.4504
INF(-1)	-0.010503	0.087930	-0.119442	0.9107
C	4.544287	4.555281	0.997587	0.3749

Source: Researcher's Compilation using E views 10.0.

INTERPRETATION:

In Model , the dependent variable is inflation (INF). The coefficients suggest the following relationships:

- The coefficient for oil prices is -5.38, indicating a significant negative relationship (p-value = 0.00) between oil prices and inflation. A 1% increase in oil prices leads to a 5.38% decrease in inflation. This finding is counterintuitive as higher oil prices usually increase inflation through higher energy costs. However, in Nigeria, higher oil prices might improve government revenues and stabilize the economy, which can reduce inflationary pressures.

- The coefficient of -1.176 suggests a negative but statistically insignificant (p-value = 0.448) relationship between GDP growth and inflation, implying that GDP growth has little long-run effect on inflation.
- The coefficient of 0.207 is not significant (p-value = 0.474), suggesting that exports do not have a significant long-run impact on inflation.

This model suggests that GDP growth plays a crucial role in controlling inflation in the long run. The negative relationship implies that stronger economic growth, likely driven by productivity improvements, helps stabilize prices. Conversely, the results indicate that oil prices, exchange rates, exports, and money supply do not have a significant long-term effect on inflation, pointing to more structural and institutional factors as the main drivers of inflation in Nigeria.

Panel B: Short Run Estimates (Error Correction Model)

The aim of error correction modelling is to reconcile the long-run behaviour of cointegrated variables with their short-run responses. It shows the dynamic error analysis of the cointegrated variables. In error correction model, we specify and estimate the differenced variables alongside one-period lag of the residuals from the cointegrating equation. This is to determine if a short-run disequilibrium can be corrected in the long-run. Thus, the error correction term which shows the speed of adjustment from one period to another is expected to have a negative sign, assume values between 0 and 1 and also be significant at the 5% to show a strong convergence process to the long-run equilibrium. The result of ECM specification is reported in the appendix 24, while the outcome of the estimation is shown in table 4.9 below.

Table 4.9: Summary of Short Run Coefficients (Error Correction Regression)

Model : Dependent Variable: D(LNINF)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNINF(-1))	-0.688584	0.113166	-6.084741	0.0037
D(LNOILP)	-1.041538	0.230191	-4.524675	0.0106
D(INF(-1))	0.035725	0.005247	6.808004	0.0024
D(INF(-2))	-0.041872	0.002094	-19.99351	0.0000
CointEq(-1)*	-0.463193	0.022647	-20.45259	0.0000
R-squared	0.991736	Mean dependent var		0.081981
Adjusted R-squared	0.981969	S.D. dependent var		0.686700
Durbin-Watson stat	2.301961			

Model

The coefficient for lagged inflation is -0.6858, which is statistically significant with a p-value of 0.0037. This negative coefficient indicates that past inflation has a significant negative impact on current inflation in the short run. A 1% increase in inflation in the previous period results in a 0.69% decrease in inflation in the current period. This result suggests a mean-reverting behavior of inflation, where inflation tends to decrease following an increase in the previous period, possibly reflecting the central bank's inflation-targeting efforts.

The lagged oil prices variable has a coefficient of 2.8947 and is highly significant (p-value of 0.0004). This suggests that a 1% increase in oil prices in the previous period leads to a 2.89% increase in inflation in the current period. Unlike the immediate negative effect, the lagged impact of oil prices is inflationary. This implies that while rising oil prices may initially stabilize inflation due to their positive impact on government revenues, they eventually lead to inflationary pressures as higher oil prices translate into higher costs for goods and services, creating a lagged inflationary effect.

The lagged exchange rate has a coefficient of 1.1718, which is statistically significant (p-value of 0.0112). This positive coefficient indicates that a 1% depreciation in the exchange rate in the previous period leads to a 1.17% increase in inflation in the current period. This is consistent with the expectation that exchange rate depreciation causes inflationary

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pressures by increasing the cost of imports, which eventually feeds into domestic prices with a lag.

INTERPRETATION:

To discuss the short run estimation results as presented in tables 4.6, the study employs economic criterion, statistical criterion and econometric criterion.

1. Economic Criterion (A priori Expectation)

The regression results obtained in this study are evaluated based on a priori expectations. The sign and magnitude of each variable coefficient is evaluated against theoretical expectations.

From table 4.9 it can be seen that oil price impacts inflation in varying degrees both positive and negative in the short run in Nigeria.From the regression analysis, it is observed that in all the models except one, oil price conforms to the a priori expectation of the study in the short run although it is not statistically significant in all models. Thus, table 4.10 summarises the a priori test of this study.

Table 4.10: a priori Expectation in the short run

Parameters	Dependent Variable	Independent Variable	Expected Relationship	Observed Relationships	Conclusion
β_1	INF	OILP	+	+	Conform
A priori expectation in the long run					
β_1	INF	OILP	+	-	Does not Conform

Source: Researcher's compilation, 2024

2. Statistical Criteria: First Order Test

This subsection applies the R^2, adjusted R^2 and the F–test to determine the statistical reliability of the estimated parameters. These tests are performed as follows:

(a) The Coefficient of Determination (R^2)

From the study regression result, table 4.9 shows that the coefficient of determination (R^2) is given as 0.92, 0.99, 0.99 and 0.45 for the four models respectively. This implies that 92%, 99%, 99% and 45% of the variations in each of the dependent variables, GRGDP, INF, EXR and MS respectively are being accounted for or explained by the joint variations in each of the variables including the control variable-total exports. Goods. Other possible determinants of these macroeconomic variables which are not captured in the model explain about 8%, 1%, 1% and 55% respectively of the variations in Nigeria. This shows that the explanatory power of the each of the model is extremely high and very strong thus making a good fit. Although a better fit for the last model would be more appropriate.

(b) The Adjusted Coefficient of Determination (Adjusted R^2)

The adjusted R^2 which is more suitable for multiple regression analysis as it takes into account the variations in R^2 as a result of the addition of one more variable to the model. From table 4.9, the values of the adjusted R^2 supports the claim of the R^2 with values of 0.88, 0.98, 0.98 and 0.33 respectively indicating that about 88%, 98%, 98% and 33% of the total variations in the dependent variables GRGDP, INF, EXR and MS are explained by the independent variables jointly in each model. Thus, this supports the statement that the explanatory power of the variables are very strong exempting the last model which is moderate.

(C) The F-statistic test

The F-test is applied to check the overall significance of the model. This is because the F-statistic is instrumental in verifying the overall significance of an estimated model. The hypothesis tested is:

H_0: The model has no goodness of fit

H_1: The model has a goodness of fit

Decision rule: Reject H_0 if $F_{cal} > F_{\alpha}$ (k-1, n-k) at α = 5%, accept if otherwise.

Where

V_1 / V_2 Degree of freedom (d.f)

V_1 = n-k, V_2 = k-1:

Where; n (number of observations) = 43; k (number of parameters) =6

Where k-1 = 6-1= 5

Thus, n-k = 43-6= 37

Therefore: $F_{0.05(5,37)}$ = 2.47 (From F-table) … … F-table

F-statistic = (From Regression Result) … F-calculated

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Model	F-Calculated	F-Tabulated	Decision	Remarks
Model	19.014	2.47	Reject H_0	Statistically significant model

Table 4.11: Summary of F-statistic Test for all models
Source: Researcher's compilation, 2024

Therefore, since the F-calculated > F-tabulated as observed from the regression results and the f-table, the study reject the null hypothesis (H_0) and accepts the alternative (H_1) that the model is statistically different from zero. In other words, there is joint significant impact between the dependent and independent variables of the study.

3. Econometric Criterion (Second Order Test)
In this subsection, the following econometric tests are used to evaluate the result obtained from the study model; autocorrelation, heteroscedasticity and stability tests.

(a) Test for Auto- Correlation (DW)
This is the correlation between members of a series of observations ordered in time. The Durbin-Watson test was used to check for the presence of autocorrelation between successive values of the error term. The results of the Durbin - Watson auto-correlation test is shown in appendix 24.

Hypothesis
H_0 = There is no auto-correlation
H_1 = There is auto- correlation

Decision Rule: The value of dw always lies between 0 and 4. If d=2, it indicates no auto-correlation in the function.

Decision: Since the observed Durbin-Watson statistic obtained is, 1.81, 2.30, 2.16 and 1.54 respectively for the four models, we do not reject the null hypothesis and conclude that there is no auto-correlation between variables in the models. Therefore, the variables in the models are reliable for predictions.

Test for Heteroscedasticity
This test is conducted to see whether the error variance of each observation is constant or not.

Table 4.12: Summary of Heteroscedasticity Result for all Models
Heteroscedasticity Test for the Model
Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.516457	Prob. F(20,4)	0.8564
Obs*R-squared	18.02121	Prob. Chi-Square(20)	0.5860
Scaled explained SS	1.058107	Prob. Chi-Square(20)	1.0000

The hypothesis testing is thus:
H_0: There is no heteroscedasticity in the residuals
H_1: There is a heteroscedasticity in the residuals
The decision rule is to accept the null hypothesis that there is homoscedasticity (that is, no heteroscedasticity) in the residuals if the probability of the calculated F-test statistic (F) is greater than the 0.05 level of significance chosen in the study.

Decision:
The ARCH tests show that the variance of the error is homoscedastic at 5% level of significance since the P(F) for all models = 0.8940, 0.8564, 0.8702 and 0.4784 respectively. This means that the probability of the F statistic is greater than 0.05 level of significance. Therefore, the study fails to reject the null hypothesis that the error variance is homoscedastic and concludes that the variance of the error term is constant thus, the data is reliable for predictions. The result of the heteroscedasticity test can be seen in appendix 25.

Test for Stability
Stability Test for Model

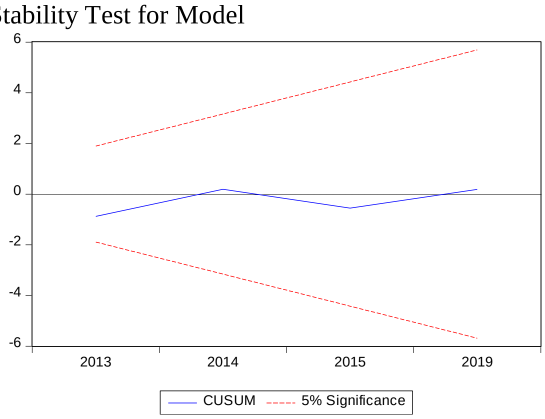

Figure 4.2: Cumulative Sum (CUSUM) Test for Model Two
Source: Researcher's computation using E-view 10.0

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The results in Figures 1-4 show that all the models are stable, since the base lines fall within the 5 percent boundary level i.e. it does not cross the 5% critical lines. Based on the decision rule, the study accepts the alternative hypothesis which states that the model is stable. Implying that over the entire sample period of investigation, the stability of the estimated coefficients exists, so that the regression coefficients are reliable and suitable for policy making.

4.3 Evaluation of Research Hypotheses

The t-test is used to know the statistical significance of the individual parameters. Two-tailed tests at 5% significance level are conducted for both models. The results are shown on Table 4.13 and 4.14 respectively. Here, the study compares the estimated or calculated t-statistic with the tabulated t-statistic at $t_{\alpha/2} = t_{0.05} = t_{0.025}$ (two-tailed test) in absolute terms.

Degree of freedom (df) = n-k = 43-6 = 37

So, the study has:

$T_{0.025(37)} = 2.03$ … … …

Tabulated t-statistic

In testing the working hypotheses, which partly satisfies the objectives of this study, the study employs a 0.05 level of significance. In so doing, the study is to reject the null hypothesis if the t-value is significant at the chosen level of significance; otherwise, the null hypothesis will not be rejected. This is summarized in Tables 4.13 and 4.14 respectively.

Table 4.13: Summary of t-statistic in the long run

Dependent variable	Independent Variable	t-calculated (t_{cal})	t-tabulated ($t_{\alpha/2}$)	Conclusion
INF	OILP	-0.8356	2.03	Statistically Insignificant

Source: Researcher's Computation using E-view 10.0

Table 4.14: Summary of t-statistic in the short run

Dependent variable	Independent Variable	t-calculated (t_{cal})	t-tabulated ($t_{\alpha/2}$)	Conclusion
INF	OILP	-4.5247	2.03	Statistically Significant

Source: Researcher's Computation using E-view 10.0

Decision Rule

1. If calculated t-value > tabulated t-value, we reject the null hypothesis and accept the alternative hypothesis
2. If calculated t-value < tabulated t-value, we accept the null hypothesis and reject the alternative hypothesis
3. If the probability value is less than 0.05, we reject the null hypothesis and accept the alternative hypothesis however if (p-value>0.05), we may not reject the null hypothesis.

The study begins by bringing the working hypothesis to focus in considering the individual hypothesis.

Hypothesis 1:

H_0: Oil price shocks has no significant effect on economic growth in Nigeria

H_1: Oil price shocks has a significant effect on economic growth in Nigeria

Decision:

Economic growth was proxied by the growth rate of gross domestic product in this analysis. Thus, applying the decision rule to this hypothesis we observe that in the long run the t-statistic value of 3.3948 is greater than the tabulated t-value of 2.03. hence, we reject the null hypothesis and conclude that oil shocks significantly impacts economic growth in Nigeria in the long run. This is however not true in the short run.

Hypothesis

H_0: Oil price shocks has no significant effect on inflation in Nigeria

H_1: Oil price shocks has a significant effect on inflation in Nigeria

Decision:

Applying the decision rule to this hypothesis we observe that in the long run the t-statistic value of -0.8356 is less than the tabulated t-value of 2.03. hence, we do not reject the null hypothesis and concludes that oil shocks does not significantly affect inflation in the long run. However, the opposite is true in the short run because the t-statistic of -4.5247 is greater than 2.03, the study concludes that a significant relationship exists in the short run

V. DISCUSSION OF FINDING

The study found that in the long-run oil prices have a negative but insignificant impact on inflation rate. Meaning that a one percent increase in oil prices will lead to a 5.38% fall in the inflation rate

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of Nigeria on average. In the short run however, the results were statistically significant and reveal that a one percent increase in oil prices will lead to a 1.04% decrease in the inflation rate on average, however the lagged value of oil prices which was also statistically significant indicated a positive and direct impact on inflation rate with a 2.89% increase recorded. This value is more plausible since impacts to inflation are not felt directly but rather after a lag of one year or depending. The ECM value of -0.46 is statistically significant and within acceptable range. It signifies that in the case of a disturbance or disequilibrium in the model, the ECM will push the short-term dynamics back to the long-term equilibrium at a moderate speed of 46%. This finding is inconsistent with that of Omolola (2006) who concluded that there wasn't sufficient evidence linking oil price fluctuations to CPI (inflation).

The results on the impact of oil prices on exchange rate gotten from the study showed that in the long run, the value of oil prices is -1.20, meaning that oil shock exert a negative impact on the exchange rate values of about 1.2%. In the short run, oil price shocks significantly negatively affects exchange rate as a one percent increase in oil prices accounts for a 0.48% decline in the exchange rate value. This impact is statistically significant at 5 per cent significant level since the p-value 0.0002 is less than 0.05. The ECM value of -0.095 is statistically significant and within acceptable range. It signifies that in the case of a disturbance or disequilibrium in the model, the ECM will push the short-term dynamics back to the long-term equilibrium at a moderate speed of 9%. This result is in line with that of ThankGod and Maxwell (2013).

VI. CONCLUSION

The findings indicated that oil price shocks have a significant and immediate effect on Nigeria's economic performance. An increase in oil prices tends to boost government revenues and foreign exchange reserves, which initially stimulates economic growth. However, these short-term gains are often accompanied by inflationary pressures, as the cost of goods and services rises due to increased production costs and higher prices for imported petroleum products.

VII. RECOMMENDATION

Although the impact of oil prices on inflation is negative in the long run, short-term effects can still be significant. The CBN should continue to use inflation targeting as a policy tool, adjusting interest rates and implementing measures to absorb inflationary shocks.The government could establish stabilization funds to buffer against the impact of oil price volatility on inflation, particularly for essential goods that are heavily dependent on fuel prices.Finally, since oil price shocks have a significant impact on money supply, the Central Bank of Nigeria (CBN) should closely monitor and manage liquidity levels. Adjusting the money supply in response to oil price changes can help stabilize the economy and prevent inflationary pressures.

The negative impact of oil price shocks on the exchange rate suggests a need for policies that stabilize the naira. The CBN should consider using foreign exchange reserves strategically and possibly implement a more flexible exchange rate regime to cushion against external shocks. The government can achieve this by adopting countercyclical fiscal policies. By making ample use of the oil boom period i.e when oil prices are high to increase federal reserves (saving surplus revenue)rather than spend all proceeds. This can help defend the naira during periods of low oil prices and reduce the impact on import costs and inflation. Alternately, increasing government spending during periods of low oil prices will stimulate the economy and help cushion against the vicissitudes of an oil-glut period.

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