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EFFECT OF OIL PRICE SHOCKS ON NIGERIA'S MACROECONOMIC VARIABLES

Buhari Bello[1]*, Zakari Saheed[2], Mustapha Muktar[3], Chris Egwaikhide[4], & Wasiu Oyeniran[5]

[1]Department of General Studies, Nuhu Bamalli Polytechnic, Zaria, Kaduna State, Nigeria

[2,3,4,5]Department of Economics, Nigerian Defence Academy, Kaduna, Nigeria

*buhari2023@gmail.com

ABSTRACT: The performance of macroeconomic variables in Nigeria has been strongly associated with the oil sector. The oil price shocks have a significant impact on a number of critical macroeconomic factors, including the exchange rate, inflation rate, oil revenue, and government expenditure, to name a few. The objective of this paper is to investigate and analyse the effect of oil price shocks on selected macroeconomic variables in Nigeria using time series techniques of the Non-linear Autoregressive distributed Lags (NARDL) model. The oil price and macroeconomic variables data were collected for the periods of 42 years (1981 – 2022) from the Central Bank of Nigeria and the US Energy Information Administration (EIA). The Bound Test of the NARDL specification suggests the presence of cointegration among variables. The results show that in the short-run and long-run, oil price shocks have a significant effect on macroeconomic variables such as exchange rate, inflation rate, oil revenue and government expenditure. The effect of global oil price shocks on inflation rate is positive, indicating that an increase in oil price leads to an increase in inflation rate in Nigeria; in contrast, the effect of shocks in the oil price on exchange rate is negative, indicating that an increase in global oil price leads to depreciation of exchange rate and fall in oil revenue thereby affecting government expenditure negatively in Nigeria. Hence, the study recommends that appropriate measures such as functional refineries and stable macroeconomic policies should be emphasized by the Nigerian government.

Keywords: Oil Price Shocks, Macroeconomic Variables, Exchange Rate, Inflation Rate, NARDL Model

INTRODUCTION

Even though there has been continuing developments on alternative sources of energy like renewable energy, constant electricity and others as sources of energy, oil still accounts for the largest fraction of energy worldwide. As a consequence of this heavy dependence on oil, and based on past experience with oil shocks, a large body of research has attempted to estimate the effect of oil shocks on macroeconomic variables. An important paper by Ahmad (2020) finds a significant negative relationship between oil prices and output. Globally, oil price shocks have been caused by various factors including the forces of demand and supply at international market, high volume of production by non-OPEC member countries like the United States of America as a major producer of crude oil worldwide in which it produces over 11 million barrels per day, followed by

OPEC member country Saudi Arabia that produces over 10 million barrels per day and then followed by another non-OPEC member country, Russia that produces over 9 million barrels per day. The Covid-19 pandemic era that started in 2020, coupled with Russia – Ukraine war in 2022 which caused a lot of energy crises also impacted negatively on every macroeconomic variable in the world as well as the world oil price shocks that led to fall in the price of oil at international oil market to less than $10/pb in 2020 (Barkindo, 2022).

Nigeria, as an OPEC member country, has been producing crude oil for decades at a low capacity- that is, less than 1.5 million barrels per day- despite its capacity of producing over 2.8 million barrels per day, according to the US Energy Information Administration (2022). This, however, comes as results insecurity in Niger Delta oil-producing states, oil theft in the oil producing states, as well as incapacitated government refineries that could not produce even one drop of crude oil daily. Nigeria is known as an import-dependent economy that highly depends on the foreign exchange through the sales of her crude oil in order to finance its enormous expenditures. Nigeria is highly affected by the shocks at the global oil market despite being in the 2nd and 5th positions of oil-producing countries in Africa and the world in 2022, respectively. With the fragile nature of the Nigerian macroeconomy and the higher dependence on crude oil transactions. (Buhari et al.., 2023).

All other things being equal, an increase in the price of oil should be seen positively in nations that export oil and negatively in those that import it; the opposite should be anticipated when the price of oil declines. For oil-producing countries like Nigeria, however, the combined impact of rising oil prices and unstable currency rates poses a truly formidable challenge to overall economic stability and progress. Considerable increases in government spending are typically linked to periods of rising oil revenues in Nigeria, while periods of declining oil revenues are typically connected with budget deficits (Eric 2020). Theoretically, the rise in the price of oil leads to a rise in the domestic cost of production, then the supplier price index will also increase, and the wages will also rise, thereby reducing the level of employment and level of output, which will lead to a rise in both the consumer and producer price indices

The Nigerian inflation rate is, however, affected by the oil price shocks because both consumption and investment were adversely affected due to a rise in oil price, which affects the disposable income of households, domestic of tradable and non-tradable goods and services. During the period under study, the year-on-year inflation rate jumped from 9.3% in October 2015 to 17.6 percent in August 2016, and there was also recent increment of inflation rate to 18.1 percent in July, 2022 to 20.3 in December 2022 as well as 25.80 in August 2023 (Buhar, *et al.*, 2023). In the medium term, lower oil prices will boost global economic growth and slash inflation, but many oil-exporting nations may find themselves in a precarious situation as a result. This is due to the fact that reducing oil revenues has an impact on the budget and that deteriorating economic growth, declining GDP, and declining per capita GDP lead to exchange rate depreciation. Variations in oil prices might impact capital flows and cause more shocks in the foreign exchange and financial markets. As a result, investments in the oil sector in nations that export oil may decline significantly.

Nigeria is, however, endowed with plentiful oil and gas resources, and its production constituted almost one-third of its GDP for over decades. Similarly, the immediate effect of a rise in oil price is the rise in oil revenue, then a rise in oil GDP that has a short-term and long-run effect. The short-term effect is the appreciation exchange rate, then a rise in wages because of the rise in money supply in the oil sector, thereby leading to a rise in the cost of production, which leads to a reduction in the level of output, and unemployment will rise as well as a rise in inflation in Nigeria. In the long run, however, the rise in wages of labour in resource and oil sector, leads a movement of labour from productive because the people are moving to oil sector since most of the investments are centred to oil and service sector due to more profits in the sector thereby leading to a shortage of goods and services from non-oil (productive) sector which consequently leads to a domestic inflation in Nigeria (Akinlolu & Nejo, 2020). Moreover, Nigeria's macroeconomic performance has been strongly associated with the oil sector. Although Nigeria remains Africa's second-largest oil producer after Angola in 2022, the country has inadequate refining capacity; hence, it imports refined petroleum products to meet the local demand. Thus, the government kept subsidising petroleum products so as to maintain its controlled price despite the changes in prices in the international oil market and the exchange rate (Bawa at al. 2020).

Nigeria has been negatively impacted by the global fall in crude oil prices that started in July 2020 due to the coronavirus, particularly in the areas of currency crises, inflation rate, declining government revenue, and government expenditure, eventually threatening the ability to meet financial bounds as and when due. The price of oil came down from its all-time high of USD 105.87 in 2013 to USD 98.94 in 2014 and to USD 40.76 in 2016. This means that from 2013 to 2016, oil prices declined sharply by more than half (64.5%) in 2016, but in 2017, the oil price started rising to $70/bpd to an even decrease of $10/bpd in 2020 (Barkindo, 2022). The resultant impact has been a huge cause of policies and programs, especially to policy makers, and debate among scholars on the best policy intervention to reverse the situation.

In light of these circumstances, the study posed the following research question: What is the effect of oil price shocks on selected macroeconomic variables in Nigeria? The following goal emerges as a means of answering the research question above: The objective of this study is to empirically analyse the effect of oil price shocks on selected macroeconomic variables in Nigeria.

LITERATURE REVIEW

This literature review has outlined the meanings of the basic concepts of the research given by various authors who conceptualised and defined the real meanings of the subject matter. The following are the basic concepts of this research:

Concept of Oil Price Shocks: According to Buhari et al. (2023), Crude Oil Price Shocks are a source of oil shocks that affect economic performance differently: oil price increases due to higher oil demand shocks affect output differently than oil price increases due to lower world oil supply shocks. They argued that positive oil supply shocks decrease domestic production. However, the crude oil fluctuation could be either in the oil prices or in the production process, which positively and negatively affects macroeconomic variables and even every sector of the economy either directly or indirectly.

Concept of Exchange Rate: According to Buhari (2020), the exchange rate is the country's currency value in terms of another country's currency. It is normally expressed as the number of units/elements of a local currency which will buy a one unit of another country's currency or the number of units/elements of another country's currency that will purchase one unit of a domestic currency, for example, the Naira per United States Dollar (N/USD) or US dollars per naira (USD/N). Essentially, exchange rate changes affect the prices of both imported and exported goods and services.

Concept of Inflation: Bawa at al. (2020) defined "Inflation" as a continuous increase in the general or average price level in the economy, usually measured through the calculation of the consumer price index. The word "persistent" is of greater importance in understanding the inflation concept. A single increase in prices is not inflation. When inflation occurs, there is a continuous increase in price levels. Prices of individual goods and services are determined in many ways. In competitive markets, the interaction of large buyers and sellers. In imperfectly competitive markets, prices are determined by producers' decisions (Friedman, 1963).

Concept of Oil revenue: It is defined as a form of government revenues earned after the sales of crude oil at the international oil market, which gives the government of a country the means (resources) to finance both capital and recurrent expenditure for the benefit of its citizens in a country. According to Akinlolu and Nejo (2020), a change in government revenue would have a positive/negative impact on growth. An increase in oil revenue could be in two ways: either through increasing the payment rate by existing taxpayers or increasing the number of taxpayers. The combined effects of the shocks in oil prices that brought about an influx of petrodollar oil revenue and the appreciation of the domestic exchange rate also have had effects on the domestic prices of products and services in Nigeria Raheem et al., 2020).

Concept of Government Expenditure: According to Usman & Buhari (2018), government expenditure is defined as total government spending on both recurrent and capital expenditures. Recurrent expenditure refers to the government expenditures on day-to-day activities such as payments of workers' salaries and wages, retirees 'pensions, fueling machines and equipment, and other recurrent spending. By capital expenditure, we mean the government spending on white elephant projects such as: building road networks, rail networks, stadia, hospitals, housing estates, and rest of others.

Theoretical Literature

the Dutch Disease Theory (DDT) was used for the theoretical foundation of the research, which posits that when a country is focused on a major source of income originating from her natural resources, such country is bound to be negatively affected over time and the supposed revenue emanated from the sales of the natural resource can turn to a disease. The classic economic model describing Dutch Diseases was developed by the Economists W. Max Corden and J. Peter Neary in 1982. In the model, there is a non-tradable sector (which includes services) and two tradable sectors: the booming sector and the lagging (or non-booming) tradable sector. However, a large increase in natural resource revenues can hurt other sectors of the economy, particularly export-based manufacturing, by causing inflation and exchange rate appreciation and shifting labour and

capital from the non-resource sector to the resource sector. This is known as "Dutch disease." While inflation and exchange rate appreciation can harm large swathes of the economy over a few years, their impacts can be felt for decades.

Empirical Literature

Buhari et al. (2023) empirically examine how shocks in oil prices affect Nigeria's inflation and exchange rate using yearly time series data from 1981 to 2021 using the Nonlinear Autoregressive Distributed Lags (NARDL) method. The results showed that that in the short-run and long-run, global oil price shock has significant effects on exchange rate and inflation rate. The findings show that the effect of global oil price shocks on inflation rate is positive meaning that increase in oil price leads to increase in inflation rate in Nigeria; In contrast, the effect of oil price shocks on exchange rate is negative, indicating that the rise in global oil price leads to the depreciation of exchange rate and the rise in interest rate in Nigeria.

Bawa et al. (2020) investigate the asymmetric impact of oil price on inflation in Nigeria using a Non-Linear Autoregressive Distributed Lag (NARDL) approach on quarterly time series data spanning 1999Q1 to 2018Q4 in Nigeria. Results showed that oil price increases led to an increase in headline, core and food measures of inflation in Nigeria. However, a decline in oil price resulted in a decline in the marginal cost of production and culminated in the moderation of domestic inflation. Furthermore, negative oil price shocks led to higher inflation in Nigeria when the exchange rate is dropped from the models, indicating that the exchange rate absorbed the impact of oil price declines earlier, as lower oil prices culminated in lower external reserve, depreciation of the naira and ultimately higher inflationary pressures. However, this research has tried to bring the theoretical underpinning of the New Keynesian model, which has been utilized as the standard framework for analysing the interactions between macroeconomic variables and the New Keynesian Phillips Curve (NKPC) framework. The NKPC describes a relationship between inflation, the expectations that firms hold about future inflation and the real marginal cost of production.

Eric (2020) empirically examines the responses of the consumer price index (CPI) to crude oil price shocks in the pre- and post-2008 global financial crisis in Nigeria. The study used the Structural Vector Autoregressive model to analyse monthly data from 2000M01 to 2019M12. According to the impulse response study, oil price shocks have a favourable effect on CPI both before and after the crisis. This had the effect of briefly raising the pre-crisis CPI by a modest amount before it vanished. However, the study above adopted various theoretical literature so as to explain different kinds of models such as The demand-pull and the supply-push factors. The changes in oil prices due to an increase in demand are said to bring about a wealth transfer effect in oil exporting economies and an inflation effect in oil importing economies. Whereas changes in oil prices due to positive changes in supply of the commodity translate to supply-side shock effects. The monetarist view of inflation is premised on the growth of money in circulation in relation to output growth.

Ahmad et al. (2020) explore the intraday dynamics of oil prices and exchange rates, specifically examining the lessons derived from the experiences of China and India. This study aims to identify

the determinants of volatility within the crude oil and foreign exchange markets, as well as to assess the jump spillover effects between these two markets. The analysis focuses on the currencies of two prominent oil-importing nations, India and China, covering the period from January 1, 2013, to October 31, 2019. The authors employ descriptive statistical methods alongside the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model for their econometric analysis, thereby enhancing the rigor of their findings; but has failed to adopt other econometric model such as Vector Autoregressive model (VAR) because it is easy to estimate and can adopt Ordinary Least Square (OLS) method, Vector Error Correction Model (VECM) which can be used to correct for short-run disequilibrium or deviations, Impulse Response Functions (IRFs) and Variance Decompositions (VCDs) so as to show the responses of exchange rate in different exchange rate regimes due to oil price shocks in two different countries under the study.

Raheem et al. (2020) investigate if an asymmetric relationship exists between oil price and inflation nexus. The study uses a multiple threshold nonlinear autoregressive distributed lag model in a dynamic common correlated effect within the environment of a heterogeneous panel framework. Results reveal the importance of asymmetry in the model for both oil-import and exporting countries, with countries responding more to positive shocks. Quantile decompositions show that the asymmetry effect of oil price change fizzles out only for the oil-importing country. For the oil-exporting countries, asymmetry is important at higher quantiles. However, this research has failed to adopt Vector Error Correction Model (VECM) which can be used to correct for short-run disequilibrium or deviations, Impulse Response Functions (IRFs) and Variance Decompositions (VCDs) so as to show the responses between oil price and inflation nexus for both oil importing and oil exporting countries.

Shitile and Usman (2020) estimate NARDL models of the link between oil price and inflation decomposed into consumer price index sub-indices of food, core, other energy and transport and find support for long-run asymmetry in relation to oil price shocks as well as incomplete pass-through of oil price to inflation in Nigeria. The results of the study suggest that it takes 4-8 quarters for the disaggregated inflation to converge to its long-run equilibrium after a negative or positive unitary oil price shock in Nigeria. However, this research has failed to adopt the Vector Error Correction Model (VECM), which can be used to correct for short-run disequilibrium or deviations, Impulse Response Functions (IRFs) and Variance Decompositions (VCDs) so as to show the responses between oil price and inflation nexus in Nigeria.

Kumar (2019) investigates the long-run and short-run asymmetric relationship of the asymmetric impact of oil prices on exchange rates and stock prices in the Indian context by using the Nonlinear Autoregressive Distributed Lags (NARDL). The theoretical argument for the relation between crude oil and stock prices can be explained through two major channels. First, oil prices can affect stock prices directly by affecting the future cash flows by their impact on the overall economy. Secondly, the oil prices can impact stock prices indirectly by affecting the interest rate used to discount the future cash flows. The results further reveal significant unidirectional nonlinear causality from exchange rates to stock prices. The results of the NARDL test reveal that previous month positive and negative shocks in oil prices have positive (negative) significant impact on exchange rate (stock prices).. However, the above research has failed to conduct Bound Test for Nonlinear cointegration results despite using Nonlinear Autoregressive Distributed Lags

(NARDL) and the results for short-run and long-run co-efficient relationships among the oil prices, exchange rate and stock prices in Indian.

Kocaarslan and Soytas (2019) empirically examine the asymmetric pass-through between oil prices and stock prices of clean energy firms: New evidence from a nonlinear analysis. The study contributes to this debate by questioning the possibility of asymmetric linkages between oil prices, interest rates, and the stock prices of clean energy and technology firms. Using a recently developed approach (nonlinear autoregressive distributed lag (NARDL) model), results suggest that the impacts of positive and negative changes in oil prices, interest rates and technology stock prices on clean energy stock prices substantially vary in the short and long run. However, this research has tried to follow different steps in conducting the Nonlinear Autoregressive Distributed Lags (NARDL) model such as the Bound Test for Nonlinear cointegration results, Nonlinear Autoregressive Distributed Lags (NARDL) results and the results for long-run co-efficient relations but failed to conduct short-run co-efficient relationship results.

Xu, Han, Wan and Yin (2019) investigate the dynamic link between oil prices and exchange rates using a nonlinear approach. The correlation coefficients between oil prices and exchange rates demonstrate that their dependences typically start from 2004 and then dynamically change over time. Theoretical explanations of the linkage between oil prices and exchange rates mainly follow two avenues. The first one assumes that oil price shocks may be transmitted to a country's exchange rate through the terms of trade. The second strand of literature focuses on the balance of payments or the so-called wealth effect. Assuming that oil demand in oil-importing countries is inelastic. Hence, in the long run, the real exchange rate will depend on some real factors, including the shares of countries in imports from and exports to OPEC and elasticity of demand for oil, but no longer on OPEC portfolio choices. However, the research should have adopted the Nonlinear Autoregressive Distributed Lags (NARDL) model in the course of analysis, whereby the Bound Test for cointegration results, NARDL results, and long-run and short-run coefficient relation results should be conducted for the right and best results.

Nwanne and Eze (2019) empirically investigated the effect of government oil revenue and the growth of the agricultural sector in Nigeria for the period of 37 years (1980 – 2017). Non-linear Autoregressive Distributed Lags (NARDL) econometric technique was adopted in analysing the data for this study with the following analysis carried out on the pre-estimation diagnostic tests (Unit Root Test, cointegration test, lag Length Selection, etc.), short-run and long-run bound test results and post-estimation diagnostic tests (stability test, normality test, etc) using the following variables in the study: Agriculture Sector contributing to GDP (AGDP), Government Oil Revenue (GOR), Exchange Rate (EXR), Inflation Rate (INFR) and Interest Rate (INTR). The results show that the government financing budget deficit through domestic means crowds out private investment, especially in the agricultural sector, thereby reducing its contributions to the growth of the economy.

METHODOLOGY

Secondary data was used for this study. The study used annual time-series data on oil price and some selected macroeconomic variables. Secondary data covered the macroeconomic variables'

yearly transactions for 42 years (1981 – 2022) for each macroeconomic variable, which was obtained from the Central Bank of Nigeria (CBN. The oil price is the Brent crude oil price and was also obtained from the US Energy Information Administration (EIA). The following was the main focus of the data collection: variables: exchange rate, inflation rate, oil revenue and government expenditure, which are the selected macroeconomic variables.

The specification of the NARDL model

The study used a different econometric framework, the Nonlinear Autoregressive Distributed Lags (NARDL) model. This model is an asymmetric extension of the well-known ARDL model of Pesaran and Shin (1999) and Pesaran et al. (2001) and was recently proposed by Shin et al. (2011 and 2014).

To begin, the study specified the following asymmetric long-run equation of macroeconomic variables (Schorderet, 2003; Shin et al., 2011):

$$oilp_t = \alpha_0 + \alpha_1 excr_t + \alpha_2 infr_t^{+} + \alpha_3 oilr_t^{-} + \alpha_4 gexp_t^{-} + e_t \text{---------} 1$$

Where *oilp* is Oil Price, *excr* is exchange rate, *infr* is inflation rate, *oilr* is oil revenue and *gexp* is government expenditure to capture effects of oil price shocks, and $\alpha = (\alpha 0, \alpha 1, \alpha 2, \alpha 3, \alpha 4)$ is a cointegrating vector or a vector of long run parameters to be estimated. In (1), $op_t^{+} + op_t^{-}$ are partial sums of positive and negative changes in *op*

$$oilp_t^{+} = \sum_{i=1}^{t} \Delta excr_i^{+} = \sum_{i=1}^{t} max(\Delta excr_i, 0) \text{----------} 2$$

$$oilp_t^{+} = \sum_{i=1}^{t} \Delta infr_i^{+} = \sum_{i=1}^{t} max(\Delta infr_i, 0) \text{----------} 3$$

$$oilp_t^{+} = \sum_{i=1}^{t} \Delta oilr_i^{+} = \sum_{i=1}^{t} max(\Delta oilr_i, 0) \text{----------} 4$$

$$oilp_t^{+} = \sum_{i=1}^{t} \Delta oilr_i^{+} = \sum_{i=1}^{t} max(\Delta gexp_i, 0) \text{----------} 5$$

According to the aforementioned formulation, there should be a positive long-term relationship (α2) between macroeconomic indicators and rises in oil prices. In the meantime, the long-term relationship between macroeconomic factors and the decline in oil prices is captured by α3 and α4. It is anticipated that they will move in the same direction. Therefore, α3 will be positive. The study also suggested that, i.e., α2 > α3, the macroeconomic variables will be more affected over the long term by rises in oil prices than by decreases in oil prices of the same size. As a result, the asymmetric long-run oil price passed through to the macroeconomic variables is reflected in the long-run relation, as shown in (1).

Equation (1) can be formulated in an ARDL environment in accordance with Pesaran and Shin (1999) and Pesaran et al. (2001), as demonstrated by Shin et al. (2011 and 2014).

$$\Delta oilp_t = \alpha + \beta_0 oilp_{t-1} + \beta_1 excr_{t-1} + \beta_2 infr_{t-1}^{+} + \beta_2 oilr_{t-1}^{-} + \sum_{i-1}^{p} \Phi_i \Delta oilp_t +$$

$$\sum_{i=0}^{q} \gamma \Delta excr_t + \sum_{i=0}^{s} (\theta_t^{+} \Delta infr_{i-1}^{+} + \theta_t^{-} \Delta oilr_{i-1}^{-}) + u_t \text{----------6}$$

The variables are defined as follows: p, q, and s represent lag orders; the long-term implications of the increase in oil prices and macroeconomic variables are represented by $\alpha 2 = -\beta 2/\beta 0$ and $\alpha 3 = -\beta 3/\beta 0$, respectively. Therefore, in this context, the asymmetric short-run effects of changes in oil prices on macroeconomic variables will be recorded in addition to the asymmetric long-run link.

The following procedures are involved in the empirical implementation of the nonlinear ARDL approach. First, unit root tests must be performed so that no I(2) variable is involved, even though the ARDL approach to cointegration is applicable whether the variables are I(0) or I(1). This is significant because the calculated F-statistics for evaluating cointegration are invalid in the presence of an I(2) variable. In order to achieve this, the study uses the popular ADF unit root tests to determine the integration orders of the variables. Using the conventional OLS estimation technique, we estimate equation (4) in the second phase. The work follows Katrakilidis and Trachanas (2012) in adopting the general-to-specific procedure to reduce inconsequential lags and arrive at the final specification of the NARDL model. Third, the study applies a limit testing approach of Pesaran et al. (2001) and Shin et al. (2011 and 2014) to test for cointegration among the variables based on the calculated NARDL. The null hypothesis, $\beta 0 = \beta 1 = \beta 2 = \beta 3 = 0$, is tested using the Wald F test in this case. The last stage involves looking at both the long- and short-term asymmetries in the relationships between oil and macroeconomic variables and drawing conclusions when cointegration is present. The robustness of the ARDL and NARDL models is evaluated using a battery of stability and diagnostic tests.

This study is conducted by adapting and modifying the work of Nwanne and Eze (2019) in the field of social sciences after slight modifications in his model. The model of Nwanne and Eze (2019) was modified on the fact that they used five variables (agriculture sector contribution to GDP, inflation rate, exchange rate, government oil revenue and interest rate) by using the NARDL model in annual time series data from 1980 to 2017. The modifications, however, affect the period and study variables; that is, this study considers annual time series data from 1981 to 2022 with oil price and the selected macroeconomic variables (exchange rate, oil revenue, inflation and government expenditure) in carrying out the study.

RESULTS AND DISCUSSIONS OF FINDINGS

Descriptive Statistics of Key Variables Used

Table 1 Descriptive Statistics Results

	LOIL_PRICE	EXCH_RATE	INFL_RATE	LOIL_REVENUE	LGOVT_EXP
Mean	6.369654	115.6848	18.93548	6.369654	6.422591
Median	7.407683	115.2551	12.94500	7.407683	6.925681
Maximum	9.091441	423.9000	72.84000	9.091441	10.10362
Minimum	1.981415	0.610025	5.390000	1.981415	2.265558
Std. Dev.	2.442191	118.9930	16.47574	2.442191	2.444989
Skewness	-0.646688	1.016872	1.870675	-0.646688	-0.352965
Kurtosis	1.935260	3.205407	5.417271	1.935260	1.862022
Jarque-Bera	4.911365	7.312042	34.72156	4.911365	3.138330
Probability	0.085805	0.025835	0.000000	0.085805	0.208219
Sum	267.5255	4858.764	795.2900	267.5255	269.7488
Sum Sq. Dev.	244.5362	580532.9	11129.45	244.5362	245.0969
Observations	**42**	**42**	**42**	**42**	**42**

Source: Computed by the Researcher from using E-Views (2023)

Table 1 shows the attributes of variables under study, the mean and standard deviation, as well as the minimum and maximum of all endogenous and exogenous variables from 1981 to 2022, which includes oil price, exchange rate, inflation rate, oil revenue and government expenditure. In addition, the standard deviation reports the rate at which these variables deviate from their individual mean values. Oil price has a high deviation from its average value. Similarly, oil revenue and government expenditure are all negatively skewed to the left, while oil price, exchange rate and inflation rate are skewed to the right. The 5.0 value of the Kurtosis suggests the normal distribution of these indicators and variables. In Jaque-bera, we can see that the probabilities are normally distributed to all significance, except for exchange rate and inflation rate; indicating that we reject the null hypotheses of the variables of interests under the study.

Tests for Stationarity Results

Table 2 Unit Root Tests

Variables	Levels (5%)	Critical Values (5%)	1st difference (5%)	P-values	Comment
Loil_price	-2.379	-3.527	-6.235	0.0000	I(1)
Exch_rate	-0.068	-3.527	-4.777	0.0023	I(1)
Infl_rate	-4.096	-3.530	-5.744	0.0031	I(0)
Loil_revenue	-0.544	-3.527	-5.564	0.0002	I(1)
Lgovt_exp	-0.403	-3.530	-7.970	0.0000	I(1)

Source: Computed by the Researcher from using E-Views 9 (2023)

The ADF statistics in Table 2 showed that only one variable (inflation rate) is at level, while none of the remaining series is stationary at the level of 5% critical values, but at first difference. Consequently, the levels in the series will generate spurious results if used for information. The table also shows the order of integration for oil price and macroeconomic variables. The variables are to be integrated of order one, with the exception of the inflation rate, which is at first difference, meaning that the series are not stationary at their level forms (*p*-value > 0.05).

Bound Test Results

Table 3 Bounds Test for Nonlinear Cointegration Results

Bound Test	**Null Hypothesis: No Level of Relationship**			
Test Statistics	**Value**	**Significance**	**I(0)**	**I(1)**
F-statistics	5.077	10%	2.25	3.52
		5%	2.86	4.49
		1%	3.74	5.06

Source: Computed by the Researcher from using E-Views 9 (2023)

Table 3 above shows the Autoregressive Distributed Lag (ARDL) Bounds test results, which depicted the co-move in the long run cointegration relations between the oil price and other macroeconomic variables (exchange rate, inflation rate, oil revenue and government expenditure). It also indicated that the F-statistics value (5.077) is greater than the critical values, especially at 5% level of significance either at lower or upper bound test. However, it also shows that there are long run equilibrium relationships between the dependent and independent variables, which is between oil prices and exchange rate, inflation rate, oil revenue and government expenditure which means the variables have passed the cointegration test. Therefore, since the F-statistics value is greater than the critical values, especially at 5% level of significance at both lower bounds and upper bounds, we reject the null hypothesis of the cointegration test. However, if we look at F-statistics value is 5.077 and greater than lower bound 0(1) and upper bound 1(1) at 5% level of significance (2.86 and 4.49); it shows that there is long run relationship between dependent variable and independent variables, that is it shows there is long run relationship between oil price and exchange rate, inflation rate, oil revenue and government expenditure from 1981 to 2022 in Nigeria. It also shows that this model has passed the cointegration test.

Short-run Coefficient Results

Table 4 Short-run Coefficient Relations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(LOIL_PRICE(POS))	0.431	0.145	2.966	0.009
(LOIL_PRICE(NEG))	-0.491	0.190	-2.585	0.020
D(EXCH_RATE (POS))	-0.001	0.001	-1.233	0.236

D(EXCH_RATE(NEG))	0.004	0.002	1.923	0.073
D(INFL_RATE (POS))	-0.004	0.001	-2.168	0.046
D(INFL_RATE(NEG)	-0.003	0.002	-1.695	0.110
D(LOIL_REVENUE (POS)	0.512	0.057	8.888	0.000
D(LOIL_REVENUE (NEG)	-0.707	0.144	-4.904	0.000
D(LGOVT_EXP (POS))	-0.006	0.136	-0.044	0.965
D(LGOVT_EXP(NEG))	-0.007	0.139	-0.053	0.958
CointEq(-1)	-0.137	0.061	-2.248	0.040
R-square	0.96			
F-statistics value	18.99			
Durbin-Watson	1.98			
P-value	0.000			

Source: Computed by the Researcher from using E-Views 9 (2023)

Table 4 shows the short-run co-efficient relationships between global oil prices and selected macroeconomic variables from 1981 to 2022 in Nigeria. The result also indicates one period lag Error Correction Term (ECT) which must be ensure that it is negative and less than one it is statistically significance. Therefore, the above results at CointEq(-1) ensure it is a negative and less than one (-0.137), and it is statistically significant (0.040) which passed three (3) basic criteria that have to be statistically significant going by probability value here, it has to be less than 0.05 (0.040), it has to be negative and less than one(1). İt is, however, shown that if our value (-0.137) is multiplied by 100%, it shows that there is a high speed of adjustment from the short run to the long run; if there is any disequilibrium in this system, it shows the high speed of adjustment from the short run to the long run. However, the model has a good fit if we look at the R-square value at 0.96. If we multiply the R-square value by 100%, then we can have 96 % to show high-speed adjustment from the short run and long run if there is any disequilibrium in the system. The F-statistics value is at 18.99, the probability value is at 0.04, which is less than 0.05, and the Durbin-Watson statistics is at 1.98, which is not greater than 2. The result, however, depicted that there was a negative relationship between oil price and exchange rate, inflation rate and government expenditure at -0.001, -0.004 and -0.006; but insignificant for exchange rate and government expenditure at 0.236 and 0.965 but significant for inflation rate at 0.046. While there is a positive relationship between the oil price and oil revenue at 0.512, it is also significant at 0.000, in which the p-values are less than 0.05 at a 5 percent level of significance.

Long Run Coefficient Results

Table 5 Long run Coefficient Relations

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXCH_RATE	0.022	0.012	1.864	0.082
INFL_RATE	-0.025	0.018	-1.373	0.189
LOIL_REVENUE	2.365	1.333	1.773	0.096
LGOVT_EXP	-2.814	1.754	-1.604	0.129
C	3.541	1.313	2.6967	0.016

Source: Computed by the Researcher from using E-Views 9 (2023)

Table 5 indicates the long-run co-movement relationships between the oil prices and macroeconomic variables of exchange rate, inflation rate, oil revenue and government expenditure from 1981 to 2022 in Nigeria. In the long run, it shows the positive co-movement relationships between the global oil prices and exchange rate and oil revenue at 0.002 and 2.365 respectively; but are significant in exchange rate and oil revenue at 0.082 and 0.096, since they are less than 5% level of significance. This means that an increase in oil price in the global oil market leads to the appreciation of exchange and a rise in oil revenue in which most of the oil revenue accrued does complement the increase in oil price globally. However, it showed the negative co-movement relationships between the global oil prices and inflation rate and government expenditure at -0.025 and -2.814. respectively, but they are statistically insignificant at 0.189 and 2.129 for the inflation rate and government expenditure.

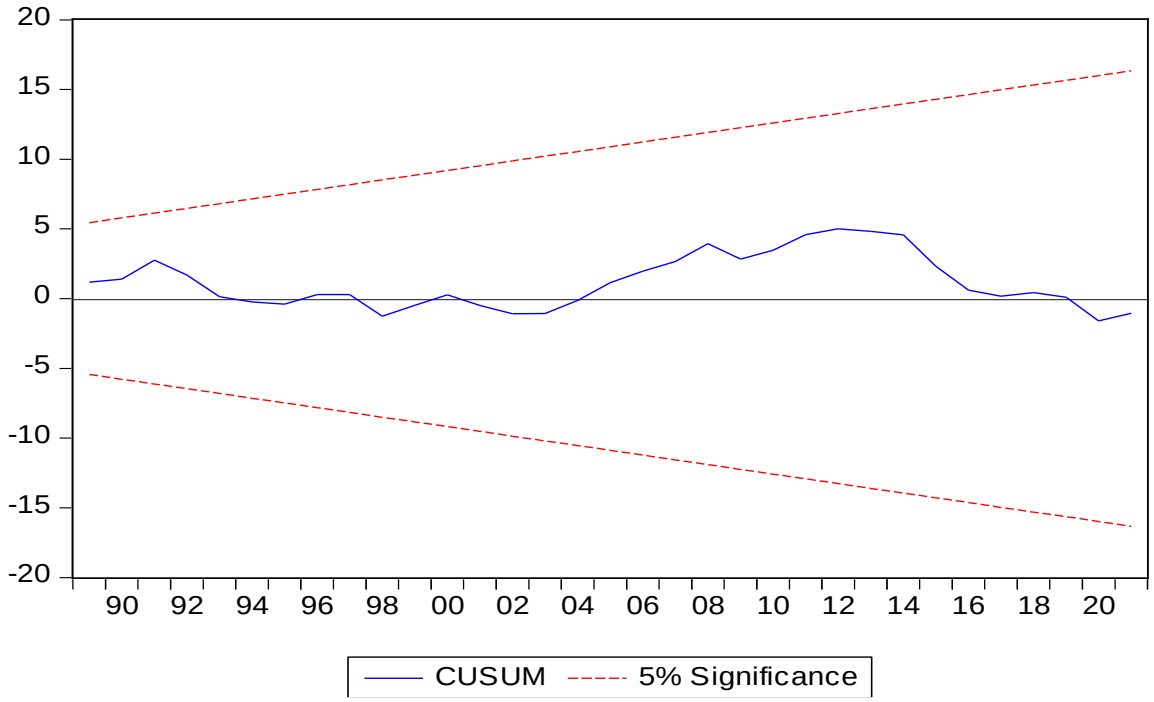
Post Estimation Diagnostic

Table 6 Post Estimation Diagnostic Results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	4.674861	Prob. F(5,10)	0.1840
Obs*R-squared	26.61399	Prob. Chi-Square(5)	0.0001
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.00123	Prob. F(22,15)	0.5110
Obs*R-squared	22.60590	Prob. Chi-Square(22)	0.4243

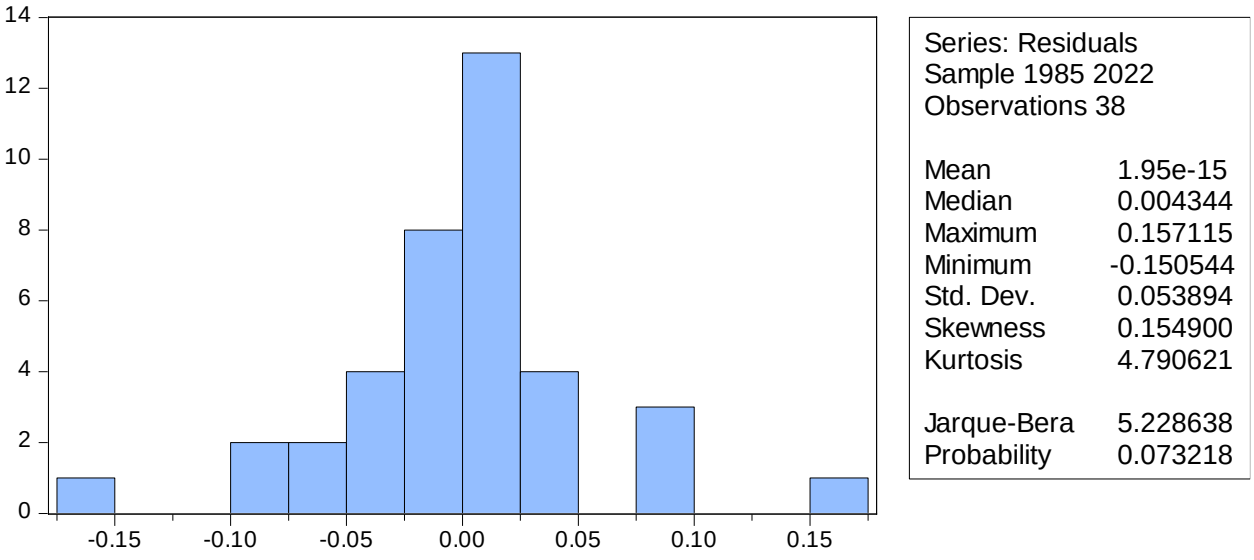
Source: computed by the Researcher from using E-views 9 (2023)

Figure 1: Stability Test



Source: Computed by the Researcher from using E-views (2023)

Figure 2: Normality Test



Source: Computed by the Researcher from using E-views (2023)

The post estimations of this study are in Table 6, which reveals a serial correlation LM test with a probability value of 0.184 that is greater than 0.05. Therefore, there is an absence of autocorrelation. İn addition, the heteroskedasticity probability value stood at 0.5110, which is also greater than 0.05; thus, there is an absence of heteroskedasticity. However, the test of stability from CUSUM in figure 1 depicts that it is within the 5% critical line; thus, the stability of estimated parameters in the study for the period under investigation. The jacque-Bera value is 5.2286, and its probability values are 2.44188 and 0.0732, respectively, which are reported in Figure 2, showing that it is good for research. Hence, acceptance of the null hypothesis that the error terms of the data used in the study are not normally distributed.

Conclusion and Recommendations

Based on the findings of this study, this study examines the dynamic relationship between oil price shocks and macroeconomic variables and examines the various oil price shocks with the implications on the Nigerian economy. Hence, the study adopts the NARDL model to examine the effect of oil shocks on the selected macroeconomic variables. İt, therefore, affirmed that oil price shocks positively affect selected average variables (exchange rate, inflation rate, oil revenue and government expenditure) of macroeconomic variables significantly under the periods of study. However, in light of the aforementioned, the following suggestions were made: First, Nigeria should invest in modular refineries to reduce dependence on oil imports, thereby stabilising the exchange rate, controlling inflation, and increasing oil revenue and oil GDP to complement government expenditure in Nigeria. Second, to facilitate the monetary authority in achieving lower inflation and stable exchange rate towards economic growth targets, counter-cyclical fiscal policies and effectively binding fiscal rules should be formulated and implemented by the Nigerian government.

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