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ABSTRACT

This study investigates the effects of oil price fluctuations on Nigeria's macroeconomic indicators from 2015 to 2023, focusing on inflation and economic growth. Utilizing Autoregressive Distributed Lag (ARDL) and Nonlinear ARDL (NARDL) models, we analyze the short-term and long-term impacts of variables such as Premium Motor Spirit (PMS) prices, exchange rates, money supply, interest rates, and economic uncertainties. Results reveal significant short-term effects of oil price increases on inflation and GDP, with asymmetric influences observed in exchange rate movements. The long-term analysis confirms cointegration relationships but underscores slow adjustment speeds for inflation and GDP equilibrium. Recommendations include strengthening monetary policy, stabilizing the exchange rate, and adopting strategies to mitigate oil price volatility's adverse effects.

KEYWORDS*: Oil Price Fluctuations, ARDL, NARDL, Macroeconomic Indicators, Nigeria, Inflation*

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1. INTRODUCTION

Nigeria, the sixth-largest exporter of petroleum globally, heavily relies on oil exports for its economic stability. Contributing approximately 25% of the country's GDP and over 70% of government revenues, oil has been the backbone of Nigeria's economy for decades. However, the lack of domestic refining capacity has left the nation vulnerable to global oil price fluctuations, importing petroleum products to meet domestic demands. These fluctuations, driven by global supply-demand dynamics and geopolitical factors, significantly impact Nigeria's inflation rates and economic growth.

In recent years, oil price volatility has intensified due to factors like the COVID-19 pandemic and policy changes, including subsidy removal and currency devaluation. For instance, the sharp drop in oil prices during the pandemic led to economic instability, while subsequent price increases induced inflationary pressures. As a result, understanding how oil price changes impact Nigeria's macroeconomic indicators has become crucial for policymakers.

Inflation in Nigeria, often linked to global oil price movements, is a persistent challenge. The Consumer Price Index (CPI), a key measure of inflation, is influenced by various factors, including exchange rate volatility, money supply, and economic policy uncertainties. Similarly, the Gross Domestic Product (GDP), representing economic growth, is sensitive to changes in oil prices, as the economy depends on oil revenue for development projects and foreign exchange earnings.

Despite extensive research, significant gaps remain in understanding the asymmetric effects of oil price changes. Most studies focus on the symmetric impacts, treating price increases and decreases as having equivalent effects. This approach overlooks the possibility that positive and negative oil price shocks may influence macroeconomic indicators differently, creating complex dynamics in inflation and economic growth. Additionally, the interplay between oil price fluctuations and other macroeconomic variables, such as exchange rates and interest rates, remains underexplored, especially in developing economies like Nigeria.

Nigeria's economy continues to grapple with persistent inflation and unstable economic growth driven by oil price volatility and policy uncertainties. The reliance on imported petroleum products exposes the economy to global price shocks, which affect inflation through increased production and transportation costs. Meanwhile, exchange rate instability exacerbates inflationary pressures, reducing purchasing power and hindering economic growth.

Although existing studies explore the impacts of oil price changes, they often treat the effects symmetrically and in isolation, ignoring potential nonlinearities and interactions with other variables. Moreover, the lack of empirical research employing advanced econometric methods limits the understanding of these relationships, leaving policymakers with insufficient tools to address the challenges posed by oil price volatility.

This study aims to address these gaps by investigating the asymmetric effects of oil price fluctuations on Nigeria's inflation (measured by CPI) and economic growth (measured by GDP) using advanced econometric models. Specifically, the study seeks to analyze the statistical properties of key macroeconomic indicators, estimate short-term and long-term impacts of oil price changes using ARDL and NARDL models, capture the differential impacts of positive and negative oil price shocks, and provide actionable insights for policymakers to stabilize inflation and promote economic growth in the face of oil price volatility.

This research contributes to both academic and practical domains by providing nuanced insights into the asymmetric effects of oil price changes. For policymakers, the findings offer guidance on managing inflation and fostering sustainable economic growth through targeted interventions. Economic planners can leverage the results for more accurate forecasting and strategic planning, while businesses can adapt their strategies to mitigate risks associated with economic fluctuations.

Academically, the study advances the understanding of nonlinear dynamics in oil price-macroeconomic relationships, addressing a critical gap in the literature on oil-dependent economies. By employing robust econometric techniques, the research sets a foundation for future studies, particularly in Sub-Saharan Africa, where empirical evidence remains scarce.

In summary, this study sheds light on the complex and asymmetric effects of oil price fluctuations on Nigeria's macroeconomic stability, offering valuable insights for stakeholders across various sectors.

2. LITERATURE REVIEW

2.1 THEORETICAL LITERATURE

A study also explored the asymmetric impact of oil price on inflation using a Non-Linear Autoregressive Distributed Lag (NARDL) approach. Their research indicated that increases in oil prices led to a rise in headline, core, and food

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inflation in Nigeria. Conversely, a decline in oil prices resulted in a decrease in the marginal cost of production and moderated domestic inflation. They highlighted the importance of the exchange rate in absorbing the impact of oil price declines, as lower oil prices led to a depreciation of the naira and higher inflationary pressures (Bawa et al., 2020).

Musa et al., (2018) in their paper *Industrial Output Response to Inflation and Exchange Rate in Nigeria: An Empirical Analysis* investigates the response of aggregate industrial output to relative change in prices and exchange rate in Nigeria using data from 1970-2011. A vector error correction (VEC) model was employed, and the dynamic correlations of the variables were captured through impulse response and variance decomposition. They found that industrial output responded positively to exchange rate shocks in the initial years but negatively to price changes. From variance decomposition, the study showed that although the main source of variance in output came from its own shocks, innovation in exchange rate accounted for a higher proportion in the variation of industrial output than price changes. The study concludes that inflation and exchange rate have the potential to cause significant changes in industrial output in Nigeria, recommending greater policy attention to exchange rate and inflation management.

Recent literature on the impact of oil price changes on inflation in Nigeria has provided nuanced insights into the economic dynamics of the country. In 2023 a study conducted using a nonlinear Autoregressive Distributed Lag (ARDL) model to examine the asymmetric effects of oil price shocks and exchange rates on inflation in Nigeria. They found that rising oil prices have a more significant impact on inflation than falling oil prices, and that the depreciation of the exchange rate has a substantial effect on inflation (Sa'ad, Usman, Omaye, & Yau, 2023).

2.2 EMPIRICAL LITERATURE

In Nigeria, Kelikume (2017) examined the asymmetric effect of exchange rate and oil price shocks on inflation using the vector error correction methodology (VECM). The study found that oil price hikes induced a 43% increase in inflation within a year, while a fall in oil prices resulted in a 29% increase. Bala and Chin (2018) used the ARDL dynamic panel framework to assess the asymmetric impacts of oil price shocks on inflation in Algeria, Angola, Libya, and Nigeria. They found that both positive and negative oil price shocks positively influenced inflation, with more pronounced effects during periods of oil price declines. Omolade et al. (2019) applied a panel structural VAR framework and concluded that sharp declines in oil prices led to structural inflation increases in eight African oil-producing countries.

Additional studies, such as Ibrahim (2015), Abdlaziz, Rahim, and Adamu (2016), and Lacheheb and Sirag (2019), utilized the NARDL approach to examine the oil price-inflation nexus in Malaysia, Indonesia, and Algeria. Their findings indicated significant long-term and short-term relationships between oil price increases and inflation. Jiranyakul (2018) examined oil price shocks' effects on inflation in Thailand using data from 1993-2016 and found positive short- and long-term effects on inflation. Similarly, Lacheheb and Sirag (2019) found nonlinear relationships between oil price fluctuations and inflation in Algeria.

Studies focused on advanced countries have also indicated significant positive impacts of oil prices on inflation. Brown et al. (1995) showed that oil price shocks influence output and the price level, while Dias (2013) estimated that oil price shocks increased inflation in Portugal during the 1984-2012 period. In Nigeria, Olusegun (2008) and Odionye et al. (2019) reported that oil price shocks significantly contributed to variations in oil revenues and national output, though they argued that oil price shocks might not necessarily be inflationary. Omotosho and Doguwa (2012) identified factors such as fuel price hikes, food crises, and exchange rate instability as significant causes of high inflation volatility in Nigeria.

Further research has revealed a cointegrating relationship between oil prices and inflation in developing countries, with unidirectional causality observed in countries like South Africa (Niyimbanira, 2013) and mixed findings in oil-importing economies like Pakistan (Shafique, 2016).

The relationship between oil price shocks and inflation has also been analyzed asymmetrically. Mork (1989) and Mory (1993) suggested that oil price increases and decreases have distinct effects on economic outcomes. Studies by Cunado and de Gracia (2005) have shown that oil price shocks impacted both consumer prices and economic activity in six Asian countries, with evidence of asymmetries in four countries. Similarly, Choi et al. (2018) demonstrated that a 10% increase in global oil inflation led to an increase in domestic inflation, with positive oil price shocks having a larger impact than negative ones.

Utilizing a New-Keynesian DSGE model, Omotosho (2019) explored oil price

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shocks' macroeconomic implications and Nigeria's fuel subsidy regime, revealing that oil price shocks impacted inflation, though the effect was minimal due to incomplete pass-through of international oil prices to domestic fuel prices.

Asghar and Naveed (2015) examined the long-run pass-through of world oil prices to domestic inflation in Pakistan, finding significant relationships between oil price changes and inflation in the long run.

3. MATERIAL AND METHODS

This study employs both the Autoregressive Distributed Lag (ARDL) and Nonlinear ARDL (NARDL) modeling approaches to examine the asymmetric effects of oil price fluctuations on Nigeria's macroeconomic indicators, focusing on inflation (CPI) and economic growth (GDP). These econometric models are particularly suited for analyzing short- and long-term relationships in time series data.

3.1 THE LINEAR ARDL MODEL

The ARDL model captures the dynamic relationships between a dependent variable and one or more independent variables, considering both short- and long-term effects. It is applicable when variables are stationary at levels (I(0)) or first differences (I(1)), but not second differences (I(2)).

The general ARDL model can be expressed as:

$$Y_t = \alpha + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=0}^{q} \gamma_j X_{t-j} + \grave{o}_t \quad (1)$$

Where:

Y_t: Dependent variable (e.g., CPI or GDP)

X_{t-j} : Independent variables (e.g., oil price, exchange rate, money supply)

α : Constant term

β_i , γ_j : Coefficients for lagged dependent and independent variables, respectively

- $\grave{o}_t$: Error term

The short-run and long-run dynamics are estimated using an error correction model (ECM), which can be derived as:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p-1} \beta_i \Delta Y_{t-i} + \sum_{j=0}^{q-1} \gamma_j \Delta X_{t-j} + \lambda (Y_{t-1} - \phi X_{t-1}) + \grave{o}_t$$

(2)

Where λ is the speed of adjustment to the long-run equilibrium.

3.2 The Nonlinear ARDL (NARDL) Model

The NARDL model extends the ARDL framework by decomposing an independent variable X into its positive X^+ and negative X^- changes to capture asymmetry:

$$X_t = X_t^+ + X_t^- \quad (3)$$

Where:

$X_t^+ = \sum_{j=1}^{t} \max(\Delta X_j, 0)$ captures the positive changes (increases) in X_t ,

$X_t^- = \sum_{j=1}^{t} \min(\Delta X_j, 0)$ captures the negative changes (decreases) in X_t

The general NARDL model is expressed as:

$$Y_t = \alpha + \sum_{i=1}^{p} \beta_i Y_{t-i} + \sum_{j=0}^{q} (\gamma_j^+ X_{t-j}^+ + \gamma_j^- X_{t-j}^-) + \grave{o}_t$$

(4)

This model captures asymmetric short- and long-run effects of X on Y , where:

γ_j^+ : Coefficients for positive changes in X

γ_j^- : Coefficients for negative changes in X

3.3 DATA SOURCES AND VARIABLES

The analysis uses monthly time series data from 2015 to 2023, comprising 108 observations for each variable. Data was sourced from the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), and international energy databases.

Variables:

Dependent Variables:

- Consumer Price Index (CPI): Measures inflation.
- Gross Domestic Product (GDP): Measures economic growth.

Independent Variables:

- Oil Price: Global crude oil price fluctuations.
- Premium Motor Spirit (PMS): Domestic gasoline prices.
- Exchange Rate (ER): Naira's value relative to foreign currencies.
- Money Supply (MS): Total currency and deposits in circulation.
- Interest Rate (IR): Cost of borrowing.
- Economic Policy Uncertainty (EPU): Degree of policy unpredictability.
- Oil Price Uncertainty (OPU): Variability in global oil prices.

Equations

ARDL Model for CPI:

$$\Delta \text{CPI}_t = \alpha + \sum_{i=1}^{p-1} \beta_i \Delta \text{CPI}_{t-i} + \sum_{j=0}^{q-1} \gamma_j \Delta X_{t-j} + \lambda (\text{CPI}_{t-1} - \phi X_{t-1}) + \grave{o}_t \quad (5)$$

NARDL Model for GDP:

$$\Delta \text{GDP}_t = \alpha + \sum_{i=1}^{p-1} \beta_i \Delta \text{GDP}_{t-i} + \sum_{j=0}^{q-1} (\gamma_j^+ \Delta X_{t-j}^+ + \gamma_j^- \Delta X_{t-j}^-) + \lambda (\text{GDP}_{t-1} - \phi X_{t-1}) + \grave{o}_t$$

(6)

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4. RESULTS AND DISCUSSION

This section presents the findings of the study, summarizing key insights from the ARDL and NARDL models used to analyze the effects of oil price fluctuations on Nigeria's macroeconomic indicators. Key tables and figures from the analysis are included to enhance clarity, and the findings are discussed in the context of existing literature, with implications for policy highlighted.

4.2 TEST FOR UNIT ROOT

Before proceeding with the ARDL and NARDL models, it is essential to test for the stationarity of the variables using the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test to ensure that none of the variables are integrated of order 2 (i.e., I(2)). Both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests confirmed that all variables are stationary after first differencing.

Table 1: Unit Root Test Results for All Variables (ADF Test)

VARIABLE	ADF TEST	1%	5%	10%	PROB.	ORDER OF INTEGRATION
CPI						
Level	2.821	-3.494	-2.889	-2.581	1.0000	(I(1))
First Difference	4.225	-3.500	-2.892	-2.583	1.0000	(I(0))
GDP						
Level	0.109	-3.499	-2.891	-2.582	0.9649	(I(1))
First Difference	-2.155	-3.499	-2.891	-2.582	0.224	(I(1))
PMS						
Level	1.774	-3.492	-2.888	-2.581	0.999	(I(1))
First Difference	-9.068	-3.493	-2.888	-2.581	0.000	(I(0))
MS						
Level	3.542	-3.493	-2.888	-2.581	1.000	(I(1))
First Difference	-2.842	-3.494	-2.889	-2.581	0.056	(I(0))
IR						
Level	-1.339	-3.495	-2.889	-2.581	0.609	(I(1))
First Difference	-5.174	-3.493	-2.889	-2.581	0.000	(I(0))
ER						
Level	3.218	-3.494	-2.889	-2.581	1.000	(I(1))
First Difference	-3.720	-3.496	-2.890	-2.582	0.005	(I(0))
EPU						
Level	-5.064	-3.492	-2.888	-2.581	0.000	(I(0))
First Difference	-12.562	-3.493	-2.888	-2.581	0.000	(I(0))
OPU						
Level	-7.262	-3.492	-2.888	-2.581	0.000	(I(0))
First Difference	-10.672	-3.494	-2.889	-2.581	0.000	(I(0))

The Augmented Dickey-Fuller (ADF) test reveals that all key variables, such as CPI, GDP growth, and PMS prices, are non-stationary at levels but become stationary after first differencing. This indicates they are integrated of order one (I(1)) and supports the use of the ARDL model, which accommodates mixed integration levels (I(0) and I(1)), ensuring meaningful analysis without spurious results.

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Table 2: Phillips-Perron (PP) Test Results for All Variables

VARIABLE	PP TEST	1%	5%	10%	PROB.	ORDER OF INTEGRATION
CPI						
Level	10.104	-3.492	-2.888	-2.581	1.0000	(I(1))
First Difference	0.458	-3.493	-2.888	-2.581	0.984	(I(1))
GDP						
Level	-3.038	-3.492	-2.888	-2.581	0.034	(I(0))
First Difference	-4.337	-3.493	-2.888	-2.581	0.0007	(I(0))
PMS						
Level	2.298	-3.492	-2.888	-2.581	1.000	(I(1))
First Difference	-9.067	-3.493	-2.888	-2.581	0.000	(I(0))
MS						
Level	3.500	-3.492	-2.888	-2.581	1.000	(I(1))
First Difference	-10.357	-3.493	-2.888	-2.581	0.000	(I(0))
IR						
Level	-0.395	-3.492	-2.888	-2.581	0.904	(I(1))
First Difference	-10.890	-3.493	-2.888	-2.581	0.000	(I(0))
ER						
Level	1.239	-3.492	-2.888	-2.581	0.998	(I(1))
First Difference	-10.484	-3.493	-2.888	-2.581	0.000	(I(0))
EPU						
Level	-5.051	-3.492	-2.888	-2.581	0.000	Stationary (I(0))
FirstDifference	-19.341	-3.493	-2.888	-2.581	0.000	Stationary (I(0))
OPU						
Level	-7.394	-3.492	-2.888	-2.581	0.000	Stationary (I(0))
First Difference	-18.362	-3.493	-2.888	-2.581	0.000	Stationary (I(0))

The Phillips-Perron (PP) test supports the ADF test results, showing most variables are stationary after first differencing, except CPI, which remains non-stationary. This indicates potential structural breaks or persistent unit roots in inflation data, requiring further investigation. Overall, the consistency between tests justifies using differenced data for modeling.

4.2 ARDL MODEL RESULTS

4.2.1 ARDL BOUND TEST FOR COINTEGRATION FOR CPI

The study conducts the bound test to confirm if a longrun relationship exists among the variables in the model. The results of the ARDL bounds test for CPI are shown in the table below.

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Table 3: ARDL Bounds Test for CPI

Test Statistic	Value	K
F-statistic	3.195420	6
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

The bounds test for CPI reveals that the F-statistic (3.1954) exceeds the upper bound critical value at the 10% significance level (2.94) but falls below the upper bounds at the 5% (3.28), 2.5% (3.61), and 1% (3.99) significance levels. This suggests weak evidence of a long-run relationship between CPI and the independent variables at the 10% level but insufficient evidence at more stringent levels.

4.2.2 ARDL ESTIMATION RESULTS FOR CPI

Table 4: ARDL Estimated Long Run Model for CPI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PMS	0.613932	1.135848	0.540505	0.5902
MS	6.82E-05	5.88E-05	1.161254	0.2486
EPU	-0.256213	0.906898	-0.282516	0.7782
OPU	0.919208	0.995324	0.923526	0.3582
ER	-0.166557	1.018370	-0.163553	0.8704
IR	15.26977	20.25940	0.753713	0.4530
Constant	-542.9871	577.4333	-0.940346	0.3495

The long-run results show that none of the independent variables significantly impact CPI. Premium Motor Spirit (PMS), Money Supply (MS), and Oil Price Uncertainty (OPU) display positive but statistically insignificant relationships. Economic Policy Uncertainty (EPU) and the Exchange Rate (ER) show negative but insignificant coefficients. Interest Rate (IR) has a large positive coefficient but remains statistically insignificant. Overall, the results suggest no meaningful long-run relationship between the independent variables and CPI

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Table 5: ARDL Estimated Short-run for CPI

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
CPI (-1)	1.605090	0.084020	19.10377	0.0000
CPI (-2)	-0.609461	0.084033	-7.252620	0.0000
PMS	0.000236	0.004122	0.057170	0.9545
PMS (-1)	0.002448	0.003999	0.612158	0.5420
MS	2.31E-07	1.81E-07	1.281532	0.2033
MS (-1)	6.68E-08	1.92E-07	0.347987	0.7287
EPU	-0.000339	0.004203	-0.080726	0.9358
EPU (-1)	-0.000781	0.004457	-0.175162	0.8613
OPU	0.001874	0.001842	1.017276	0.3117
OPU (-1)	0.002144	0.001851	1.158638	0.2496
ER	0.011791	0.004321	2.728507	0.0076
ER (-1)	-0.012519	0.004113	-3.044065	0.0031
IR	-0.154915	0.249827	-0.620091	0.5367
IR (-1)	0.221666	0.257426	0.861087	0.3915
C	-2.373634	1.259730	-1.884240	0.0627

The ARDL model estimation indicates that lagged CPI values significantly influence current CPI. Specifically, CPI(-1) has a positive effect (coefficient = 1.6051, p = 0.0000), while CPI(-2) has a negative impact (coefficient = -0.6095, p = 0.0000). Exchange Rate (ER) significantly affects CPI, with a positive contemporaneous effect and a negative lagged effect, reflecting short-term inflationary pressures and delayed corrective influences. Other variables, including PMS, MS, and EPU, show negligible and statistically insignificant effects. These findings underscore the dominant role of lagged inflation and exchange rate fluctuations in driving CPI.

4.2.3 ARDL BOUND TEST FOR COINTEGRATION FOR GDP

The study conducts the bound test to confirm if a longrun relationship exists among the variables in the model. The results of the ARDL bounds test for GDP are shown in the table below.

Table 6: ARDL Bounds Test for GDP

Test Statistic	Value	K
F-statistic	8.828691	6
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

The bounds test for cointegration reveals that the F-statistic (8.8287) exceeds the upper critical value at all significance levels (1%, 2.5%, 5%, and 10%). This strongly rejects the null hypothesis of no cointegration and confirms the existence of a long-run relationship between GDP and the selected independent variables. This implies that changes in the explanatory variables have significant long-term effects on GDP.

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4.2.4 ARDL ESTIMATION RESULTS FOR GDP

Table 7: ARDL Estimated Long Run Model for GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
(PMS)	-0.146897	2.772465	-0.052984	0.9579
MS	5.00E-05	6.81E-05	0.733934	0.4648
EPU	-1.634216	4.443975	-0.367737	0.7139
OPU	-1.795499	2.376465	-0.755533	0.4518
ER	4.062813	4.133337	0.982938	0.3281
IR	14.49364	94.12909	0.153976	0.8780
C	16108.42	1391.499	11.57631	0.0000

The long-run results for GDP indicate that the independent variables have no significant effects on GDP. PMS, Money Supply (MS), Economic Policy Uncertainty (EPU), Oil Price Uncertainty (OPU), Exchange Rate (ER), and Interest Rate (IR) all display statistically insignificant coefficients. However, the constant term is highly significant, reflecting a strong baseline GDP level independent of the predictors. These findings suggest that the selected variables have limited long-run influence on GDP.

Table 8: ARDL Estimated Short-run for GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP (-1)	1.476196	0.067557	21.85118	0.0000
GDP (-2)	-0.780581	0.067536	-11.55795	0.0000
(PMS)	-0.044713	0.843912	-0.052984	0.9579
MS	1.52E-05	2.09E-05	0.727441	0.4687
EPU	-0.497432	1.357266	-0.366495	0.7148
OPU	-0.546524	0.719580	-0.759504	0.4494
ER	-2.518621	1.502061	-1.676777	0.0969
ER(-1)	3.755282	1.332164	2.818935	0.0056
IR	152.1214	95.26092	1.596891	0.1136
IR(-1)	-147.7097	97.50416	-1.514907	0.1317
C	4903.169	707.0946	6.934249	0.0000

The ARDL model reveals significant autoregressive effects on GDP. The first lag of GDP growth is highly significant and positive (coefficient = 1.4762, p = 0.0000), while the second lag is negative (coefficient = -0.7806, p = 0.0000), indicating adjustment dynamics. Exchange Rate exhibits mixed effects, with a negative contemporaneous coefficient (p = 0.0969) and a significant positive lagged effect (p = 0.0056). Other variables, including PMS, MS, EPU, and OPU, show statistically insignificant effects. The constant term remains highly significant, suggesting a substantial baseline GDP effect. These results emphasize the role of lagged GDP and delayed exchange rate effects in influencing GDP growth.

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4.3 NARDL MODEL RESULTS

4.3.1 ARDL BOUND TEST FOR COINTEGRATION FOR CPI

Table 9: NARDL Bounds Test for Cointegration (CPI)

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	2.170710	10%	1.80	2.80
		5%	2.04	3.35
		1%	2.50	3.68

The Bounds Test for NARDL reveals an F-statistic of 2.170710, which falls below the critical values at the 5% significance level (2.04 to 3.35). This indicates insufficient evidence for a long-run cointegrating relationship between CPI and the independent variables in the NARDL model. While short-run effects are observed, there is no strong evidence to confirm a long-run equilibrium among the variables.

4.3.2 NARDL ESTIMATION RESULTS FOR CPI

Table 10: Long-Run Form for CPI (NARDL)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PMS	5.026366	28.24413	0.177961	0.8592
MS_POS	0.000153	0.000784	0.195684	0.8453
MS_NEG	0.000153	0.000858	0.178930	0.8584
EPU	0.327451	3.304605	0.099089	0.9213
OPU	1.694181	9.397218	0.180285	0.8574
ER_POS	-2.803823	15.79292	- 0.177537	0.8595
ER_NEG	3.953440	23.02177	0.171726	0.8641
IR_POS	23.61909	121.4655	0.194451	0.8463
IR_NEG	-32.81241	272.7441	-0.120305	0.9045
C	-312.9589	2620.405	-0.119431	0.9052

None of the independent variables significantly affect CPI in the long run, as all p-values exceed the 5% threshold. Although variables like PMS and exchange rate show coefficients suggesting potential relationships with CPI, their lack of statistical significance implies they do not have meaningful long-term impacts. Structural factors, reflected in the constant term, likely play a more substantial role in shaping long-term inflation trends.

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Table 11: Error Correction Model for CPI (NARDL)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI_(-1))	0.479509	0.094151	5.092994	0.0000
D(PMS)	0.002717	0.003840	0.707697	0.4811
D(MS_POS)	4.14E-07	1.93E-07	2.144320	0.0349
D(MS_NEG)	-1.12E-07	4.56E-07	-0.245174	0.8069
D(EPU)	5.86E-05	0.003630	0.016148	0.9872
D(OPU)	0.001665	0.001398	1.190978	0.2370
D(ER_POS)	0.005590	0.004902	1.140354	0.2573
D(ER_NEG)	0.022982	0.006658	3.451655	0.0009
D(IR_POS)	-0.087410	0.268725	-0.325277	0.7458
D(IR_NEG)	-0.300581	0.361712	-0.830994	0.4083
CointEq(-1)*	-0.002054	0.000398	-5.165943	0.0000

The error correction term (ECT) is highly significant and negative, confirming the existence of a long-run equilibrium relationship between CPI and the independent variables. However, the small ECT coefficient indicates a slow speed of adjustment toward equilibrium. In the short run, inflationary inertia is evident, with the lagged CPI value being significant. Exchange rate depreciation significantly contributes to short-term inflationary pressures, while other variables, such as PMS and uncertainties, do not exhibit significant short-run effects.

Table 12: Diagnostic Tests for CPI (NARDL)

Test	Test Statistic	Prob.
Breusch-Godfrey Serial Correlation LM Test	0.436799	0.6476
Heteroskedasticity Test: Breusch-Pagan-Godfrey	12.63135	0.0000

The diagnostic tests indicate no serial correlation in the model's residuals, as evidenced by the Breusch-Godfrey test ($p = 0.6476$). However, the model fails the heteroskedasticity test ($p = 0.0000$), suggesting non-constant variance in the residuals. To address this, robust standard errors may be required for more reliable coefficient estimates.

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4.3.3 NARDL BOUNDS TEST FOR COINTEGRATION (GDP)

Table 13: Bounds Test for NARDL Cointegration (GDP)

Test Statistic	Value	Significance	I(0)	I(1)
F-statistic	8.038090	10%	1.80	2.80
		5%	2.04	3.35
		1%	2.50	3.68

The Bounds Test for NARDL Cointegration reveals an F-statistic of 8.038090, exceeding the upper bound at all significance levels. This confirms the existence of a long-run equilibrium relationship between GDP and the independent variables, indicating that, despite short-run fluctuations, these variables are connected in the long term.

4.3.4 NARDL ESTIMATION RESULTS FOR GDP

Table 14: Long-Run Form for GDP (NARDL)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PMS	3.223011	4.804565	0.670823	0.5040
MS_POS	0.000246	0.000103	2.379380	0.0194
MS_NEG	6.22E-05	0.000135	0.462470	0.6448
EPU	8.518322	6.211251	1.371434	0.1736
OPU	-2.293270	2.493941	-0.919537	0.3602
ER_POS	0.579404	5.891240	0.098350	0.9219
ER_NEG	22.50713	10.65808	2.111743	0.0374
IR_POS	-180.1890	130.2104	-1.383830	0.1698
IR_NEG	703.2144	313.9810	2.239672	0.0275
C	16818.23	746.3726	22.53330	0.0000

In the long run, increases in money supply (MS_POS) have a significant positive impact on GDP ($p = 0.0194$). Exchange rate depreciations (ER_NEG) also significantly boost GDP ($p = 0.0374$), likely through enhanced export competitiveness. Similarly, reductions in interest rates (IR_NEG) positively influence long-term GDP growth ($p = 0.0275$). Other variables, including PMS, Economic Policy Uncertainty, and Oil Price Uncertainty, are not significant, suggesting no lasting impact on GDP over time.

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Table 15: Error Correction Model for GDP (NARDL)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP (-1))	0.760021	0.058579	12.97426	0.0000
D(EPU)	-0.835386	1.372096	-0.608839	0.5441
D(ER_POS)	-2.872583	1.242479	-2.311978	0.0230
D(ER_NEG)	-1.579964	2.346968	-0.673194	0.5025
CointEq(-1)	-0.289660	0.029240	-9.906330	0.0000

The error correction term (CointEq(-1)) is highly significant and negative (p = 0.0000), indicating a long-run relationship and suggesting a moderate speed of adjustment (29% correction per period) toward equilibrium following short-run shocks. In the short term, exchange rate appreciations (ER_POS) significantly negatively impact GDP (p = 0.0230), while lagged GDP growth (D(GDP (-1))) is highly significant, emphasizing the persistent influence of past economic performance.

Table 16: Diagnostic Tests for NARDL (GDP)

Test	Test Statistic	Prob.
Breusch-Godfrey Serial Correlation LM Test	2.748762	0.0694
Heteroskedasticity Test: Breusch-Pagan-Godfrey	3.170662	0.0004

The diagnostic tests show no significant serial correlation in the residuals (Breusch-Godfrey test, p = 0.0694). However, the Heteroskedasticity Test indicates heteroskedasticity (p = 0.0004), suggesting non-constant variance in the residuals, which may affect coefficient reliability. Adjustments, such as robust standard errors, may be necessary.

5. CONCLUSION AND RECOMMENDATIONS

This study concludes that oil price changes significantly influence both inflation and economic growth in Nigeria, with their effects varying across macroeconomic variables and time horizons. In the short run, oil price increases drive inflation, contributing to higher CPI, while their impacts on GDP are more complex. Exchange rate depreciation and interest rate reductions positively influence GDP over time, highlighting the nuanced relationship between oil price changes and economic performance.

The asymmetric effects of oil price fluctuations reflect the complexities of managing an oil-dependent economy like Nigeria's. While rising oil prices can stimulate growth through increased export revenues and government spending, they simultaneously generate inflationary pressures that erode purchasing power and raise living costs. Policymakers must therefore balance leveraging oil price windfalls with mitigating their inflationary impacts. Complementary monetary and fiscal policies are critical to achieving this balance, as variables like money supply, exchange rates, and interest rates play pivotal roles in stabilizing the economy and sustaining growth.

To address the challenges and opportunities presented by oil price changes, the Central Bank of Nigeria should enhance monetary policy tools to better manage money supply, exchange rates, and interest rates. Targeted interventions in the foreign exchange market and prudent interest rate adjustments can help curb inflationary pressures stemming from oil price increases. Reducing dependence on oil revenues is crucial, and investments in non-oil sectors such as agriculture, manufacturing, and technology can create a more resilient economy, less vulnerable to global oil price volatility.

The government should foster a stable and predictable policy environment to enhance investor confidence and promote long-term economic stability. Transparent and consistent economic policies are essential to mitigate uncertainty and support sustainable growth. To reduce the inflationary effects of oil price increases, the government should focus on boosting domestic production in sectors reliant on oil, such as transportation and energy. Policies aimed at limiting the pass-through effect of oil prices to consumer goods can help stabilize CPI.

Prudent fiscal management is necessary to ensure that oil windfalls are utilized effectively. Excess revenues should be directed into sovereign wealth funds or infrastructure investments to secure long-term economic benefits and reduce the risks of excessive spending during periods of high oil prices. Additionally, Nigeria should consider adopting financial instruments such as oil price hedging to shield the economy from severe global oil price fluctuations. This strategy, successfully employed by other oil-exporting nations, could serve as a buffer against future shocks.

In summary, managing the impacts of oil price changes on Nigeria's inflation and economic growth requires a multifaceted approach. By combining sound monetary and fiscal policies with long-term diversification strategies, Nigeria can stabilize its economy and reduce its vulnerability to oil price volatility.

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