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AN ARDL ANALYSIS ON THE EFFECT OF OIL PRICE INSTABILITY ON FOREIGN RESERVE IN NIGERIA (2015-2022)

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ABSTRACT

The auto regressive distributive lag (ARDL) model was utilised in this paper to investigate the impact of oil price volatility on Nigeria's foreign reserve by analysing current monthly time series data spanning the years 2015–2022. The long-term relationship between the volatility of oil prices and foreign reserves is confirmed by the presence of cointegration in the model, as evidenced by the results of ARDL Bound cointegration. The results of the ARDL long-term analysis demonstrate that fluctuations in oil prices have a substantial and adverse impact on foreign reserves. Similarly, foreign reserve is significantly and negatively impacted by the rate of inflation. However, it has been discovered that oil revenue significantly and favourably affects foreign reserve. Additionally, the short run estimates from ARDL suggest that there is a short-term correlation between oil prices and foreign reserves. Based on the results, the coefficient of error correction term shows that each month, almost 30% of the difference between the long-run or equilibrium value of foreign reserve and its actual value is eliminated or corrected. Additionally, the Granger causality test results show a unidirectional causal relationship between the volatility of oil prices and foreign reserves. The study makes the recommendation that policy makers adopt a framework for policy that will eliminate corruption and guarantee macroeconomic stability based on the empirical findings. Additionally, policymakers must to take action to lessen the detrimental effects that changes in oil prices have on Nigeria's foreign reserve.

Key terms: Oil Price Instability; Foreign Reserve; ARDL; Granger Causality Test; Nigeria

INTRODUCTION

Since oil was discovered in the 1970s, the Nigerian economy has relied mostly on oil exports as a source of income and GDP. Nigeria earns a substantial amount of foreign cash through its oil exports. Additionally, it finances national development programmes, infrastructure improvements, and government budgets. The money obtained from oil exports is also utilised for the import of goods and services, such as machinery, technology, and necessities from other nations. Since oil exports make up an average of 80% of government revenue, foreign exchange earnings, and government budget, they play a crucial role in the conduct of Nigeria's fiscal and monetary policies.

Due to ongoing supply and demand shocks in the global crude oil market, oil producing exporters have been subject to price swings in recent years (Hamilton, 1983, Lorruso and Pierroni, 2015). From US$25 per barrel in 2002 to US$55 in 2005, the price of oil increased until reaching a peak of US$138 in 2008. Oil prices fell precipitously as a result of the global financial crisis, which began in the second quarter of 2008 and reached an average of $30 in the US in 2016. As of 2016, the price of a barrel of oil has been comparatively steady, ranging from $50 to $80. In the meanwhile, the 2020 COVID-19 pandemic caused an unprecedented drop in oil prices, with crude briefly trading below US$37 (CBN, 2022). Global economies started to recover from the epidemic in 2021, and oil prices slowly stabilised at between US$65 and US$80 per barrel.

Nigeria's economy is more susceptible to changes in the price of oil due to its excessive reliance on oil exports. When oil prices are high, the nation's economy prospers as a result of increased revenue from oil exports. Nigeria's economy, however, suffers when oil prices decline since the nation receives less money from oil exports and may find it difficult to meet its financial obligations. The devaluation of the Nigerian currency, as well as the reduction of foreign reserves, the balance of payments, and the general economic stability of the nation, have been brought about by the erratic behaviour of oil prices in the world oil market (Michael, 2017). Variations in oil prices have a negative impact on economic expansion, cause panics on stock exchanges, and cause inflation, all of which contribute to monetary and financial instability. Since crude oil is the foundation of Nigeria's economy, a decline in its price typically has a negative impact on both the country's economic progress and the well-being of its citizens throughout.

Building up foreign reserves has been an important tool adopted in Nigeria to mitigate the potential effects of oil price fluctuations on its economy. The foreign reserves are assets held in reserve by a government in the event of an economic emergency, such as a rapid decline in oil prices. It can be used to fund imports, debt service, and other financial commitments. The International Monetary Fund (IMF) defines foreign reserves as foreign assets that are readily available to, and controlled by the monetary authorities, for direct financing of payment imbalances, and directly regulating the magnitude of such imbalances, through intervention in the exchange market. The

management of foreign reserves is crucial for economic stability, as reserves play a role in supporting the national currency, facilitating international trade, and managing external debt. The governments typically aim to build and maintain an adequate level of foreign reserves to cushion against economic shocks and ensure stability. The international community places confidence on any country with adequate foreign reserves to secure international creditworthiness recognition and it also makes obtaining external debt easier.

Despite the potential role of foreign reserve in mitigating oil shocks, accumulating foreign reserve has been challenging in Nigeria as its economy is weak and financially unstable to cope with the influences of external shocks. Kalu (2019) found that a fluctuation in the oil price in the international market has led to instability in Nigeria external reserves which in turn resulted to the drastic devaluation in the country currency. High level of Corruption, resource mismanagement and external trade dynamics also undermines the effective use of foreign exchange earnings in Nigeria, leading to a decline in foreign reserves (Shiro, 2022). Other factors such as lack of economic diversification, infrastructure development, and effective governance also contribute for decline in foreign reserve.

In an effort to reduce vulnerability of foreign reserve to oil shocks, several studies have assessed the relationship between oil price fluctuations and foreign reserve (Uguru 2015; Babajide and Soile 2015; Zhao et al. 2016; Babalola, Akindele and Rotimi, 2018; Shiro, 2022). However, their findings have been inconclusive. While some authors (e.g. Ani et al., 2014) argued that oil price fluctuations do not influence foreign reserve. Others (e.g. Babajide and Soile 2015; Uguru 2015);) maintained that oil price changes affect foreign reserve. In contrast, Zhao et al. (2016) and Alhassan and Kilishi (2016) provided empirical evidence that oil price fluctuations affect only economies of oil exporting countries.

This paper examined the effect of oil price instability on foreign reserve in Nigeria using monthly time series data for the period of 2015-2022. The paper improved on the existing literature as it captures the potential effects of oil price instability on foreign reserve in Nigeria within the context of the global economic crises, post global economic crisis and the recession that the country experienced during the study period. The

relevance of this study cannot be overemphasised as it recommend empirical based suggestions that lessen the nation's reliance on oil exports and increase the economy's resistance to oil shocks. It also offers effective strategies to minimizing the effects of oil price variations on foreign reserve in Nigeria. The paper also provided policymakers with empirical based measures to manage the country's economy by understanding how oil price fluctuations affect Nigeria's foreign reserve.

To achieve the foregoing objective, the remaining paper is structured into four sections. Section two presents empirical literature. The third section focuses on methodology. Section four presents results and discussion while section five offers some concluding remarks and recommendations.

Review of Related Literature

The potential impact of oil price fluctuations on real sector has stimulated the interest of scholars in assessing the effect of oil price shocks on foreign reserve and economic activities. In this vein, Uguru (2015) examined the effects of oil price instability, foreign exchange rate instability on external reserves in Nigeria from 1999 to 2009. The study reaffirms that the nation's external account was pruned to fluctuations in the global oil prices. Similarly, Babajide and Soile (2015) employed ARDL and vector error correction model to examined effect of oil price shocks on economic activity in Nigeria using quarterly data from 1980 to 2011. They found that oil price shocks and their transmission channels have negative and significant on selected macroeconomic variables which served as proxies for economic activities in Nigeria.

Furthermore, Alhassan and Kilishi (2016) used impulse response function and the variance decomposition analysis to examine the impact of oil shocks on the Nigerian economy. The result showed that oil price shocks adversely affect trade balance, inflation, government revenue, and exchange rate. The study indicated that oil price decrease affected macroeconomic indicators than oil price increase. However, the study has not established asymmetric relationship between oil price shocks and GDP as the effects were found to be minimal the analysis. Also, Augustine (2015) examined the nexus and the magnitude of the effects of oil price fluctuations on Nigerian economic performance. The variables employed as a measure of economic performance include

gross domestic product, real exchange rate, trade openness, inflation and terms of trade. The study found that oil price shocks led to macroeconomic fluctuations in Nigeria.

At the general level, Zhao et al. (2016) used open-economy dynamic stochastic general equilibrium (DSGE) model to assess the impact of oil price shocks on output and inflation in the Chinese economy. The study categorized four types of oil price shocks to include supply shocks driven by political events in OPEC countries, other oil supply shocks, aggregate shocks to the demand for industrial commodities, and demand shocks that are specific to the crude oil market. The study revealed that the first shock mainly accounts for short-term changes to output and inflation in China, while the other three shocks lead to relatively long-term effects. Demand shocks that are specific to the crude oil market add the most to the variations in China's output and inflation. In the same vein, Conflitti and Luciani (2017) examined the oil price pass-through to inflation in both the US and Euro area utilizing dynamic factor models and VAR. After distinguishing between the common and idiosyncratic effects of oil price shocks on inflation, the study showed that oil price influences inflation mainly through the common effect, the pass-through was small, but significant and long lasting.

Using the simple regression analysis, Pearson product moment correlation and chi square, Nwoba, Nwonu, and Agbaeze (2017) considered the correlative effect of oil price shocks on economic growth indicators spanning from 2011 - 2015. They found that oil price fluctuations have negative and significant effect on foreign exchange earnings. Similarly, Babalola, Akindele and Rotimi (2018) examined the effect of crude oil prices on government revenue in Nigeria. The Vector Auto-regression (VAR) and impulse response analysis revealed that crude oil price shocks affected government revenue.

In recent time, Bawa et al (2020), utilized the NARDL approach and quarterly data for the period 1999 – 2018 to axamine the effect of oil price fluctuations on headline, core and food inflation in Nigeria. The results of their asymmetric analysis indicated that oil price increase significantly impacted on headline, core and food inflation in Nigeria. However, they conclude that oil price fluctuations at the international commodities market affect all economies of the world including the oil producers. Global oil price shocks often

impacted these economies through a number of channels.

The reviewed literature suggests a paucity of studies on effect of oil price instability on foreign reserve in developing countries. In addition, there is no empirical study has so far been published to examine the relationship oil price instability on foreign reserve in Nigeria using recent data covering the most recent economic recession that gripped Nigeria between 201o and 2020.

Methodology

a. Source of Data

The study employed monthly time series data spanning from January 2015 to December 2022 to examine both the long and short-run effect of oil price instability on foreign reserve in Nigeria using ARDL analysis. The data were sourced online from the website of Central Bank of Nigeria (www.cbn.gov.ng). This period was chosen in order to capture the effects of oil price instability on foreign reserve in Nigeria within the context of the global economic crises, post global economic crisis and the recession that the country experience from 2016 to 2022.

b. Model Specification

Following Bawa et al. (2016) the econometric model to examine the effects of oil price fluctuations on foreign reserve in Nigeria is specified as:

(1)

Where:

FR=Foreign Reserve

0PF = Oil Price Fluctuations

INF= Inflation OR=Oil Revenue

μ= Error Term

1; 2; 3 and 4 = Parameters of the explanatory variables included in the model

Technique of Data Analysis

The paper adopted an autoregressive distributed lag (ARDL) model as a statistical tool of the analysis. In addition, it also employed granger causality test to ascertain the direction of causality between the variables used for the study, namely oil prie stability. The ARDL model is an ordinary least square technique based model which is applicable for both first difference stationary time series variables as well as for time series with mixed order of integration. To capture both the short run and long run the econometric model presented in equation 1 is

framed in an ARDL setting along the line of Pesaran and Shin (1999) and Pesaran et al. (2001) as:

Where:

All variables in the model are as defined in equation one (1)

, and denote the long run coefficients

represents the short run coefficients.

Results and Discussion

Trend of Oil Price, Foreign Reserve, Inflation Rate and Oil Revenue

Figure 1 presents the trend of all the variables of the study for the period of 7 years from 2015-2022. The variables include: Foreign reserve (FR) as the dependent variable, while OIL price fluctuations (OPF), Inflation (INF), and Oil revenue (OR) as the independent variables.

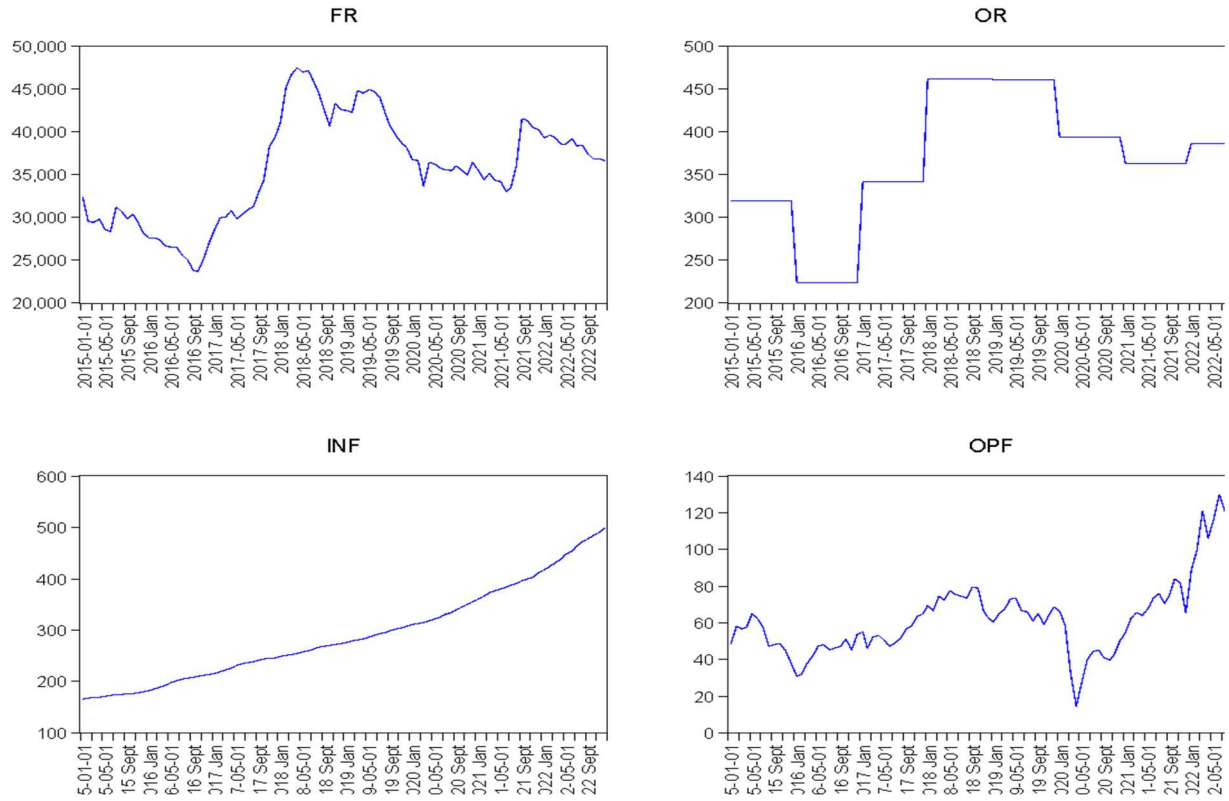


Figure 1 Source: Author's computation, Eviews 9

The trends of all the variables are inconsistent over the period of study spanning from 2015 - 2022. As shown in the Figure 1, the foreign reserves position has been fluctuating over the years. The foreign reserve was at its peak in January of 2018 and it was at its lowest

point in September, 2016. Likewise oil prices and oil revenue have been fluctuating over the years; they were at its lowest point in 2020 and highest in 2022. Inflation on the other hand has a constant upward trend and has been increasing from 2017 January until December 2022 and it was at its peak in December 2022.

Results of Unit Root Test

In order to avoid spurious regression, the paper first conduct unit root test to check the stationary of the variables in the study. A time series is stationary if the statistical features of the distribution, namely, mean, variance and covariance, remain constant across time. The results of ADF unit root test presented in Table 1 shows that LFR (Foreign reserve), LOP (Oil price) and LOR (Oil revenue) were stationary at level while Inflation (INF) was stationary at first difference. This satisfies the condition for ARDL analysis.

Table 1: Results of Unit Root Test

VARIABLES	ADF UNIT ROOT TEST				Order of Integration
	LEVEL		1st Difference		
	T-Statistics	Prob	T-statistics	Prob	
LFR	0.477119	0.8162	-7.718495 ***	0.0000	I(1)
LOP	0.142384	0.7250	-8.063864 ***	0.0000	I(1)
LOR	0.235658	0.7525	-9.643651 ***	0.0000	I(1)
INF	3.963869**	0.9992	----------	----------	I(0)

******, ** and * denotes 1%, 5% and 10% significance of levels respectively***

Source: Author's computation, Eviews 9

Results of ARDL Bound Cointegration Test

The result of the ARDL Bounds test presented in Table 2 revealed that the value of F-statistic (6.4) is greater than lower bound I(0) and the upper bound I(1) at all the levels of significance. This confirm that a long run relationship between the variables of the study,

Table 2: Results of ARDL Bound Cointegration Test

T Statistic	Value	K
F- Statistic	6.40	3
Critical Value Bounds		
Significance	**I(0) Bound**	**I(1) Bound**
10%	2.72	3.77
5%	3.23	4.35
2.5%	3.69	4.89
1%	4.29	5.61

Source : Author's computation, Eviews 9

In the presence of cointegration as presented in Table 1, the paper goes further to assess the effect of oil price instability on Foreign Reserve in Nigeria using ARDL model.

Results on the effect of oil price instability on foreign reserve in Nigeria

The results of the ARDL short run estimates presented in Table 4.5 shows that foreign reserve at lag 1 and 2 have positive and significant on the current value of foreign reserve. Likewise, oil revenue at lag 3 has positive and significant effect on the current value of foreign reserve. As expected, the error correction term for the model is less than one (0.30) with a negative sign and is statistically significant at one percent. This indicates that in the case of any downswing in the foreign reserve, the system may correct itself in 4 months at the monthly speed of adjustment of 30%.

	Variable	Coefficient	Std.Error	T-statistic	Prob.
Short Run Estimates	**LFR(-1)**	1.059599	0.110647	9.576374	0.0000
	LFR(-2)	0.242641	0.100173	2.422223	0.0176
	LOPF	0.019513	0.014656	1.331404	0.1867
	INF	0.004709	0.005375	0.875959	0.3836
	INF(-1)	-0.009985	0.010916	-0.914706	0.3630
	INF(-2)	-0.003674	0.011232	-0.327081	0.7444
	LOR	0.094856	0.040829	2.323241	0.0226
	EC	1.259151	0.350537	3.592066	0.0006
Long Run Estimates	**LOPF**	-0.239641	0.100187	-2.42123	0.0174
	INF	0.000110	0.000101	1.087556	0.2796
	-LOR	-0.671068	0.038631	-17.37104	0.0000

Table 3: Results on the effect of oil price instability on foreign reserve

******, ** and * denotes 1%, 5% and 10% significance of levels respectively***

Source: Author's computation, Eviews 9

Furthermore, the results of the ARDL long run estimates presented in Table 3 shows that both oil price fluctuations and oil revenue have a negative and significant effect on foreign reserve position at 5% level of significance. The results indicate that a change in oil price by one naira will lead to decrease in foreign reserve by 23% and 67% respectively. However, the result suggests that inflation rate has a positive sign, but it has no significant impact on foreign reserve. The results were in tandem with those of Shiro et al. (2022) which revealed that oil price has an asymmetric relation with foreign reserve.

Result of the Granger Causality Test

The results of granger causality test presented in Table 3 indicate that there is unidirectional causality between oil price fluctuations and foreign reserve. In other words, oil price fluctuations granger causes foreign reserve in Nigeria.

Table 3: Results of Granger Causality Test

Null Hypothesis	F-Statistic	Prob.
LOPF does not Granger Cause LFR	3.36300	0.0166
LFR does not Granger Cause LOPF	0.50035	0.1005
INF does not Granger Cause LFR	2.80270	0.0660
LFR does not Granger Cause INF	1.01749	0.3657
LOR does not Granger Cause LFR	1.92834	0.1514
LFR does not Granger Cause LOR	1.29671	0.1828
INF does not Granger Cause LOPF	3.31903	0.0407
LOPF does not Granger Cause INF	0.76283	0.4694
LOR does not Granger Cause LOPF	0.50197	0.6070
LOPF does not Granger Cause LOR	1.04046	0.3576
LOR does not Granger Cause INF	1.69390	0.1897
INF does not Granger Cause LOR	0.74027	0.4799

Source: Author's computation, Eviews 9

Furthermore, the findings show that there is unidirectional causality between inflation rate and foreign reserve. Finally, the results also show that inflation granger foreign reserve in Nigeria.

Stability Test

The paper conducted LM diagnostic tests for testing structural stability of the models. The result of LM test presented in Table 5 indicates that all the two models are stable and free from serial correlation.

Table 5: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.091	Prob. F(2.21)	0.3485
Obs*R-squared	2.56384	Prob. Chi Square(2)	0.2775

The result of Breusch-Godfrey Serial Correlation LM Test table 5 present the has probability of the chi-square (2) is 0.2775 and this is greater than 0.05 at 5% significance level and therefore the null hypothesis is

accepted. This implies and therefore confirms the absence of serial correlation

Summary and Conclusion

This paper employed ARDL model to examine the effect of oil price instability on foreign reserves in Nigeria using monthly time series variables covering 96 months (7 years) over the period of 2015-2022. The findings revealed that oil price fluctuations have a negative and significant effect on foreign reserve. The results of granger causality further suggest a unidirectional causal relationship between oil price fluctuations and foreign reserve. The empirical findings of the paper demonstrated the crucial relevance of mitigating the impact of fluctuations in oil prices on Nigeria's foreign reserves. Based on the empirical findings, the paper concludes that Nigeria as a country with great potential beyond oil resources should diversity its economy and invests in a diverse range of economic activities, such as agriculture, manufacturing, and services. There is also the need for the policy makers to adopt an effective policy framework that will get rid of corruption and ensure macroeconomic stability. It is expected that the pursuit of such measures would minimize the country's over reliance on volatile oil markets, create long-term economic growth, and protect the well-being of its population in an increasingly volatile global economy.

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