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Assessing the Impact of Changes in Crude Oil Prices and Exchange Rates on the Performance of Nigeria's Stock Market

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Abstract:- This study assessed the impact of changes in crude oil prices and exchange rates on the performance of Nigeria's stock market. The analytical method used include: the ADF unit root test, ARDL bound test co-integration, ECM, and Pair-Wise Granger causality test. The study made use of yearly time series data that covered the years 1986 to 2022. According to the ARDL projections, the early favorable effects of crude oil prices eventually turn negative as a result of inflationary pressure. The short-run implications were confirmed by error correction modeling. Granger causality studies revealed that there is a bidirectional causal link between exchange rates and stock market performance, but not between the price of crude oil and stock market performance. The empirical models demonstrated diagnostic validity. Key findings show that oil prices and macroeconomic factors such as interest and inflation rates drive Nigeria's stock market. The paper recommends diversifying the economy by developing other sectors such as agriculture, manufacturing and services. This would alleviate excessive dependence on oil exports and insulate the stock market from associated vulnerability. It also recommends increasing investor education and awareness, monitoring inflation and interest rates, and managing exchange rate fluctuations.

Keywords:- *Stock market performance, crude oil price, exchange rate, inflation and interest rate, ARDL.*

I. INTRODUCTION

Crude oil plays a pivotal role in Nigeria's economy, accounting for the bulk of exports, government revenue, and foreign exchange earnings since commercial production began in the late 1950s following initial discoveries (EIA, 2016; CBN, 2015). However, excessive dependence on an unstable commodities has created structural challenges. Oil prices are highly volatile on global markets. Nigeria's heavy reliance on oil revenues and the sensitivity of its exchange rate to crude price movements cause recurring macroeconomic instability. When oil prices rise, Nigeria's currency, the naira, tends to appreciate as foreign reserves swell, making domestic stocks cheaper for foreign investors and boosting capital inflows into the equity market. However, oil price declines depreciate the naira, reducing the relative value of Nigerian equities for foreign investors and dampening foreign capital flows into the stock exchange, which depends on them for liquidity. Therefore, the naira exchange rate transmits global oil shocks into the domestic stock market (EIA, 2016). Successive governments have formulated policies to diversify the oil-dependent economy and achieve sustained non-oil growth, but with limited results so far. Persistent dependence on crude oil revenues continues to expose Nigeria to external volatility. Recent global shocks such as the COVID-19 pandemic have further highlighted these structural weaknesses. While past studies have analysed oil-exchange rate-stock market linkages in Nigeria, some limitations persist. The relatively short data periods, narrow methodologies, and lack of simultaneous long-term analysis of oil prices and exchange rate impacts on equities limit the generalizability of findings. Moreover, insufficient attention has been paid to other relevant macroeconomic variables such as inflation, interest rates and evolving global conditions. This study aims to address these research gaps using robust time series econometric techniques such as ARDL and Granger causality over longer data spans encompassing recent periods of global volatility. The simultaneous examination of oil prices, the naira exchange rate, and Nigerian stock market performance while controlling for key macroeconomic variables will provide enhanced empirical insights into this relationship. The findings can inform sound policies to manage oil and forex risks to support the capital market and broader economic development. The policy learnings are also relevant for other emerging commodity-dependent economies seeking greater resilience to external resource price shocks. Overall, a rigorous empirical analysis of the oil-exchange rate-stock market nexus covering recent periods of global uncertainty can make important contributions to the extant literature. The enriched understanding will provide Nigerian policymakers with useful guidance in navigating the complex linkages between these variables to promote the country's macroeconomic and financial market stability.

The rest of the paper, aside from the introduction, which occupies section one is arranged as follows: Section 2 reviews relevant literature, Section 3 outlines the methodology, and Results and Discussion of Findings are presented in Section 4. Section 5 contains the Conclusion and Recommendations.

II. LITERATURE REVIEW

A. Conceptual Framework

This conceptual framework diagram provides a schematic representation of the theory-based causal linkages hypothesised in this study. The arrow from Independent Variables to Mediating Variables represents hypothesised relationships, whereas the arrow from Mediating Variables to Dependent Variable represents impact pathways. Plus (+) and minus (-) signs on arrows indicate expected positive or negative relationships. The arrow pointing from the Mediating Variables towards Stock market performance indicates the various channels through which crude oil price and forex can influence the stock market. These channels are known as multiple transmission mechanisms.

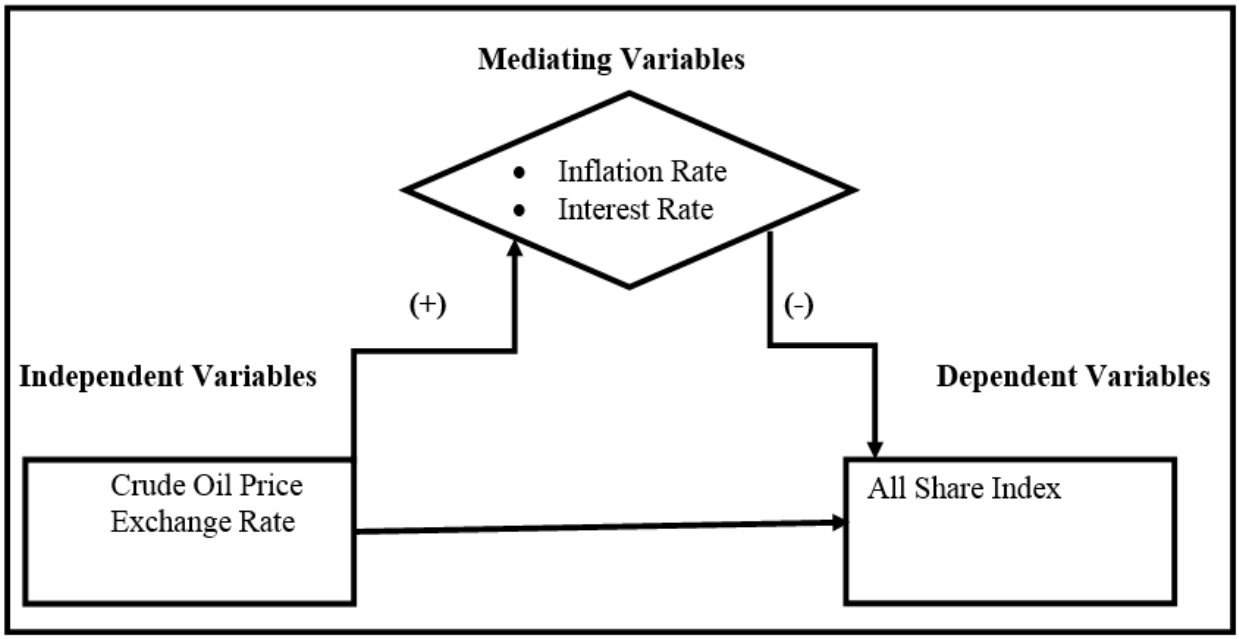

Fig. 1: Conceptual Framework Diagram
Source: Authors' Design

B. Theoretical Literature

Various theories have been presented in the last few decades that link crude oil prices, exchange rates, the stock market, and economic growth. They include:

- *Portfolio Balance Theory*

The Portfolio Balance Theory provides insights into how fluctuations in commodity prices such as oil and exchange rates influence the relative attractiveness of stocks across countries for investors. It posits that investors hold diversified hold a portfolios of assets, such as stocks, bonds, and commodities, with the goal of maximising their returns and minimising their risk. When oil prices rise, oil-exporting countries benefit from higher revenues. Their economic prospects improve, making their stocks more appealing to investors, which is reflected in stock market gains. Similarly, currency depreciation makes a country's stocks cheaper for foreign investors, thereby enhancing capital inflows and stock performance. The theory highlights cross border investment implications of commodity and currency movements.

- *Monetary Theory of Exchange Rates*

The Monetary Theory of Exchange Rates establishes a relationship between money supply and demand dynamics and exchange rate determination. It states that exchange rates are driven by relative money demand and supply between countries. Economic growth spurs money demand as transaction volumes increase. Higher money demand raises a currency's value, making exports expensive and imports cheaper. This improves trade balance and economic prospects as reflected in stock market gains. In contrast, money supply expansion through quantitative easing makes a currency less scarce, thereby reducing its worth and competitiveness. The consequent inflationary pressures and economic weakness dampen the stock market. The theory emphasises analysing monetary factors alongside trade and growth dynamics to understand exchange rate-stock market connections.

- *Resource curse hypothesis*

The resource curse hypothesis argues that heavy dependence on natural resource exports such as oil correlates with poor stock market outcomes due to commodity price volatility. For major oil exporters, oil revenue fluctuations significantly impact government budgets. High oil prices increase government revenues, enabling higher spending and investment, thus boosting stock markets. Low oil prices shrink revenues, necessitating spending cuts and dampening stock market activity. Furthermore, the abundance of natural resource endowments can result in Dutch disease, whereby a booming resource sector causes currency appreciation and crowds out other exports and investments. The resultant economic underperformance depresses the stock markets. The theory highlights the risks for resource-dependent countries from commodity price volatility and reduced economic diversification pressures on long-term stock market development.

➢ *The monetary approach to the balance of payments*

The monetary approach to the balance of payments provides another lens to analyse the impact of exchange rate changes on stock market performance, through the channels of trade balances and inflation. It posits that a country's balance of payments, reflecting transactions with the rest of the world, depends on monetary factors such as domestic money supply and interest rates.

According to this theory, currency appreciation makes a country's exports more expensive, thereby reducing its export competitiveness. This decreases the trade balance and overall balance of payments. Deterioration in the balance of payments signals weaker economic prospects, dampening investor appetite and equity prices. Additionally, currency appreciation increases import prices fueling, inflationary pressures. Higher inflation typically hampers stock investment and returns.

Conversely, currency depreciation makes exports cheaper and more competitive globally. This could improve the trade balance and overall balance of payments, signalling stronger economic conditions. Furthermore, lower import prices ease inflationary pressures. Lower inflation provides a more attractive stock investment climate. Thus, the monetary balance of payments approach indicates that exchange rate movements can impact stock markets through trade balance and inflation channels.

For a commodity exporter like Nigeria, exchange rate fluctuations significantly influence its exports, trade balance, and inflation, given its reliance on oil exports. Naira appreciation due to positive oil shocks could reduce non-oil export competitiveness and stoke inflation, whereas depreciation could have opposite effects. The net impact on the Nigerian stock market would depend on the relative strength of these countervailing mechanisms. Detailed empirical analysis is required to determine the actual magnitude and direction of the effects and causal relationships between the variables over time.

In summary, the Portfolio Balance, Monetary, Dutch Disease, and Balance of Payments theories provide interconnected frameworks that posit a significant influence of oil prices and exchange rates on stock market performance through wealth effects, relative competitiveness, money demand-supply, resource crowding out, and trade balance mechanisms. However, empirical research needs to analyse the relative dominance of positive and negative transmission channels across different time horizons to determine the net impact suitable for policy insights.

C. Empirical Literature

The stock market has been a focal point of research, particularly in relation to crude oil prices. In recent times, exchange rates and crude oil prices have emerged as significant variables for study. Due to the crucial role of crude oil in the Nigerian economy, numerous research efforts have been dedicated to understanding the relationship between crude oil prices and exchange rates. However, the findings of these studies have been inconsistent. A summary of these studies is provided below.

Ogiri et al. (2013) evaluated the short- and long-term dynamics of oil prices, currency rates, and the stock market in Nigeria using complex time series techniques of VAR and VECM. They discovered co-integration using yearly data from 1985 to 2011, which suggests that these variables have an equilibrium connection over the long term. Their impulse response functions showed that oil price shocks had a considerable, immediate, and favorable impact on stock prices. Further Granger causality tests revealed a one-way causal relationship between oil prices and the Nigerian stock market.

Mohd et al. (2013) examined the effects of oil price shocks on Malaysia's economic sectors. Using quarterly time series data from the 2000 to 2011. The Granger casualty test, the Johansen co-integration test, and the unit root test were applied. The findings indicated that Malaysia's oil price volatility has an impact on the agriculture sector's performance. Additionally, it was discovered that the building industry is reliant on oil prices.

Wilson et al. (2014) investigated the relationship between changes in oil prices and economic development in Nigeria using yearly time series data from 1980 to 2010. In order to determine the correlation between oil prices and macroeconomic variables, the Granger causality test and ordinary least squares were utilized in the study. The findings indicate that there is no causal association between oil prices and macroeconomic indices, nor do they have a materially favorable effect on Nigeria's economic expansion or other macroeconomic indicators. This conflicting conclusion demonstrates that resource-rich nations like Nigeria expand more slowly than other nations.

Suriani et al. (2015) investigated the connection between Pakistan's exchange market and stock market. The Pakistani Rupee (RS) is used to indicate the exchange rate against the US dollar (RS / US $), while the KSE-100 Index is used as an alternative to stock prices. The monthly statistics range from January 2004 to December 2009 and are presented below. They employed the ADF test. To ascertain the causal connection between the variables, the Granger Causality test was applied. The study's findings demonstrate that the exchange rate and stock price have no relationship to one another and are separate factors.

Stober (2016) used time series data from 1970 to 2014 to study macroeconomic behavior and crude oil price shocks in Nigeria. Using econometric methods like the Augmented Dickey-Fuller test and the ordinary least square (OLS) model, the regression equation was calculated. According to the findings, shocks in the price of crude oil have a favorable effect on Nigeria's economy and are a major driver of its expansion.

Lesotho et al. (2016) used Johansen's co-integration approach and the VECM framework to analyze the relationship between stock market returns and exchange rates in Botswana from 2001 to 2014. They focused on effective exchange rates and used the bilateral exchange

rates, in contrast to most prior studies. The results showed that bilateral exchange rates had a significant impact on stock price performance.

Dinh et al. (2016) investigated the link between Vietnamese stock prices and currency rates. The variables' daily data were utilized between March 1, 2007, and March 1, 2014. To determine the causal connection between the two variables in this study, co-integration tests and the Granger causality test are used. The findings showed that there is no link between the exchange rate and the price of a stock. This indicates that the exchange rate and stock price are unrelated.

Gunther (2017) used cross-country panel data models, which explain economic development through a collection of exchange rate variations and control factors, to assess the impact of exchange rate fluctuations on economic growth in developing Europe and East Asia. The estimations are performed using both a GMM framework and a generalized least square fixed effect (GLS) model. According to empirical studies, emerging markets with stable exchange rates have greater growth. This is due to the favorable effects of a stable exchange rate on global commerce, interest rates, and macroeconomic stability. To enable mediation in international commodities and financial markets, capital barriers must be lifted.

Broni et al. (2018) conducted a case study of oil-exporting nations to investigate the economic impacts of oil price volatility on emerging nations. The impacts of changes in the price of oil on macroeconomic variables in Nigeria were estimated using ordinary least square (OLS) estimation. The findings demonstrate that price volatility has an impact on interest rates, the balance of payments, gross domestic and foreign direct investment, and that swings in oil prices are mostly connected to the macroeconomic variables examined.

Azodo (2019) evaluated Nigeria's consumer prices and oil price shocks using yearly time series data from 1970 to 2017. The ADF test, co-integration test, and Granger causality test were the statistical and economic methods employed in the study. The findings indicate a link between the factors under consideration in both the short and long terms. The results also suggest a bidirectional association between inflation and oil prices, oil price shocks, and inflation.

Tumba (2019) examined the impact of fluctuating oil prices on the value of the Nigerian Naira. The autoregressive distributed lag (ARDL) bound testing approach was applied to the yearly time series data from 1986 to 2015 used in the study. Granger causality tests were employed to estimate the exchange rate and causality models, respectively, after the variables were integrated of orders I (0) and I (1). The results show that over the long run, there is a considerable negative association between exchange rates in Nigeria and the volatility of crude oil prices. Although this link was unfavorable in the short term during the research period, it was not statistically significant.

Maheu et al. (2020) examined the correlation between oil shocks and economic growth volatility in the US from 1974 to 2018. The link between economic growth and oil price changes was estimated using the autoregressive (AR) and generalized autoregressive conditional heteroscedasticity (GARCH) models. It was discovered that variations in oil prices had an impact on economic growth.

Seraj et al. (2020) investigated the relationship between crude oil prices and currency exchange rates in five significant oil exporting nations: Canada, Russia, Saudi Arabia, the United Arab Emirates, and the United States. Changes in these nations' exchange rate policies have recently been made. Monthly data from April 1996 to January 2020 was studied in the study, which used a nonlinear causality method known as Quantile on Quantile. The results show a strong link across quantiles in all the nations under study between the price of crude oil and currency rates. These nations, it should be noted, depend largely on income from the oil trade.

Adediran et al. (2020) used ARDL bound testing to analyze the effect of oil prices on the Nigerian stock market. The analysis included the years 1985 through 2018. Co-integration was discovered, confirming a long-term partnership. The findings also revealed a link between oil prices and the Nigerian stock market.

Victor and Mah (2021) evaluated the effects of changes in oil prices on the South African economy in their article. The quarterly time series data from 2000 to 2020 were used to run the GARCH model and analyze price changes for South African oil. As a consequence, while per capita GDP growth and inflation have a little impact on changes in oil prices in South Africa, rising interest rates and an increase in the amount of money in circulation do. Volatility from the first and second quarters of the previous year has had a good and a negative impact on South Africa's current oil price swings, respectively.

Raouf (2021) conducted a study on the impact of oil price shocks on government spending. The study utilized annual time series data from 1980 to 2018 and employed a vector autoregressive model (VAR), impulse response function, and variance decomposition to analyze the effects of oil price shocks on government spending components in both oil-exporting and oil-importing countries. The results indicate that oil price shocks have a positive impact on current government spending in two groups of countries. Specifically, it positively affects government capital spending in oil-exporting countries, but negatively affects oil-importing countries.

Akinola et al. (2021) used data from 1985 to 2019 to evaluate the causal connections between crude oil prices, currency rates, and the stock market in Nigeria. The vector error correction model (VECM) was used in this study to look at both the short- and long-term causal linkages between the variables. According to the findings, there is a causal link flowing in both directions from crude oil prices and currency rates to stock market performance, as well as vice versa. The authors came to the conclusion that both

changes in the price of crude oil and those in the exchange rate had an impact on the Nigerian stock market.

Udeh et al. (2022) looked at the effect of crude oil price volatility on the performance of the Nigerian stock market. Using data from 2000 to 2020. To calculate the volatility of crude oil prices and stock market returns, this study employed the GARCH (1,1) model. The findings showed that Nigeria's stock market performance is significantly negatively impacted by crude oil price volatility.

Ezeokoli et al. (2022) used data from 2004 to 2018 to examine the effect of exchange rate volatility on Nigerian stock market performance. The ARDL model was used in this study to look at both the long- and short-term links between exchange rate volatility and stock market performance. According to the findings, Nigeria's stock market performance is significantly harmed by exchange rate fluctuation.

Okonkwo and Ekeocha (2022) investigated the causal links between crude oil prices, currency rates, and the stock market in Nigeria. Using data from 2005 to 2019. In this work, the dynamic interactions between the variables were investigated using the impulse response function (IRF) and variance decomposition (VD) analysis. According to the findings, there is a causal link flowing in both directions from crude oil prices and currency rates to stock market performance, as well as vice versa. The authors came to the conclusion that the Nigerian stock market is significantly impacted by changes in both crude oil prices and currency rates.

III. METHODOLOGY

The study used a quantitative research approach, and data on the important variables, including the all-share index, crude oil price, currency rate, inflation rate, and interest rate, were gathered during a 36-year period (1986–2022). To accurately represent the stock market performance on the Nigerian capital market, the All-Share Index (ASI) was found to be appropriate. The CBN statistics bulletins (2023), the Nigerian Stock Exchange, and the British Petroleum statistics Review of World Energy (2023) were the particular sources of the data. All of the variables were tested for stationarity using the enhanced Dickey-Fuller test and Phillips-Perron (P-P) tests since stationarity is essential for the usefulness of the findings of any time series investigation.

To further examine the connection between the variables over the long run, the ARDL bound test co-integration approach was used. The choice to employ the error correction model was made as a result of the co-integration's importance. The Granger causality test was also used to establish the causal relationship between the variables under study.

A. Model Specifications

According to the accepted literature, equation (3.1) may be used to represent the functional connection reflecting the reaction of stock market performance to changes in global crude oil prices and exchange rates:

ASI = f (COP, EXR, INF, INT) ----------eqn (3.1)

In an explicit and econometric form, equation (3.1) can be expressed as follows:

$$\mathbf{ASI_t = \beta_0 + \beta_1 COP_t + \beta_2 EXR_t + \beta_3 INF_t + \beta_4 INT_t + \mu_t} \text{ ---------eqn (3.2)}$$

Where: ASI stands for All Share Index, a proximate measure of stock market performance.

COP = Crude oil price, EXR = exchange rate, INF = inflation rate, INT= interest rate

β_0, β_1, β_2, β_3 and β_4 = Denotes unknown parameters to be estimated. μ_t = Error term,

t= Time trend.

B. ARDL specification

The ARDL, representation of the relationship between the variables in the model is given:

$$\Delta lnASI_t = \alpha_0 + \emptyset_1 lnASI_{t-1} + \emptyset_2 lnCOP_{t-1} + \emptyset_3 lnEXR_{t-1} + \emptyset_4 lnINF_{t-1} + \emptyset_5 lnINT_{t-1} + \sum_{i=1}^{k1} \sigma_{1i} \Delta ln\, ASI_{t-1} + \sum_{i=0}^{k2} \gamma_{2i} \Delta ln\, COP_{1t-i} + \sum_{i=0}^{k3} \varepsilon_{3i} \Delta ln\, EXR_{1t-i} + \sum_{i=0}^{k4} \gamma_{2i} \Delta ln\, INF_{1t-i} + \sum_{i=0}^{k5} \gamma_{2i} \Delta ln\, INT_{1t-i} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3.3$$

The Δ is the first-difference operator, and (ASI, COP, EXR, INF, INT,) are the five variables selected in the study. In equation (3.3), ASI is the dependent variable, with (COP, EXR, INF, INT) are the long run regressors. Accordingly, a joint significance test that implies no co-integration hypothesis, (H0: $\gamma1 = \gamma2 = \gamma3 = \gamma4 = \gamma5 = 0$), is tested against the alternative hypothesis, (H1: $\gamma1 \neq \gamma2 \neq \gamma3 \neq \gamma4 \neq \gamma5 \neq 0$) denoted by F (COP, EXR, INF, INT), terms $\varepsilon1 - \varepsilon6$ are mutually uncorrelated white noise error terms. Two sets of critical values are reported in Pesaran and Pesaran (1997) and Pesaran *et. al.* (2001). The two sets of crucial 1(0) are co-integrated one with the other. We took the relevant critical values from Narayan (2005), which were derived for small sample sizes of between 30 and 80 observations, given the very small sample size of 36 observations in our investigation. The first set assumes that all variables are I(0),

whereas the second set assumes that all variables are I(1). The H0 is rejected if the computed F-statistic is higher than the upper critical bound value. The test is no longer conclusive if the F-statistic is between the limit. Last but not least, no co-integration is implied if the F-statistic is below the lower critical bound value.

C. Pairwise Granger causality model

The causality test clearly demonstrates the direction of the causal link between two or more variables. To accomplish the goals of the study, a pair-wise granger causality test was used. Thus, the following is a specification of the causality test model:

$$ASI_t = \sum \phi i\ ASI_{t-1} + \sum \Theta j\ COP_{t-1} + \sum \Theta j\ EXR_{t-1} + \sum \Theta j\ INF_{t-1} + \sum \Theta j\ INT_{t-1} + \mu t \text{ ----------3.4}$$
$$COP_t = \sum \phi i\ COP_{t-1} + \sum \Theta j\ ASI_{t-1} + \sum \Theta j\ EXR_{t-1} + \sum \Theta j\ INF_{t-1} + \sum \Theta j\ INT_{t-1} + \mu t \text{ ----------3.5}$$
$$EXR_t = \sum \phi i\ EXR_{t-1} + \sum \Theta j\ COP_{t-1} + \sum \Theta j\ ASI_{t-1} + \sum \Theta j\ INF_{t-1} + \sum \Theta j\ INT_{t-1} + \mu t \text{ ----------3.6}$$
$$INF_t = \sum \phi i\ INF_{t-1} + \sum \Theta j\ COP_{t-1} + \sum \Theta j\ EXR_{t-1} + \sum \Theta j\ ASI_{t-1} + \sum \Theta j\ INT_{t-1} + \mu t \text{ ----------3.7}$$
$$INT_t = \sum \phi i INT_{t-1} + \sum \Theta j\ COP_{t-1} + \sum \Theta j\ EXR_{t-1} + \sum \Theta j\ INF_{t-1} + \sum \Theta j\ ASI_{t-1} + \mu t \text{ ----------3.8}$$

IV. EMPIRICAL RESULT AND DISCUSSION OF MAJOR FINDINGS

A. Presentation and Analysis of Descriptive Result

Table 1: Descriptive Statistics

	ASI	COP	EXR	INF	INT
Mean	18831.95	47.41313	131.2382	19.38085	2.538942
Median	22895.38	38.23000	125.8331	12.87658	4.522189
Maximum	50789.75	111.6517	424.5287	72.83550	18.18000
Minimum	149.8167	12.77917	2.020575	5.388008	-31.4526
Std. Dev.	16042.81	32.39343	118.5502	17.33302	9.815923
Skewness	0.383376	0.700982	0.903444	1.77136	-1.22184
Kurtosis	1.950429	2.155752	3.016199	4.851716	5.350339
Jarque-Bera	2.604659	4.128978	5.033703	24.63539	17.72252
Probability	0.271898	0.126883	0.080713	0.000004	0.000142
Sum	696782.3	1754.286	4855.812	717.0914	93.94085
Sum Sq. Dev.	9.27E+09	37776.04	505949	10815.61	3468.684
Observations	37	37	37	37	37

Source: Author computation based on E-views 10 (2023)

Table 1 presents the maximum and mean values for ASI, COP, EXR, INF, and INT were 50789.75 (18831.95), 111.6517 (47.41313), 424.5287 (131.2382), 72.83550 (19.38085), and 18.18000 (2.538942), respectively. The values indicate the importance of these variables in explaining the impact of crude oil prices and exchange rates on stock market performance. Notably, the maximum values of these variables exceed their mean values, highlighting their significance in the All Share Index equation. The Jarque-Bera, Kurtosis, and Skewness of INF are higher than those of other variables, implying a possible impact of inflation rate on other variables in the equation.

B. Stationarity test

The study used the Phillips-Perron test with constant (intercept) and trend and the Augmented Dickey-Fuller (ADF) to test stationarity. Table 2 displays the outcomes. The ARDL test can be carried out since the unit root tests in the table show that the variables are a mix of I(0) and I(1).

Table 2: Augmented Dickey-Fuller (ADF) test and Phillips-Perron test I(0) and I(1)

Variables	ADF I(0) t-statistics	ADF I(1) t-statistics	Phillips-Perron I(0) t-statistics	Phillips-Perron I(1) t-statistics
LNASI	-1.351246	-5.480072**	-1.262094	-4.683826**
LNCOP	-2.132255	-5.445699***	-2.251435	-5.306967**
LNEXR	-2.657370	-6.202217**	-2.657139	-6.474033**
INF	-4.593515**	-4.101868**	-3.390321	-6.701685**
INT	-2.738498	-6.451709**	-4.047367**	-14.03760**

Note (**) (***) denotes statistical significance at 1% and 5% respectively
Source: Author computation based on E-views 10 (2023)

C. Correlation matrix

The study next looked at the correlations between the independent variables as well as the endogenous variable's (LNASI) and exogenous variables' (LNCOP, LNEXR, INF, and INT) correlations after establishing that the variables did not include unit roots. In Table 3, the correlation matrix's findings are displayed.

Table 3: Correlation matrix

	LNASI*	**LNCOP***	**LNEXR***	**INF**	**INT**
LNASI*	1.000000	0.796050	0.945837	0.440020	0.357595
LNCOP*	0.796050	1.000000	0.775323	0.470944	0.379874
LNEXR*	0.945837	0.775323	1.000000	0.403711	0.335926
INF	-0.440020	-0.470944	-0.403711	1.000000	-0.781899
INT	0.357595	0.379874	0.335926	-0.781899	1.000000

Note: * represent the variables of interest
Note: * represents the variables of interest
Source: Author computation based on E-views 10 (2023)

The correlation matrix's findings, which are shown in Table 3, show a strong connection between the variables of interest. The correlation between the price of crude oil and the All Share Index is specifically 79.61% positive, while the correlation between the exchange rate and the All Share Index is 94.58% positive. These results are consistent with earlier predictions for Nigerian inflation, currency rates, and crude oil prices.

D. Optimal lag selection

The study used the ARDL bound testing approach to ascertain if the variables were co-integrated. To prevent residual term autocorrelation, the best lag duration was chosen before running the bound test. To choose the best lags for the model, the study used vector autoregressive (VAR) lag order selection criteria. The results of the lag length selection criterion are shown in Table 4, and they suggest a lag order of 3 based on the minimal value of the AIC (13.64851*). To avoid underestimating the model, the research chose a lag duration of three.

Table 4: Optimal lag(s) selection criteria

Lag	LogL	LR	AIC	SC	HQ
0	-346.0484	NA	20.64990	20.87437	20.72645
1	-216.9532	212.6273	14.52666	15.87345*	14.98595
2	-189.9340	36.55548	14.40788	16.87699	15.24992
3	-152.0246	40.13932*	**13.64851***	17.23994	14.87329*

* indicates the lag order selected by the criterion.
Source: Author computation based on E-views 10 (2023)

E. ARDL bound test for co-integration

The study proceeded to estimate the ARDL bound test after determining the number of lags to be used. Table 5 presents the results of the ARDL bound test for co-integration.

Table 5: Bound test for co-integration

Null Hypothesis: No Long-run Relationships Exist		
Test Statistic	Value	K
F-Statistic	**9.387175***	4
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

* denotes that the computed f-statistic is higher than the upper bound values
Source: Author computation based on E-views 10 (2023)

Comparing the estimated f-statistic with its critical values from Pesaran et al. (2001) research is the first step in this approach. At k=4 (number of independent variables), the estimated F-statistic (9.387175) was calculated and surpassed the upper critical value at 10%, 5%, 2.5%, and 1%. Since there is no long-term link between the independent and dependent variables, the null hypothesis was disproved, and the alternative hypothesis was accepted. This demonstrates that the variables are co-integrated. The findings show that from 1986 to 2022, there is a statistically significant long-term equilibrium link between crude oil prices, exchange rates, inflation, interest rates, and the Nigerian stock market.

F. Error correction model (ECM) for selected ARDL model

To ascertain the dynamic behavior of the All Share Index equation, the study evaluated the Error Correction Model (ECM). In the occurrence of system shocks, the ECM variable records short-run dynamics, and its coefficient quantifies how quickly short-run disequilibrium transitions to long-run equilibrium. Table 6's ECM estimate findings illustrate the short-run dynamics as the factors influencing the Nigerian stock market converge to long-term

equilibrium. The speed at which the disequilibrium caused by the shocks of the previous year converged back to the long-term equilibrium in the present year is indicated by the substantial negative coefficient on ECM(-1), which is around 32.6%. This is a moderate speed of adjustment, which aligns with how stock markets work. The significant negative coefficient on the lagged ECM term confirms co-integration among the variables, validating the existence of a long-term relationship. The short-run impacts of changes in crude oil prices, exchange rates, inflation, and interest rates are statistically significant with expected signs, supporting the theory that these factors drive the stock market in the short term.

Table 6: Result of error correction model (ECM) and coefficient of short-run

ARDL(1, 2, 2, 1, 2) Chosen Based on Akaike Information Criterion Dependent Variable (LNASI)				
Variable	**Coefficient**	**Std. Error**	**t-statistic**	**Probability**
D(LNCOP)	0.327555	0.131997	2.481540	0.0212
D(LNCOP(-1))	-0.310538	0.133440	-2.327171	0.0296
D(LNEXR)	-0.204383	0.111002	-1.841252	0.0791
D(LNEXR(-1))	-0.261598	0.121849	-2.146900	0.0431
D(INF)	-0.006067	0.003096	-1.959520	0.0628
D(INT)	-0.009330	0.004714	-1.979186	0.0604
D(INT(-1))	0.010616	0.003529	3.008525	0.0065
ECM(-1)*	-0.325581	0.039160	-8.314069	0.0000
R-squared	0.727251	Mean dependent var		0.160686
Adjusted R-squared	0.656538	S.D. -dependent var		0.292521
F-statistic	197.7407	Durbin-Watson stat		1.647311
Prob(F-statistic)	0.000000			

ECM= LNASI - (0.0669*LNCOP + 0.8612*LNEXR -0.0470*INF -0.1118*INT + 7.0521)

Source: Author computation based on E-views 10 (2023)

G. ARDL results

The study presents the ARDL results in Table 7. The coefficient of lagged stock market performance (LNASI(-1)) is positive and highly significant, indicating persistence and momentum in stock market performance. The contemporaneous coefficient of crude oil price is positive (0.327) and statistically significant at the 10% level, implying that a 1% increase in crude oil prices is associated with a 0.33% increase in stock market performance. This aligns with a priori expectations, as higher oil prices increase government revenue and foreign exchange inflows, which should boost the stock market. However, the lagged coefficient of -0.616300 implies that this impact becomes negative after a period. A potential explanation is that higher oil prices cause inflationary pressures on the Nigerian economy over time, negating the initial positive impact. The exchange rate does not have a significant effect on the stock market in either the short or long run, as the coefficients on LNEXR lags are statistically insignificant. Contrary to expectations, exchange rate changes (LNEXR) do not significantly impact stock returns, possibly because the mitigating effects of exchange rate policy in the context of oil export dependence. The inflation rate (INF) has a significant negative coefficient at the 5% level on its first lag, indicating that higher inflation depresses stock market performance with a lag. This aligns with the theory that high inflation hurts valuations. The interest rate (INT) has significant negative coefficients on its first and second lags, implying that tighter monetary policy negatively affects the stock market over time. This makes sense because higher interest rates increase the cost of borrowing and discourage investment in stocks. An adjusted R-squared of 0.985803 indicates 98.6% of the total variation in LNASI is explained by the independent variables. The model has very high explanatory power. The F-statistic of 197.7407 is statistically significant, implying that the overall model is statistically significant in explaining LNASI. The Durbin-Watson statistic of 1.647311, which is approximately 2, demonstrates that the residuals are not autocorrelated. In conclusion, the results offer empirical affirmation of a priori premises regarding the predominance of oil price fluctuations and monetary policy constraints in shaping Nigerian stock market performance. Overall, the parsimonious ARDL model is statistically robust and theoretically consistent in elucidating Nigerian stock market dynamics.

Table 7: ARDL results dependent variable: (LNASI)

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
LNASI(-1)	0.674419	0.078308	8.612378	0.0000
LNCOP	0.327555	0.158365	2.068356	0.0506
LNCOP(-1)	-0.616300	0.233394	-2.640599	0.0149
LNCOP(-2)	0.310538	0.168672	1.841082	0.0791
LNEXR	-0.204384	0.190850	-1.070911	0.2958
LNEXR(-1)	0.223175	0.188302	1.185196	0.2486
LNEXR(-2)	0.261599	0.158785	1.647504	0.1137

INF	-0.006067	0.004959	-1.223519	0.2341
INF(-1)	-0.009219	0.004260	-2.164359	0.0416
INT	-0.009330	0.006774	-1.377400	0.1822
INT(-1)	-0.016449	0.006757	-2.434261	0.0235
INT(-2)	-0.010616	0.005604	-1.894478	0.0714
C	2.296028	0.517156	4.439722	0.0002
R-squared	0.990814	Mean dependent var		9.198366
Adjusted R-squared	0.985803	S.D. -dependent var		1.593932
F-statistic	197.7407	Durbin-Watson stat		1.647311
Prob(F-statistic)	0.000000			

Source: Author computation based on E-views 10 (2023)

H. Diagnostic test

According to Gujarati (2004), diagnostic tests must be carried out to ensure that the final model is a good model in the sense that all estimated coefficients have the correct signs and are statistically significant based on the t and F tests. This study used the heteroscedasticity test, serial correlation LM test, and histogram and normality test as diagnostic tests.

Table 8: Results of the normality test

Normality test	**Value**
Jarque-Bera	0.404112
Probability	0.817049

Source: Author computation based on E-views 10 (2023)

Table 8 shows the results of the normality test. The probability of Jarque-Bera is 0.817049, therefore, because the probability value (0.817049) is greater than 5%, we accept the null hypothesis and conclude that the samples are normally distributed. This means that the skewness and kurtosis of the sample are not significantly different from what we would expect in a normal distribution.

Table 9: Results of the Breusch-Godfrey serial correlation LM test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.940395	Prob. F(2,20)	0.4071
Obs*R-squared	3.008468	Prob. Chi-Square(2)	0.2222

Source: Author computation based on E-views 10 (2023)

From table 9 above, it can be seen that the probability value of the Chi-Square for obs*R-squared is 0.2222. Therefore, the probability value (0.2222) is greater than 5%, hence, we accept the null hypothesis, which states that there is no serial correlation in the residuals. This implies that there is no serial correlation in the model.

Table 10: Results of the heteroscedasticity test: Breusch-Pagan Godfrey

Heteroscedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.637073	Prob. F(12,22)	0.7890
Obs*R-squared	9.025863	Prob. Chi-Square(12)	0.7007
Scaled explained SS	2.802047	Prob. Chi-Square(12)	0.9968

Source: Author computation based on E-views 10 (2023)

Table 10 above demonstrates that the probability value for Obs*R-squared is 0.7007. We thus accept the null hypothesis that there is no heteroscedasticity because the probability value (0.7007) is larger than 5%. As a result, it may be concluded that our model is homoscedastic, which is ideal.

Based on the results of these diagnostic tests, the estimated model may be used with confidence to develop policies in Nigeria.

I. Granger causality test

The ARDL approach used in the study revealed long-run co-integration information among the variables but did not indicate causality between them. To determine the direction of causality, the researchers conducted a Granger causality test.

Table 11: Pair-Wise Granger causality test

Null Hypothesis	**Obs**	**F-statistic**	**probability**
LNCOP does not Granger Cause LNASI	35	0.21125	0.8108
LNASI does not Granger Cause LNCOP		1.68105	0.2032
LNEXR does not Granger Cause LNASI	35	4.58447	0.0183
LNASI does not Granger Cause LNEXR		3.63671	0.0385

Source: Author computation based on E-views 10 (2023)

The results of the test showed that there was no causality between the crude oil price and all share indexes. This is because the probability values of 81.1% and 20.3% were greater than 5%, indicating that the null hypothesis of no causality was accepted. The researchers concluded that Nigeria does not have control over the price of crude oil, which is determined by OPEC.

On the other hand, the probabilities for the causal variable, exchange rate, and all share index were 0.0183 and 0.0385, respectively. Therefore, the null hypothesis was rejected, and a bidirectional causal relationship was found to exist between the exchange rate and stock market performance in Nigeria.

J. Stability test

Figure 2 and 3 show the cumulative sum (CUSUM) and cumulative sum of square (CUSUMQ) statistics for the stability of the relationship together with short-run movement between variable of interest. The CUSUM test confirms the long-run coefficient stability. However, CUSUMSQ instability indicates short-run fluctuations, (expected of stock markets), affirming the variances in transient impact shown in the ARDL error-correction model. The stability tests underscore the need to differentiate between short and long-run impacts, given the contrasts in relationship stability across timeframes. The diagnostic tests affirm model stability; normal residuals; homoscedasticity, and absence of serial correlation, underpinning the reliability and statistical validity of the parsimonious ARDL model.

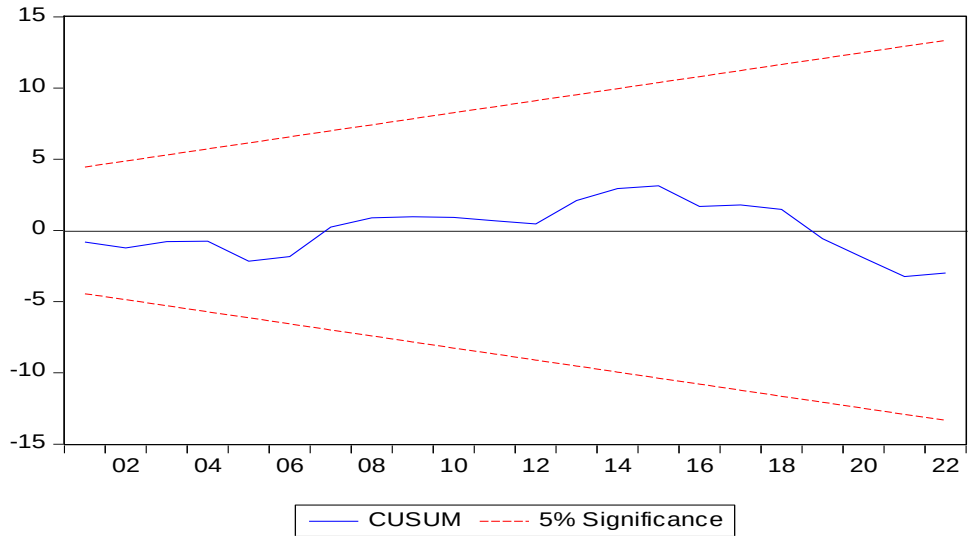

Fig. 2: CUSUM stability test

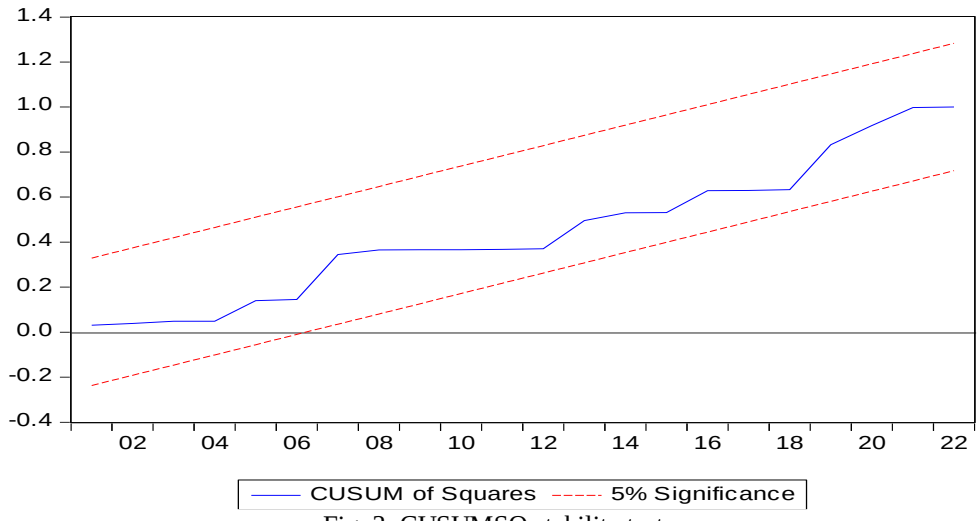

Fig. 3: CUSUMSQ stability test

K. Discussion of the major findings

The empirical findings from the ARDL and Pair-Wise Granger causality models provide significant insights into the impact of crude oil prices and exchange rates on stock market performance in Nigeria from 1986 to 2022. The bound test validates co-integration among the variables, affirming a long-term relationship between, crude oil price, exchange rate, interest rate, inflation rate, and stock market performance from 1986-2022. This aligns with past studies such as Ogiri et al. (2013), Adediran et al. (2020), and Akani and Nwakanma (2020) that found co-integration, validating long-term relationships between these macroeconomic factors and the stock market.

The error correction model reveals short-run dynamics as the variables adjust to equilibrium. The coefficient of -0.326 on ECM(-1) shows a moderate speed of convergence to equilibrium annually. The significant short-run impacts validate the theorised role of crude oil prices, interest rates and inflation in influencing stock market performance. Moderate adjustment speed aligns with adaptive expectations in stock markets.

The autoregressive distributed lag (ARDL) model provides evidence that crude oil prices have a significant positive contemporaneous impact on stock market performance, aligning with a priori expectations given the economy's oil dependence. This aligns with findings by Ogiri et al. (2013) and Adediran et al. (2020) who also found a positive relationship between oil prices and the Nigerian stock market, but contrasts with Ogboro et al. (2020) who found a negative relationship. However, the negative lagged coefficient indicates that this impact becomes adverse over time, substantiating the postulated inflationary pressures from oil price shocks and Dutch disease dynamics highlighted in the literature as negating the positive effects over time, eroding real returns. Surprisingly exchange rate fluctuations do not significantly affect stock returns, consistent with Adebiyi et al. (2020). However, this contradicts Lesotho et al. (2016), who found significant effects within the past decade. The lack of exchange rate impact could result from mitigating central bank policies in Nigeria aimed at minimising currency fluctuations due to oil export dependence, as noted by Ezeokoli et al. (2022). The negative short-run effects of inflation and interest rates align with recent findings by Umar (2020), Uguru et al. (2020), and Azeez et al. (2021) that tighter monetary policies discourage stock investment. The adverse inflation and interest rate lagged coefficients align with the theory that high inflation dampens valuations while tight monetary policies discourage stock investment.

The ARDL model has strong explanatory power. The diagnostic tests affirm model stability; normal residuals; homoscedasticity, and absence of serial correlation, underpinning the reliability and statistical validity of the parsimonious ARDL model.

The stability tests underscore the importance of differentiating short and long-run effects, given disparities in the stability of oil prices and exchange rate impacts on the stock market across timeframes. Overall, the empirical analysis provides robust evidence that oil prices, inflation, interest rates, and exchange rates significantly drive the dynamics of the Nigerian stock market. The results provide empirical support for the theoretical premises and align with some previous studies, while contrasting others.

The Pair-Wise Granger causality tests reveal no causal relationship between oil prices and stock market performance, contrary to Oriakhi and Osaze (2013). However, there is evidence for bidirectional causality between the exchange rate and stock market performance. This contrasts with Ogiri et al. (2013), who found unidirectional causality from oil prices to the stock market. The results implies that exchange rate policy has more ability to influence stocks than crude oil prices.

In conclusion, the empirical findings strongly validate the significance of crude oil prices, inflation, and interest rates as drivers of the Nigerian stock market. The use of robust time-series techniques such as ARDL and Granger causality tests, overcomes the methodological limitations of some past studies. The longer study period captures recent structural changes that are missed in studies with shorter samples. These results highlight the primacy of oil prices over exchange rates in driving the Nigerian stock market. Causality analysis provides new evidence on the direction of influence between variables. Overall, while building on the existing literature, this study provides fresh empirical insights into crude oil and exchange rate impacts on the Nigerian stock market. It addresses the gaps in modelling macroeconomic determinants highlighted in the literature.

V. CONCLUSIONS AND RECOMMENDATIONS

A. *Conclusions*

This study assessed the impact of changes in crude oil prices and exchange rates on the performance of Nigeria's stock market from 1986 to 2022.

The share index equation's variable relationship were estimated using a variety of descriptive and econometric methodologies. The variables are co-integrated, according to the empirical findings. The ARDL model results show that although crude oil prices have a short-term beneficial influence on the stock market, this effect eventually becomes negative, most likely as a result of inflationary pressures. Contrary to popular belief, exchange rate fluctuations had little impact on stock returns throughout the time period.

The ECM supports the explanatory factors' short- and long-term effects on the stock market.

Granger causality studies indicate that there is a bidirectional causal link between exchange rates and stock market performance, but they do not show a clear causal relationship between oil prices and the stock market. The empirical results show that the Nigerian stock market is driven by fluctuations in crude oil prices as well as macroeconomic variables like interest rates and inflation.

B. *Recommendations*

The following suggestions were offered in light of the study's findings:

- First, accelerating economic diversification is imperative to moderate overreliance on crude oil exports. Developing sectors such as agriculture, manufacturing, and services can alleviate the stock market's vulnerability to oil price swings.
- Second, while surging oil revenues present short-term gains, sustainable long-term growth necessitates diversified income sources. Policymakers should balance the utilizing of windfalls for development spending while exploring new growth drivers.
- The study found that inflation and interest rates have a negative impact on stock market performance in the

short run. Therefore, policymakers should monitor inflation and interest rates and take appropriate measures to ensure stability in these areas. This could be achieved by improving fiscal management and implementing monetary policies that promote price stability.

- The study found that the exchange rate has a positive impact on stock market performance in the long run. Therefore, it is recommended that policymakers manage exchange rate fluctuations and take appropriate measures to ensure stability in the exchange rate. This could be achieved by implementing policies that encourage exports and foreign investment.
- The study recommended that investors should be educated and made aware of the factors that drive stock market performance in Nigeria, including the impact of crude oil prices and exchange rates. This will help investors make informed investment decisions and reduce the volatility and risk associated with stock market investments, and promote market stability and growth.
- Finally, we discovered a bidirectional causal relationship between the Nigerian stock market's performance and the exchange rate. In order to increase investment and stimulate the economy, the Nigerian government should support transparency and stability in the stock market and exchange rate.

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