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Macroeconomic Determinants of Economic Growth in Nigeria: An Econometric Analysis of Exchange Rate, External Reserves, and Oil Prices

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Abstract

This study discusses how External Reserves and Exchange Rates can increase the Resilience of the Economy in Nigeria, which is a resource-driven economy that is very vulnerable to external shocks. The study tests the relationships between Gross Domestic Product (GDP), external reserves, exchange rates, and oil prices using annual time series data in 1986-2024, and employs Augmented Dickey-Fuller (ADF) unit-root tests, Johansen cointegration analysis, Ordinary Least Squares (OLS) and an Error Correction Model (ECM) to analyse the variables. The findings show that the long-run relationship between the external reserves and GDP is positive and statistically significant and the relationship between the exchange rates and GDP is positive and statistically significant whereas the impact of oil prices on the output is negative and statistically insignificant. The adverse and substantial error-correction variable verifies long-run convergence, which implies that reserve accumulation and exchange-rate management are effective in shock absorption to macroeconomic shocks. Nevertheless, the excessive reliance of Nigeria on oil revenues limits the sufficiency of reserves and undermines the economic stability. The research findings indicate that to improve resilience, a wise management of reserve, a lower exchange-rate volatility, and export diversification are necessary. Policy suggestions include the need to bolster local manufacturing, encourage non-oil exports, and decrease reliance on imports as a strategy of stabilising the external balance and enabling sustainable development.

Keywords

International Reserves, Exchange Rate Management, Economic Resilience, Oil Price Shocks, Nigeria

1. Introduction

In resource dependent economies like Nigeria, international reserves and exchange rate management is a critical tool to build economic resilience to exogenous shocks. International reserves provide liquidity, so they smooth the payments of imports, service of the external debt, and defence of the domestic currency, dampening the effect of the global disturbance to the domestic economic activity (Adama, Ohwofasa, & Onabote, 2022; Kalu et al., 2019). Empirical results always point to the positive correlation of increased levels of foreign reserves with greater macroeconomic stability and stronger growth performance in Nigeria, which depend on the time and the specifications of each model (Adama, Ohwofasa, & Onabote, 2022; Omobolanle & Temitope, 2021; Ishaka & Adam, 2023). An example is that excess reserves are found to have a positive and statistically significant long-run impact on real GDP, with estimated coefficients of about 0.22 to 0.40; meaning that a 1% change in reserves has an approximation of 0.24% - 0.4% effect on output, which is positive in the long run (Ezebunwo, 2024; Omobolanle & Temitope, 2021; Ishaka & Adam, 2023).

Simultaneously, frequent instances of drastic depreciation, as well as various floating windows have characterised the exchange-rate regime of Nigeria, which is indicative of an increased exposure to oil price variations and capital flows inversions (Ignatius, Clara, & Chidiebere, 2025; Soro & Aras, 2021). The fact shows that changes in exchange-rates have large effects on growth and some studies have shown that depreciation has negative effects on real GDP growth both in the short run and long run; this illustrates the negative effect of exchange-rate fluctuations on growth considering the current import and production structure in Nigeria (Ignatius, Clara, & Chidiebere, 2025; Ozigbo, Ekane, & Ujuju, 2025). Other predictors of economic resilience identified by machine-learning based analyses of Nigerian macroeconomic data include exchange-rate variability and foreign reserves with a predictive strength of around 86 percent (Omololu, Ajibade, & Abolore, 2025). This observation highlights the macro-cruciality of the exchange-rate and reserve management to maintain the resilience.

However, times of high external reserves by Nigeria, commonly more than the standard three-month adequacy of imports, have not correlated with stable growth performance; rather, these may be periods of high volatility and high pro-cyclicality of growth, especially in oil-price crises (Abuh-Amasi, Joshua, & Onoyom, 2022). These papers indicate that although the reserve and exchange options interventions have the potential to promote growth, their success as a resilience instrument is limited because of weak institutional quality, lack of coor-

dination between monetary and fiscal policy, and vulnerability to oil-price shocks (Karokatose et al., 2025; Abuh-Amasi, Joshua, & Onoyom, 2022). The ongoing weakening of the naira, combined with diminishing reserves and increasing external vulnerability, reveals that there is a policy-effectiveness gap: the amount and composition of reserves, and the trend of exchange-rate management, have not been enough to stabilize output and prices in the face of repeated shocks (Adenigbagbe et al., 2024; Soro & Aras, 2021).

This makes the main issue that the current paper aims to tackle the perceived lack of linkage between the large reserve build-up, proactive policies of intervention in the exchange-rate, and the low economic resilience of Nigeria to external shocks. The main research problem, thus, is to empirically investigate the effects of external reserves, and exchange-rate management on the economic resiliency of Nigeria, and whether, and how, these policy tools can increase the ability of the economy to absorb and recuperate the negative impact of domestic and external shocks.

2. Literature Review

2.1. Conceptual Framework

2.1.1. International Reserves

The central bank of a country has international reserves comprising of foreign currency reserves, gold, Special Drawing Right (SDRs) and other highly liquid external reserves to cushion against external shocks (Harkusha, 2021). These reserves play a key role in averting import spending, external debt service, and exchange-rate interventions in over-reliant Nigeria and hence the stability of the external sector (Ojum, 2025; Rukayat & Temitope, 2021). The oil still forms around 80% - 90% of the foreign-exchange earnings of Nigeria, which makes the reserve levels extremely vulnerable to the changes in global oil prices. The sharp reserve losses, the balance-of-payments strain, and the naira depreciation have been linked to the episodes of oil-price collapse, i.e., those of 2015 to 2016 and 2020 to 2021 (Lucky Ignatius et al., 2025). Empirically, it is found that properly managed external reserves are beneficial and contribute to growth and discourage currency crises by having the firepower to intervene as well as signalling creditworthiness (Adenigbagbe et al., 2024; Eichengreen, Park, & Shin, 2024; Kayode, Martins, & Bisola, 2021). On the other hand, the times of declining reserves have limited the ability of the Central Bank of Nigeria (CBN) to counter the pressure on the exchange rate, and it has raised the issue of sufficiency and sustainability of the reserves (Itodo, Ichoku, & Olushola, 2023; Oyalowo, 2025).

2.1.2. Control of the Exchange Rate

One of the major channels of transmission is the exchange rate that determines the price of one currency in terms of another one, and thus, external shocks are transmitted to the economy and influence inflation, trade performance, and growth in Nigeria (Ojum, 2025; Johnson, Uke, & Iheukwumere, 2025; Ufi, Olanipekun, & Otakpor, 2025). Nigeria has been shifting between fixed, managed-float, and more

lenient regimes since the mid-1980s, with many windows, in a bid to contain the volatility and maintain the naira (Femi-Olagundoye & Adedokun, 2025). The results of the empirical research show that exchange-rate depreciation and volatility are prone to undermine growth and trade balance, in particular, in an import-based, oil-exporting model (Lucky Ignatius et al., 2025; Ufi et al., 2025; Mba et al., 2025). At the same time, foreign-reserved CBN interventions have been proved to greatly stabilise exchange rate in both the short and long term, therefore, highlighting the significance of reserve stock in effective exchange-rate management (Kayode et al., 2021; Adenigbagbe et al., 2024). Most recent experience highlights that the presence of flexible regimes alongside credible and rules based interventions and sufficient reserves helps to promote resilience and in contrast, complex multiple-rate systems risk undermining confidence and promoting speculation (Ebipre, Ebikeiseye, & Wosowei, 2025; Eichengreen et al., 2024).

2.1.3. Economic Resilience

Economic resilience describes the ability of an economy to absorb, adjust, and recover during negative shocks, such as, commodity-price shocks, reversal of capital flows, as well as global uncertainty (Eichengreen et al., 2024). In cross-country data, it is shown that elevated foreign-reserve reserves, robust current-account, and trade openness and exchange-rate flexibility are systematically related to stronger after-shock recoveries (Eichengreen et al., 2024). In the case of Nigeria, recent machine-learning experiments find GDP growth, inflation, exchange-rate variability, and foreign reserves to be some of the key indicators of resilience and models predict downturns with 86 percent accuracy (Omololu, Ajibade, & Abolore, 2025). Oil-price shocks have kept propagating rapidly using reserve depletion, naira devaluation, and inflation which have exposed the structural vulnerabilities in the external sector (Mba et al., 2025; Ojum, 2025). In turn, it is noted in the literature that to develop resilience, sufficient reserves and coherent exchange-rate policy, as well as diversification beyond oil, enhanced policy credibility, and improved coordination of monetary and fiscal policies to reduce the amplification of shocks are required (Ufi et al., 2025; Oyalowo, 2025; Omololu et al., 2025).

2.2. Theoretical Framework

2.2.1. Buffer Stock Model of International Reserves

The concept of the buffer stock model by Frenkel and Jovanovic (1981) views international reserves as an ideal stock that a government has in order to smooth the external payments and also absorb shocks to the balance of payment. Governments trade the adjustment cost of exhausting reserves with the opportunity cost of holding large and low yield liquid assets. With the Nigerian context, the model is that the reserves accumulated by the Central Bank of Nigeria (CBN) are precautionary in nature, to alleviate oil price volatility, to counter exchange rate pressures and sudden stop risks, but not to pursue the mercantilist goals of export-promotion. Empirical evidence on Nigeria supports the fact that the optimal re-

serve levels are significantly responsive to the exchange-rate volatility and external shocks yet are relatively insensitive to imports and opportunity costs, which is consistent with a precautionary buffer-stock explanation (Oyeniran & Alamu, 2020; Irefin & Yaaba, 2011). In turn, the present research uses the buffer-stock framework as the theoretical foundation to hypothesize that the increased and well-managed level of reserve stock can increase the resiliency of the economy by reducing the output and exchange-rate effects of external shocks (Allegret & Allegret, 2018; Aizenman, 2019a).

2.2.2. Contemporary Trilemma/Quadrilemma Framework

According to the Mundell Fleming trilemma, which was first published by Mundell and Fleming in the 1960s, a sovereign state cannot be able to pursue full monetary autonomy, fixed exchange rates and free capital movements at the same time; only two out of the three can co-exist (Mundell, 1963; Fleming, 1962). Aizenman (2019a) expands this model to a four-objective quadrilemma by including financial stability as the fourth goal because, according to Aizenman, emerging-market economies banks on large foreign reserves and controlled exchange-rate regimes in negotiating a trade-off between exchange-rate stability, monetary autonomy, financial openness, and macro-financial stability (Aizenman, 2019a). In the case of Nigeria, a very open and heavily oil-dependent economy, it explains the reason why authorities use reserves and active exchange-rate management as policy buffers to terms-of-trade as well as capital-flow shocks (Semmler & Toure, 2024; Aizenman, 2019b). Based on this, this paper uses the quadrilemma to forecast that combinations between reserve accumulation and managed exchange-rate policies enhance macroeconomic resilience, which, on the one hand, can include curbing crisis-induced devaluations and maintaining policy flexibility, but, on the other hand, excessive rigidity or inadequate buffers can also increase vulnerability (Semmler & Toure, 2024; Allegret & Allegret, 2018; Omobolanle & Temitope, 2021).

2.2.3. Reserves-Resilience (Self-Insurance) Hypothesis

The reserves-resilience or self-insurance hypothesis argues that the presence of large international reserves enhances the ability of a nation to absorb external shocks through instant liquidity to protect the currency, facilitate imports, as well as stabilise output (Allegret & Allegret, 2018). Allegret and Allegret (2018) establish that the occurrence of the reduced output losses after external shocks is especially evident in reserve-bearing emerging economies, although the nexus is non-linear, and it starts to decrease as the reserve stocks become very high. International evidence shows that the accumulation of pre-crisis reserves is associated with stronger post-crisis growth and less susceptibility to capital-flow volatility (Semmler & Toure, 2024; Allegret & Allegret, 2018). The theoretical implications of this in the Nigerian context context are that high reserves, in combination with plausible policy regimes, can mitigate the negative impact of oil-price crashes and exchange rate volatility on growth and inflation and, therefore, make economies

more resilient. The framework also warns policymakers against trade-offs: above a certain optimal scale, the extra reserves will involve the growing cost in terms of opportunity cost without the corresponding resilience payoffs (Oyeniran & Alamu, 2020; Bianchi & Sosa-Padilla, 2020).

2.2.4. The Monetary/Foreign Exchange Intervention Theory

According to monetary approach to determine exchange rate, exchange rates are determined by relative amounts of money supplied, income levels and interest rates (Frenkel & Johnson, 1976). Continuing on this basis, modern foreign exchange intervention theory studies the way central banks use reserves-funded interventions to influence the direction of exchange-rate changes and reduce volatility. Akdogan (2020) specifies the functions of central-bank reaction and finds that interventions, which are identified by a change in reserve balances, have causal effects on the exchange-rate dynamics in emerging economies and advanced ones (Akdogan, 2020). As applied to Nigeria, where CBN often uses reserves to smooth their naira fluctuations, the theory describes the working nexus between reserves (as the instrument) and exchange-rate administration (as the channel) to stabilise their macro economics (Ebipre, Ebikeiseye, & Wosowei, 2025; Itodo, Ichoku, & Olushola, 2023; Akdogan, 2020). In the framework of this research, well-timed interventions with proper reserves are expected to mitigate the spikes in the exchange-rate and help preserve the balance-sheet integrity and trade, strengthening the resilience of the economy; poorly designed or insufficiently funded interventions are also likely to drain reserves without benefiting the economy in the long-term (Ebipre, Ebikeiseye, & Wosowei, 2025; Akdogan, 2020).

2.3. Empirical Review

Empirical studies that conducted research on Nigeria provide a significant amount of evidence as to the relationship that exists between international reserves, exchange rate movements, and macroeconomic performance; however, the inference of the findings to economic resilience is still not well knit together. There is a large part of the literature which finds a positive long-run correlation between external reserves and economic growth on the basis that this correlation is due to a greater supply of external liquidity, better exchange-rate stability and increased investor confidence. According to a number of studies conducted using ARDL, VAR, and cointegration-based designs, reserve accumulation has a statistically significant positive effect on the real GDP in Nigeria, especially in the long run (Adama, Ohwofasa, & Onabote, 2022; Ishaka & Adam, 2023; Nyeche, 2024). Such observations confirm the perception that reserves can be considered as a macroeconomic buffer movie that can help to cushion the negative impact of external shocks.

A very similar literature is on the subject of exchange-rate movements and volatility. The empirical evidence indicates that depreciation and fluctuations in the exchange-rate have negative impacts on the growth of output in Nigeria that is an

import-oriented economy particularly in the short run (Ozigbo, Ekane, & Ujuju, 2025; Mba et al., 2025). Nevertheless, positive long-run correlation between the exchange-rate depreciation and output is also recorded in some studies, which argues that the growth effects of participation of exchange-rate movements are context-dependent, mediated by the trade structure and policy reactions (Ogwuche et al., 2024; Nyeche, 2024). All in all, the literature highlights the macro-critical importance of exchange-rate management in the determination of growth and stability outcomes.

The other literature line studies the relationship between the exchange rates and the reserve dynamics. Articles using ARDL and VECM models state that exchange-rate change affects reserve accumulation and reserves have a reciprocal relationship with exchange-rate stability (Kalu et al., 2019; Abuh-Amasi et al., 2022). Conversely, there are also some data with weak or insignificant causation between reserve changes and the exchange-rate volatility based on high-frequency data which indicates that reserve accumulation, without credible policy frameworks and institutional strength, may not be adequate to stabilise the currency (Kelikume & Nwani, 2019). These contradictory results underscore the need to have coherence and transparency in policy regarding the reserve-based intervention.

Oil price dynamics is a prominent feature in the Nigerian literature although its chemical relationship with output is not so obvious. Though the oil prices are closely connected with the level of foreign-exchange earnings and reserves, various studies discover that oil price changes do not influence the economic performance directly but have an indirect effect via exchange-rate depreciation, reserves depletion, and inflationary effects (Isibor et al., 2022; Mba et al., 2025). This is an indication that oil price fluctuations increases macroeconomic vulnerability through its destabilising impact on exchange-rate and its deterioration of external buffers.

More recent works take a more global approach with the inclusion of financial flows and institutional factors. Research has shown that capital flight causes very high foreign reserve depletion and also leads to exchange-rate depreciation, which is destabilizing the macroeconomic situation (Collins, Essien, & Essien, 2025). Other researchers draw attention to the importance of export diversification, the openness to trade, and the quality of institutions as the main variables of sustainable accumulation of reserves and stability (Abuh-Amasi, Joshua, & Onoyom, 2022; Eichengreen, Park, & Shin, 2024). Evidence based on machine-learning methods also reveals that foreign reserves and exchange-rate variability are one of the best predictors of the negative economic cycles in Nigeria which further justifies their applicability to the resilience analysis (Omololu et al., 2025).

Although this research has been extensive, there is a definite gap in the literature. The majority of the research looks at the reserves, exchange rates, or the oil prices separately, without much looking at the effects of the combined factors in a single resilience framework. Further, economic resilience is not something that can be conceptualised and easily empirically evaluated because growth or macro-

economic stability has been used in its place. This research fills these gaps by simultaneously examining the international reserves, exchange-rate management, and the dynamics of oil prices within one long-run and short-run model using a very long time frame (1986-2024). In this way, it will add a more integrated and policy-relevant evaluation of the role of central-bank instruments in determining the economic resilience in an economy that relies on commodities in its development.

3. Methodology

3.1. Research Design and Data

This research has a quantitative time-series research design where it seeks to find out the dynamic relationships between international reserves, exchange rate management, oil prices, and economic performance in Nigeria. The selected methodology suits well when analysing the dynamics of the macroeconomic processes through time and assessing both short-term and long-term balance relationships between non-stationary variables.

Annual statistics are being used covering the period of 1986-2024. The chosen sample outlines major changes in Nigeria exchange rate regimes, reserve accumulation periods, oil price cycles and structural reforms thus providing an overall empirical base. The data sources will include Central Bank of Nigeria (CBN) Statistical Bulletin and some addition of complementary CBN publications and data on Macrotrends to provide simultaneous consistency and coverage.

The variables used in analysis are the real Gross Domestic Product (GDP) used as a measure of economic performance, the external reserves (EXRSEV), the nominal exchange rate (FXR) and the international crude oil prices (OILPRICE). To keep the economic interpretation and scale effects at bay, all the variables are specified in natural logarithmic or level formations, as suitable.

3.2. Model Specification

It is based on the theoretical background of the buffer-stock approach to reserves and the open-economy macroeconomic model that the present study formulates a reduced-form relationship of growth in which economic performance depends on the state of external reserves, exchange-rate fluctuations and oil-price fluctuations. The functional relationship at the baseline is given as:

$GDP_t = f(EXRSEV_t, FXR_t, OILPRICE_t)$

This relationship is operationalised in linear econometric form as:

$GDP_t = \beta_0 + \beta_1 EXRSEV_t + \beta_2 FXR_t + \beta_3 OILPRICE_t + \mu_t$

where β_0 is the intercept, β_1 - β_3 are long-run coefficients to be estimated, and μ_t is a stochastic error term assumed to be white noise.

3.3. Estimation Procedure

This empirical study follows a few steps or phases that are in line with the conventional approach to central-bank and applied macroeconomic studies.

First, to identify the order of integration of the variables, the time-series prop-

erties of the variables are first analysed with the help of the Augmented Dickey-Fuller (ADF) unit-root test. To prevent spurious regression estimates it is necessary to establish stationarity, which will provide an idea of which estimation method to use.

Second, since both variables are proved to be order one integrated, the Johansen cointegration method is used to detect the presence of a long-run equilibrium relationship between GDP, external reserves, exchange rates, and oil prices. The Johansen method has been chosen since it allows the determination of more than one cointegrating vectors in a multivariate model and it is a highly appropriate method of macroeconomic systems with the endogens that include endogenous interaction.

Third, an Error-Correction Model (ECM) is estimated to obtain the short-run dynamics and maintain the long-run equilibrium relationship on the confirmation that there exists cointegration. The specification of the ECM allows evaluating the short-run effect of the changes in the explanatory variables as well as the pace of restoring the long-run equilibrium levels. The overall ECM equation can be written as:

$$\Delta \mathrm{GDP}_t = \alpha_t + \sum \alpha_1 \Delta X_{t-i} + \phi \mathrm{ECM}_{t-1} + \in_t$$

where Δ represents the sequence of first differences, X the vector of explanatory variables, ECT_{t-1} the lagged error-cancellation term which was later to arise in the cointegrating relation and ϕ the parameter indicating the adjustment rate towards the long-run equilibrium. A negative statistically significant ϕ hence represents convergence after transitory shocks.

Lastly, in a paradigm of cointegration, the Ordinary Least Squares (OLS) estimation will give interpretable long-run coefficients, but diagnostic statistics will be used to test the overall sufficiency of the model.

3.4. Justification of Methodological Approach

The togetherness of unit-root testing, cointegration analysis, and error-correction modelling offers a consistent study of the long-term relations and short-term adjustment. This methodology is widely used in work of central-bank researchers due to its capability to address peaks and declines of non-stationary macroeconomic variables and its policy interest in examining shock propagation as well as adjustment processes.

The explicit modeling of reserves, the exchange rates and the prices of oil inside the same framework enables the methodology of evaluating the contribution of the external buffers and the exchange rate management in enhancing the economic resiliency of Nigeria over time.

4. Empirical Results and Discussion

This section deals with data interpretation and discussion of findings made from the analysis. The data used are represented in a graph below (**Figure 1**):

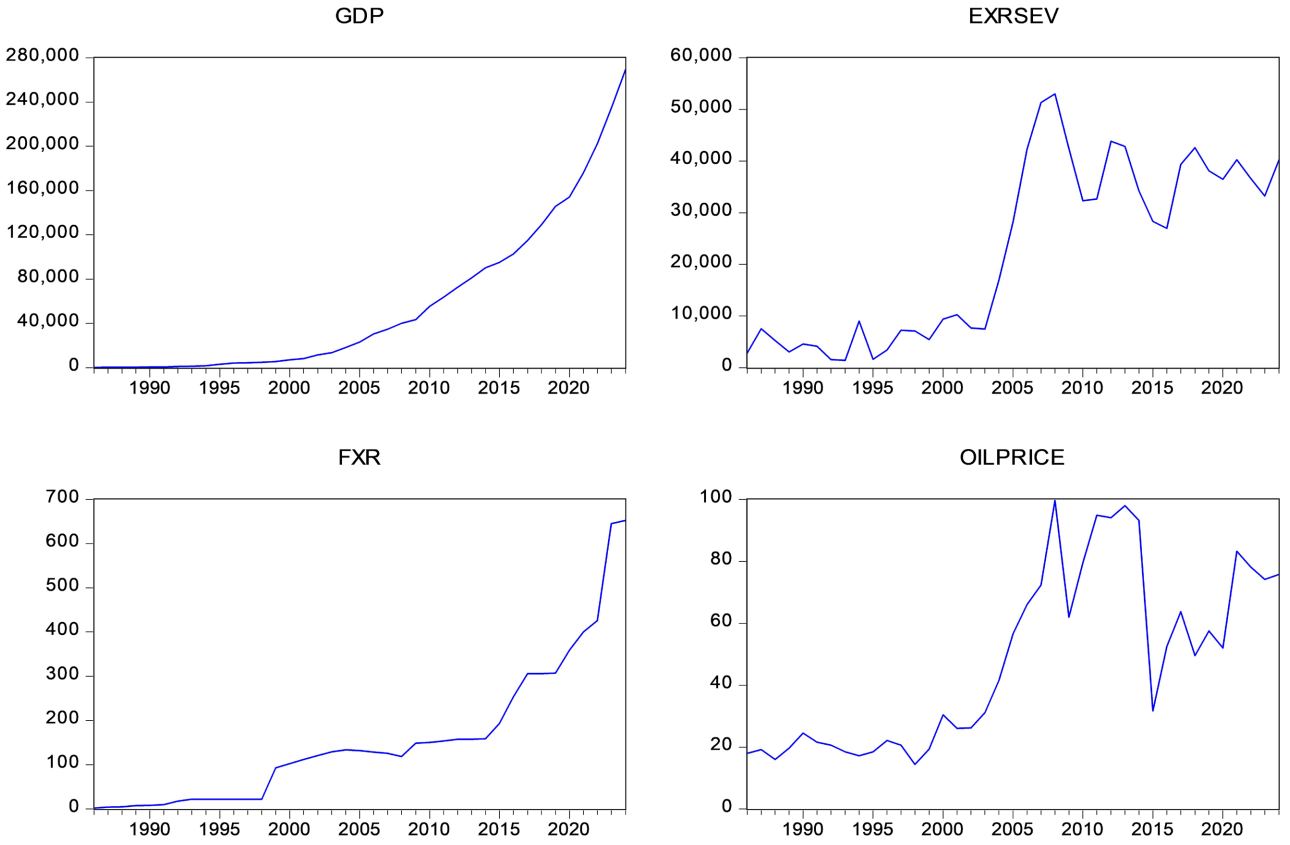

Figure 1. Graphical representation of variables.

The graph shows that EXRSEV and OILPRICE have similar trend of inconsistency. However, economic output (GDP) and exchange rate (FXR) show an upward movement trend implying that business output and exchange rate respectively have been consistent for the period under review.

Table 1. Correlation matrix.

	GDP	EXRSEV	FXR	OILPRICE
GDP	1.000000	0.657250	0.970036	0.613202
EXRSEV	0.657250	1.000000	0.628396	0.896943
FXR	0.970036	0.628396	1.000000	0.576109
OILPRICE	0.613202	0.896943	0.576109	1.000000

Source: Author's Correlation Matrix Output.

Table 1 shows the inter-correlations among the three independent variables in the regression model. It can be deduced that EXRSEV has a positive correlation (0.628396) with FXR and OILPRICE (0.896943). FXR shows a positive correlation (0.576109) with OILPRICE. As we can see, several of these pair-wise correlations are high, suggesting that there is no collinearity problem among the independent variables.

Table 2. Descriptive statistics and test for normality.

Date: 07/09/25 Time: 14:40				
Sample: 1986 2024				
	GDP	EXRSEV	FXR	OILPRICE
Mean	57560.71	22591.22	157.8244	47.67949
Median	23121.88	26990.58	128.6516	41.51000
Maximum	269290.4	53000.36	652.5004	99.67000
Minimum	198.1232	1429.590	2.020575	14.42000
Std. Dev.	72323.83	17231.04	163.4502	28.64148
Skewness	1.344571	0.135654	1.523631	0.432041
Kurtosis	3.925815	1.412526	5.061915	1.724017
Jarque-Bera	13.14401	4.214733	21.99812	3.859002
Probability	0.001399	0.121558	0.000017	0.145221
Sum	2244868	881057.4	6155.153	1859.500
Sum Sq. Dev.	1.99E + 11	1.13E + 10	1015206	31172.70
Observations	39	39	39	39

Source: Author's Regression Output.

The descriptive Table 2 above shows the mean values of the variables indicating that GDP has mean of 57560.71 which implies an annual average GDP of N57560.71b. EXRSEV has a mean of 22591.22 which implies an annual average of external reserve accumulation of $22591.22 m. FXR has a mean of 157.8244 which implies an average naira to dollar exchange of N157.8244 while OILPRICE has a mean of 47.67949 which implies an annual average $47.67949.

The normality test shows that Jarque-Bera probability value for GDP and FXR as 0.001399 and 0.000017 respectively which implies that series are significant but not normally distributed in the EXRSEV and OILPRICE have Jarque-Bera probability value of 0.121558 and 0.145221 respectively.

Table 3. Summary of ADF unit root test result.

Variable	ADF Test Statistics				Stationarity	
	Level	Prob	1st Diff	Prob	Level	1st Diff
D (GDP)	8.921974	0.0000	0.750608	0.9914	I (0)	I (0)
D (EXRSEV)	2.863953	1.0000	−4.212042	0.0019	none	I (1)
D (FXR)	−2.695734	0.0872	−6.195345	0.0000	none	I (1)
D (OILPRICE)	−2.234994	0.1975	−7.062104	0.0000	none	I (1)

Source: Author's computation.

From Table 3, it is evident that EXRSEV, FXR, OILPRICE are non-stationary

at levels but stationary at 1st difference, i.e., they are integrated of order 1 or I (1). This shows care needed to be taken to avoid spuriousity in our model. Thus, it has become imperative to use cointegration for further test.

Table 4. Summary of cointegration.

Trace			Maximum Eigenvalue		
Trace Statistic	0.05 Critical Value	Probability	Max-Eigen Statistic	0.05 Critical Value	Probability
65.15442	47.85613	0.0005	28.49649	27.58434	0.0381
36.65793	29.79707	0.0069	16.83091	21.13162	0.1801
19.82702	15.49471	0.0104	12.25448	14.26460	0.1014
7.572548	3.841466	0.0059	7.572548	3.841466	0.0059

Source: Author's computation.

The result for co-integration in Table 4 using trace statistics shows that there are 4 cointegrating vectors in the equation model while maximum Eigenvalue shows that are 2 cointegrating vectors which indicates that there is long-run relationship among the variables. The co-integration test is conducted at the lag interval test of 1 to 2 and there is linear deterministic trend in the data.

Table 5. ECM result.

Dependent Variable: D (GDP)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (GDP (-1))	0.445354	0.119776	5.412652	0.0000
D (EXRSVE (-1))	0.116769	0.046110	3.132250	0.0372
D (EXRSVE (-2))	0.089604	0.031890	2.413560	0.0371
D (FXR (-2))	0.172629	0.003447	4.290125	0.0210
D (FXR (-3))	0.056237	0.000992	5.197145	0.0200
D (TOILPRICE (-1))	−0.165901	0.391017	0.397756	0.6950
D (OILPRICE (-2))	−0.062168	0.193198	0.883033	0.3877
ECT (-1)	−0.150671	0.066078	−2.280212	0.0337
C	−4.534277	10118.56	−0.293192	0.7724
R-squared	0.564334	Mean dependent var		0.187473
Adjusted R-squared	0.413527	S.D. dependent var		0.112113
Sum sq. resids	0.191660	Akaike info criterion		−0.026431
S.E. equation	0.085858	Schwarz criterion		1.908981
Log likelihood	43.15811	Hannan-Quinn criterion		24.81573
F-statistic	3.742089	Durbin-Watson stat		1.754796
Prob (F-statistic)	0.000000			

Source: Author's ECM Output.

The error correction estimates in Table 5 shows the coefficient of the error correction term ECT is negative (−0.150671) and it is highly statistically significant at 5 percent level. The negativity of the ECT signals that the system is stable enough and is capable of converging to the long run equilibrium after some shocks/disturbances in the system. The adjusted R-squared value of 41.35% implies that about 41.35 percent of variation in the dependent variable is accounted for by variations in the independent variables. The result as shown in Table 5 shows that EXRSVE has positive relationship with GDP in lag 1 (coefficient = 0.116769). The prob value of 0.0372 which is less than 0.05 level of significance, which indicates that there is longrun significant relationship between external reserve and economic growth in Nigeria. The result shows that FXR has positive relationship with GDP in lag 1 (coefficient = 0.172629) with prob value of 0.0210, implying that there is longrun significant relationship between exchange rate and economic growth in Nigeria. From the result, OILPRICE has negative relationship with GDP (coefficient = −0.165901). The prob value of 0.6950 is greater than 0.05 level of significance implying that there is no longrun significant relationship between trade openness and economic growth in Nigeria.

5. Discussion

The results indicate that the Nigerian currency has been weak and volatile thus making the economy vulnerable to the major external shocks. Recent empirical research also reports continued exchange-rate volatility, and attributes it to macroeconomic vulnerability and instability, especially using oil prices and global uncertainty (Ogwuche et al., 2024; Mba et al., 2025; Ehikioya, 2019).

The high and statistically significant influence of exchange rate movements on the GDP of Nigeria as indicated in the present research highlights the degree of centrality of the exchange rate on the dynamics of growth. Nigerian research supports this claim by finding that the exchange rate is a key determinant of economic growth, but the relationship can have either a negative growth effect related to depreciation or volatility (Ozigbo, Ekane, & Ujuju, 2025; Ignatius, Clara, & Chidiebere, 2025; Adama, Ohwofasa, & Onabote, 2022), or the depreciation can have a positive short-run or long-run effect on real GDP (Ogwuche et al., 2024). In turn, the strong association found between exchange rate and growth in the present study is consistent with the existing body of research that exchange rate behaviour is macro-critical in Nigeria, despite its context-dependent arbitrary growth impact.

The positive impact of the reserves on GDP as indicated in the analysis is in tandem with a lot of ARDL and VAR studies which have found reserves accumulation to be a growth medium, a booster of economic growth and a macroeconomic performance support (Ozigbo, Ekane, & Ujuju, 2025; Adama, Ohwofasa, & Onabote, 2022; Ishaka & Adam, 2023; Loretta, 2021). According to recent studies, external reserves have a long-term effect on the real GDP and act to absorb exchange-rate pressures and foreign shocks (Adama, Ohwofasa, & Onabote, 2022;

Ozigbo, Ekane, & Ujuju, 2025). These results support the classical view championed by Meade (1951) that reserves that are insufficient in the case of depreciation may restrain growth and those that are sufficient actually increase resiliency.

The fact that oil prices do have negative but not statistically significant impact on GDP, even though oil is the hub of foreign revenue, is also present in the available literature. A number of Nigerian studies show that oil prices largely influence the growth indirectly, as they influence the exchange rate, external reserves, and macroeconomic stability, as opposed to a strong direct impact of GDP (Isibor et al., 2022; Ogwuche et al., 2024; Mba et al., 2025). Further, a part of the research suggests that the volatility of oil prices can interrupt the growth and worsen the exchange-rate volatility (Ehikioya, 2019; Mba et al., 2025; Ogwuche et al., 2024).

In sum, the findings align closely with recent Nigerian evidence and support the core narrative of the study: Nigeria's growth performance is shaped less by oil prices per se and more by how exchange rate dynamics and external reserves interact within an oil-dependent economic structure. An unstable exchange rate regime combined with inadequate buffers heightens vulnerability to external shocks, whereas effective reserve management and exchange rate stability are critical for sustaining growth and macroeconomic resilience.

6. Conclusion

The study has empirically examined the role of external reserves and exchange rate management in economic stability in Nigeria. The trend in external reserve and exchange rate fluctuation shows that the two variables impact on Nigeria's economy while oil price has no impact on Nigeria's economic growth. Based on the findings, the following policy recommendations have been formulated:

1) Government should put in place policy measures that increase the growth of foreign reserve such as increasing in oil production, investment in agriculture and manufacturing sectors, investment in telecommunication and entertainment industries which have all proved to be viable sources of international revenue.
2) Frantic efforts should be made by the government to ensure stability of the exchange rate by investing in export promotion.
3) Additionally, this study suggests that monetary regulators, policymakers, and other stakeholders should work toward reducing exchange rate depreciation below the threshold to curb inflation. The CBN could do this by adopting suitable and efficient policy interventions through its forex forward trading by injecting enough foreign currency to meet the excess demands. Policymakers must create a more favourable investment environment for public-private partnerships to establish import substitution industries. This will help reduce the demand for foreign currency for imports and this will in turn strengthen the domestic currency against foreign currency.
4) The government and monetary authorities need to work together and harmonize their various policies towards curbing inflation in Nigeria.

5) The government should make significant policy efforts to stimulate domestic production, encourage export promotion and reduce importation as this will help to balance its trade openness.

Declaration of AI Use

During the preparation of this manuscript, the authors used Consensus. app for accurate sources of citations and grammar improvement. All AI generated outputs were critically reviewed, edited, and approved by the authors, who take full responsibility for the final content of the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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