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Exchange Rate, External Reserves, and Economic Growth Nexus: Empirical Evidence from EMDE

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Abstract

This study employs an Autoregressive Distributed Lag (ARDL) bounds testing methodology to investigate the dynamic tripartite relationship between real effective exchange rates, external reserves, and economic growth in an emerging market and developing economy. Utilizing a Nigerian sample spanning 2014Q1 to 2024Q1, the cointegration test confirms a stable long-run equilibrium relationship among the variables, rejecting the null hypothesis of no level effects. The associated Error Correction Mechanism (ECM) reveals a statistically significant and negative correction coefficient, confirming a rapid return to long-run equilibrium following short-run deviations. The short-run dynamics indicate strong positive autoregressive persistence in GDP growth.

The empirical results demonstrate that exchange rate depreciation exerts a statistically significant, positive short-run effect on growth, yet this coefficient becomes insignificant in the long-run specification, suggesting the effect is transient. Impulse response functions derived from a parallel Vector Error Correction Model (VECM) further substantiate the economy's resilience, showing that shocks from inflationary pressures and oil price volatility exhibit mean-reverting characteristics, with their impulse responses largely dissipating within subsequent quarters.

Furthermore, the analysis reveals the heterogeneous efficacy of policy instruments. The monetary policy rate emerges as a potent short-term stabilization tool with a strongly significant coefficient, whereas the null hypothesis for money supply (M2) cannot be rejected, indicating limited efficacy of traditional monetary expansion. The long-run estimates confirm that the exchange rate regime is a cointegrated determinant of sustainable growth, while financial market development proxies exhibit weak exogeneity. These findings underscore the criticality of a hybrid exchange rate framework and carefully calibrated, data-dependent monetary policy for emerging economies with analogous structural vulnerabilities.

Keywords: ARDL model, exchange rate, economic growth, external reserves, Nigeria economy

JEL Classification Codes : C32, F39, F43, G19, O47.

1. Introduction

Exchange rate, external reserves and growth are fundamental macroeconomic variables that are pivotal to the overall economic sustenance of any nation. Over time, emerging market economy such as Nigeria, has faced significant economic volatility, causing substantial fluctuations in its exchange rates and external reserves. Data from the Central Bank of Nigeria’s (CBN) statistical data base reveals that Nigeria’s exchange rate depreciation has astronomically been on the rise, from N164/$1 in Q12014 to N1,498.60/$1 in Q12024. Also, external reserves dropped over the last decade from $37.39 billion in Q12014 to $32.29 billion in Q12024. This impacted negatively on the overall growth of the economy as GDP recorded a decline from a growth rate of 6.21

percent to 3.58 percent within the same period.

Moreover, the exchange rate remained relatively stable until Q42019, witnessing exponential depreciation from N306.46/$1 to N/$1,498.60 in Q12024, thus impeding growth, while external reserve experienced a slight drop with exchange rate spike and overall decline from $38.09 billion in Q42019 to $32.29 billion in Q42024. GDP growth also remained stunted and weak from 1.87 percent in Q12024 to through the period Q12024. Furthermore, these fluctuations suggest an inverse relationship as currency depreciation drops, volume of external reserve declines and impedes growth. Given this scenario, the exchange rate fluctuation accompanied by declining external reserve alters growth indicating economic challenges.

Further, foreign exchange volatility devalues the naira, attributable to a decline in foreign exchange revenues amid demand pressure for foreign exchange. For instance, a drop in the price of crude oil (Nigeria's main source of revenue) internationally between 2014 and 2016, complemented by low export receipts plunged Nigeria into economic recession in 2016.

On the other hand, a depleting or low foreign reserve can weaken the local currency, increase import costs, trigger imported inflation, increase currency volatility, and limit the country's capacity to respond to external shocks. Other factors may include reduced economic activities, low investor confidence, declining foreign direct investment (FDI), low foreign portfolio investment (FPI), deficit in current account balance, balance of trade deficit, less global competitiveness among others.

Therefore, for an economy to remain stable and to be able to withstand external shocks, there must be sufficient external reserve levels (Adekunle 2020; Nwafor 2017). Also, exchange rate, which expresses the value of a country's currency in relation to other currencies, has a significant effect on capital flows, global trade, and overall macroeconomic stability (Akinboyo et. al 2016). In a similar vein, the nation's holdings of foreign currency and other reserve assets act as a cushion to manage and control exchange rate volatility, buffer against external shocks, and contribute to economic growth and development (Johnny, 2018, IMF 2007; Obaseki 2007).

Due to exchange rate fluctuation, maintaining a reserve level below the minimum may be risky to the nation's credit rating and international trade (Ijokoh, 2024). Also, Nwamuo (2023) posits that foreign reserves are external assets that are managed by a nation's monetary authorities for that country's international transactions. Thus, external reserves are utilized for a variety of motives, such as the direct financing of imbalances in external payments, intervention in the foreign exchange markets to influence the currency exchange rate, amongst other roles (IMF 2003). Additionally, the relevance of holding external reserve is to act as buffer for the local currency at the global level, for transitionary, cautionary, wealth preservation and diversification purposes. (Nwafor 2017;).

Additionally, a depreciating currency can erode consumer purchasing power, elevate inflation and impede growth. Volatility in exchange rates have a negative impact on the performance of

exports and the domestic economy (Adama et. al 2022). They also have a pass-through effect on inflation. Additionally, fluctuations in exchange rates impact business decisions and create uncertainty in trade. Elevating inflation, in the opinion of economists, has a negative effect on real income, which lowers household welfare and purchasing power.

Given this background, it is therefore imperative for an economy to be on the path of growth which is driven by a stable exchange rate and robust external reserve buffers amongst other macroeconomic fundamentals. However, this has not been the case for Nigeria as it continues to experience persistent exchange rate volatility and unstable external reserves, thus impeding overall growth.

Therefore, understanding the dynamics amongst these indicators is paramount to economic development as posited by economic analysts, financial experts, industry participants, the academia, policy makers amongst others (Nwosa 2017).

From the forgoing, this study aims to diagnose the empirical relationship between exchange rate, external reserve, and economic growth from the period 2010 to 2024 using quarterly time series data for Nigeria.

This paper adds value to the existing body of knowledge by excavating more findings on the impact of exchange rate and external reserve on economic growth in Nigeria and employing a novel methodological approach with fundamental macroeconomic variables which makes it novel and unique. Policy makers, researchers and financial market analysts among other climes would find this study relevant.

The other sections of this work are as follows. Chapter 2 shall x-ray the theoretical, conceptual, and empirical literature from diverse scholars with various findings, while chapter 3 employs the methodological approach to the study. Chapter 4 discusses the results from the estimation and the study's conclusion and recommendation are finalised in chapters 5 and 6 respectively.

2. Literature Review

In economic literature, there has been continuous debate and empirical investigation on the relationship between exchange rates, external reserves, and economic growth. While some contemporary studies focused on the relationship between exchange rate and growth, others concentrated on the nexus between external reserves and growth. However, some schools of thought also provided evidence of the linkages between exchange rates and external reserves. Given this background, our paper focuses on the combined impact of exchange rates and external reserves on economic growth in Nigeria, thus adding to the corpus of literature in this subject research area. This study reviews some theoretical underpinnings around exchange rate, external reserve, and growth, x-ray conceptual issues, and provides empirical linkages among these variables. The literature is summarized with specific findings around economic levels, and

geographical and methodological approaches as well.

2.1 Theoretical Underpinnings

This study's theoretical review is built around theories such as purchasing power parity, balance of payments, precautionary, mercantilist, endogenous growth, and classical and exogenous growth theories. This forms the fundamental line of thought linking the variables used in the study.

Equilibrium exchange rates, exchange rate adjustments, long-term exchange rate predictions, international comparisons, currency valuation, and inflation differentials are all connected to the purchasing power parity (PPP) theory (Casel 19181). The PPP theory posits that exchange rates between currencies should be determined so that the purchasing power of each currency is the same in different countries. In other words, a unit of currency should be able to buy the same basket of goods in any country after accounting for the exchange rate. This is disaggregated into absolute PPP which states that the exchange rate between two currencies should equal the ratio of the price levels of the two countries. On the other hand, Relative PPP focuses on the changes in price levels and exchange rates over time, stating that the percentage change in the exchange rate between two currencies over any period should equal the difference in the percentage changes in national price levels.

Meade (1951), Mundell (1963) & Fleming (1962) propounded a Balance of payments theory of exchange also known as the demand-supply theory. This theory emphasizes how a country's balance of payments significantly determines its exchange rate. Therefore, an improvement or appreciation in the external value of the nation's currency is a result of a positive balance of payments. However, external value depreciates due to an unfavorable balance of payments (Jhingan, 2004). This further suggests that a country's exchange rate is determined by the demand for and supply of foreign exchange in that market.

Further, from a precautionary standpoint, Aizenman & Lee (2005) posit that countries accumulate foreign exchange reserves as a form of buffer against potential external shocks, sudden stops in capital flows, and other economic crises. This theory suggests that holding substantial reserves allows countries to buffer against sudden capital outflows, maintain liquidity during economic downturns, intervene in foreign exchange markets to stabilize their currency, and provide confidence to international investors and creditors.

In practice, Precautionary Theory has led many emerging market economies to significantly increase their foreign exchange reserves, especially after experiencing or witnessing financial crises. This approach to reserve management has become a key aspect of macroeconomic policy in many countries, influencing decisions on reserve adequacy, composition, and utilization. This is in conformity with the mercantilist theory which opined that wealth accumulation, favorable trade balance, government intervention zero-sum game. While modern reserve management is far more nuanced and considers a broader range of economic factors, echoes of mercantilist

thinking can still be observed in how some countries approach their external reserve strategies. However, contemporary economic theory generally recognizes the mutual benefits of international trade and the complexities of global financial systems, moving beyond the simplistic zero-sum view of mercantilism (Egwakhe & Osabuohien, 2008).

While emerging markets and developing economies (EMDEs) face unique challenges, including infrastructure deficits and economic disparities, the Endogenous Growth Theory provides a framework for understanding how investments in knowledge, technology, and human capital can drive increasing returns to scale leading to sustainable GDP growth (Odhiambo and Chirwa, 2018). It underscores the importance of policies that foster innovation, education, and technological advancement in EMDEs development strategy. This portrays the notion that a country's investments in education, skills acquisition and training, technology adoption, innovation, research and development, digital economy, informal sector building among others are endogenous factors that directly impact its GDP growth, thus, aligning with the theory's emphasis.

On the other hand, Exogenous growth theory, primarily emphasizes that economic growth is primarily driven by external factors rather than internal factors within an economy (Solow & Swan, 1956). Key points include capital accumulation, technological progress, labour growth, diminishing returns. It further suggests that as capital accumulates, each additional unit of capital adds less to output than the previous unit, highlighting the importance of technological progress for sustained growth. This theory fundamentally superseded the Harrod-Domar model of the Keynesian School of Thought.

2.2 Empirical Literature

Determining the impact of exchange rate fluctuations on Nigerian economic growth, Alasha (2020) adopted variables such as exchange rate, interest rate, inflation rate, and trade balance, with data culled from the Central Bank of Nigeria (CBN) and the National Bureau of Statistics (NBS). Employing the ordinary least square (OLS) method, and techniques as well as Cointegration, and Granger Causality test, the study found that inflation and exchange rates negatively impact GDP, while interest rates have a positive impact on GDP. This finding was also supported by the work of Ewubare & Ushie (2022) employing the ARDL and bounds cointegration test.

Ascertaining the impact of exchange rate volatility on Nigerian economic growth from 1986 to 2013 using secondary data from the CBN and analyzed with OLS regression and correlation analysis. Adeniran, Yusuf, & Adeyemi (2014) ascertained that exchange rates have a positive but no significant impact on economic growth, suggesting that developing countries benefit from flexible exchange rate regimes. Additionally, interest rates and inflation rates were found to have a negative but no significant impact on economic growth.

A Meta Regression Analysis of the real exchange rate and economic growth by Ridhwan et al.,

(2024) demonstrates that Real Exchange Rate (RER) depreciation, or undervaluation, promotes economic growth. However, RER depreciation affects economic growth in emerging nations more than it does in wealthy nations, on average. The study's findings suggest that keeping the RER undervalued could be beneficial to promote economic growth, particularly in developing nations.

Another study on the real exchange rate impact on economic growth reproducing the work of Dani Rodrik was conducted by Seraj & Coskuner (2021). This compared the fundamental equilibrium exchange rate (FEER) and Balasa Samuelson based Rodrik approach (BS), using a panel of 93 countries covering the period 190-2018. While the results of FEER are more significant than those of BS, the study's findings confirm Rodrik's conclusion that undervaluation significantly affects economic growth. Furthermore, the impact of the first undervaluation lag is significant to economic growth and sustainability.

Panel data for Botswana, Ghana, Kenya, Nigeria, South Africa, and Uganda from 2000 to 2021 were used to investigate the effects of exchange rate volatility on macroeconomic performance, by Okozu et al., (2023). The Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) model was utilized to quantify exchange rate volatility, and panel data models were then employed to examine the impact of exchange rate volatility on inflation, economic growth, and balance of payments. The findings indicated that the inflation rate and balance of payments are positively impacted by exchange rate volatility, suggesting that an increase in exchange rate volatility (depreciation) will lead to more inflation. On the other hand, exchange rate volatility has a negative effect on economic growth, suggesting that long-term increases in exchange rate volatility will harm economic growth.

An empirical investigation on the impact of external reserves on economic growth in Nigeria conducted by Oforah & Umeora (2023), spanning the period 1987-2021 found no significant long-run correlation between external reserve and economic growth. It was also revealed that economic growth has an endogenous impact on the model of external reserve strategies for economic growth. The study concluded that external reserve is not an effective macroeconomic tool to drive economic growth in Nigeria during a deregulated era. However, Johnny (2018); Awoderu et al., (2017); found that external reserves have a positive and significant long-run relationship with real gross GDP.

However, Ngozi et al. (2016) employed a 2-Regime Threshold Vector Error Correction Model (TVECM) to ascertain the relationship between exchanges rate and external reserves in Nigeria. Using daily time series data covering the period January 01, 2014, to July 31, 2015. The findings revealed that linearity is rejected in favour of threshold-type-non-linearity. However, the ECM impacts only in BDC rates in both the linear and threshold VECM, but the threshold model uncovers strong asymmetric in the speed of adjustment. It also found that the speed of adjustment is higher in the unusual regime than the usual one. Furthermore, Ijokoh (2024) determined the relationship between external reserve and exchange rate adopting the Granger

Causality Test Approach. Results found a long-run and unidirectional relationship between external reserve and exchange rate. Result also show that external reserve granger cause exchange rates.

This was further expanded by a broader investigation by Egbulonu & Okani (2019), Employing the OLS and ECM techniques to determine the nexus between foreign reserve management and Economic growth in Nigeria. While the ECM found a long run relationship between the external reserve and growth, the OLS found an inverse and insignificant relationship between them. They found that external reserve to GDP is found to be low and significantly inversely related to the GDP per capita in Nigeria. Onah, et al (2022) further that eternal reserve has positive significant impact on growth in Nigeria.

Another study conducted by Igoni et al. (2021). They opined that effective management of external reserves and economic growth in Nigeria can only be achieved through a more innovative means of production to boost exports and aid stable exchange rate. Employing the OLS analysis, the stationary test results found first order integration at differenced levels for all the variables. The findings further revealed that external reserves rate and exchange rate have a positive but not significant relationship in the short run. However, exports had a positive and significant relationship with Economic growth in Nigeria.

Additionally, an analysis of the relationship between foreign reserve and growth in Nigeria suggests a significant interplay between Nigeria's foreign reserve management and its economic performance (Elijah, 2020; Ihensekhien et al. 2023). The study further found that both exchange rate and external reserve have positive impact on economic growth in Nigeria. Result also demonstrated a bidirectional causality between external reserves and economic growth.

An analysis of the impact of the level of volatility of the Real exchange rate (RER) on output in EMDEs (Rapetti, 2020), revealed a survey of literature that explained the growth impact of the RER. While one clearly analysed that undervalued RER declines macro volatility, the other stressed that a competitive RER accelerates accumulation of capital in trading activities, thus, fostering structural change and growth.

Employing a panel of 120 industrialized and developing countries between 1981 and 2010, Sula & Oguzoglu (2021), examine the nexus between international reserve levels and economic growth. The study discover that foreign reserves have a favorable impact on growth by using dynamic panel data approaches and adjusting for a wide variety of factors. Additionally, as the opportunity cost of maintaining reserves rises, the impact becomes less pronounced.

A cross-country analysis using a panel of about 100 countries examines the impact of various international capital flows (FDI, portfolio investment, equity investment, and short-term debt) on economic growth from 1990 to 2010 (Aizenman et al., 2013). The analysis spans the period of emerging markets' increased integration into global finance and considers pre- and post-global crisis effects. Key findings revealed that growth-capital flow relationship varies by flow type,

economic structure, and global growth patterns. Also, FDI (both inflows and outflows) shows a strong, consistent correlation with growth. However, Equity flows exhibit a weaker, less stable relationship with growth. Short-term debt had no significant impact pre-crisis but negatively affected growth during the crisis.

2.3 Summary of Literature

The study reviewed relevant theoretical and empirical papers on the subject matter and found diverse correlations between exchange rates, external reserves, and economic growth. Most studies found an inverse relationship between exchange rate and economic growth, while others found otherwise. However, a positive relationship was observed between external reserves and economic growth variables and otherwise. Given economic levels, the empirical review covered Emerging Markets, and Developing Economies, and Advanced economies. Studies employing econometric methods such as OLS, ARDL, Bounds Test, Meta-Regression, GARCH, TVECM, ECM, and VECM were also reviewed in the work. The uniqueness of this study is built on the introduction of more control variables such as inflation, oil price, stock market capitalization, and the monetary policy anchor rate making it novel for Nigeria.

This study advances existing theories by integrating additional control variables, such as inflation, oil prices, stock market capitalization, and the monetary policy anchor rate, into established econometric models, offering a more robust and context-specific analysis of exchange rates, external reserves, and economic growth in Nigeria.

2.4 Contribution to Knowledge

This paper adds to the corpus of literature in diverse intellectual climes and contributes significantly to knowledge. Apart from exchange rate and external reserves, four (4) fundamental control variables such as inflation rate, oil price, stock market capitalization and the monetary policy anchor rate were employed respectively to impact economic growth as a dependent variable covering the period Q12014 and Q12024, allowing us to deduce the impact of relevant macroeconomic indicators on economic growth.

3. Method and Data

This study explores the dynamics of Nigeria's external reserve, exchange rate, and economic growth, in the context of an Autoregressive Distributed Lag (ARDL) model which is particularly well-suited for examining complex relationships. In this study, a mixed order of integration was observed among the interest variables, however, given the relatively small sample size (2014Q1 - 2024Q1), and the need to simultaneously understand both the short-run and long-run dynamic relationships among the interest variables with minimal or no issues of endogeneity. This study leverages the ARDL model, which is widely recognized for its robust performance under these conditions, to address the identified research gap.

3.1 Autoregressive Distributed Lag (ARDL)

Following the nature of economic growth and the observed attribute of a mixed-order integration among the variables considered in this study, the paper employed the Autoregressive Distributed Lag (ARDL) model (Pesaran, Shin, and Smith, 2001), to test the hypothesis, that exchange rate and foreign reserve, interest rate, money supply, inflation, and stock market influences economic growth in Nigeria. More so, to bring out the dynamic relationship between the variables in terms of the short and long-run stability over time, Error Correction and a bounds test were conducted. However, because the ARDL technique supports the generation of short-run and long-run elasticities for small sample sizes the model is suitable for examining the above relationship and to test this relationship, the model is thus constructed.

$$Gdp_t = \alpha_0 + \alpha_1\ Exhr^*_t\ + \alpha_2\, Res_t\ + \alpha_3\, Inf_t\ +\ \alpha_4\, Oil_p_t + \alpha_5\, Mc_t\ + \alpha_6\, MPR_t\ +$$

$$\alpha_2\, M_{3_t}\ +\ \epsilon_t$$

----------(1)

Where Gdp_t represents economic growth rate,

$Exchr^*_t$ represents the Exchange rate.

Res_t represents the total stock of external reserves.

Inf_t represents inflation rate.

Oil_p_t represents oil price.

Mc_t represents stock market capitalization.

Mpr_t represent the monetary policy anchor interest rate.

Mc_t represents total stock market capitalization.

M_{3_t} represents the stock of broad money supply.

ϵ_t represents the error term.

From equation (1), which represents an inclusive growth function, the equation is used to generate the compact ARDL form:

$$Gdp_t = \alpha_0 + \sum_{i=0}^{n} \alpha_{1n}\, Gdp_{t-n} + \sum_{i=0}^{i} \alpha_{2i}\ \Delta Exchr^{*}{}_{t-i} + \sum_{i=0}^{j} \alpha_{3j}\ \Delta lnRes_{t-j} + \sum_{i=0}^{k} \alpha_{4k}\ \Delta Inf_{t-k} + \sum_{i=0}^{l} \alpha_{5l}\, \Delta Oil_p_{t-l} + \sum_{i=0}^{m} \alpha_{6m}\ \Delta lnMc_{t-m} + \sum_{i=0}^{p} \alpha_{7p}\ \Delta mpr_{t-p} + \sum_{i=0}^{q} \alpha_{8q}\ \Delta lnM_{3_{t-p}} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (2)$$

The result of the short-run ARDL estimation is presented in Table (3) below with unrestricted constant and no trend, the appropriate lag selection for this mode is generated based on AIC criteria, which shows that (1, 2, 0, 1, 1, 2, 0, 0) is the best selection criteria for the growth model. This order of selection indicates the lagged values of the variables in the model.

3.2 Data Description

The data used in the study include GDP growth rate expressed in percentage, exchange rate (which is an adjusted rate with 30 percent weight assigned to the Nigerian foreign exchange market (NFEM) rate and 70 percent weight assigned to the Bureau De Change (BDC) rate), External reserve measure in billions of US$, inflation rate, the oil price in dollar per barrel, stock market capitalization measured in trillions of naira, monetary policy rate in percentage points and broad money supply in billions of naira. The data on these carefully selected variables were sourced from the CBN data warehouse, National Bureau of Statistics.

4. Empirical Results

4.1 Descriptive Statistics

Table 1 above presents the exploratory statistics of the quarterly data for the variables used in this study. From the table, it is evident that over the study period, 2014Q1 – 2024Q1, the average growth rate was 2.00. This suggests that over the period, and on average, the economy grew by 2 percent. However, the growth rate ranged between 6.54 percent and -6.10 percent. This wide range is indicative of economic volatility over the study period, characterized by episodes of economic downturns including the 2016-2017 crude oil price-induced recession, the 2020-2022 COVID-19 pandemic-induced recession, and the Russian-Ukraine war impacts, the 2023 energy and exchange rate policy reforms that slowed down economic activities contribute to the slow pace of growth over the period.

Considering exchange rate developments over the period of estimation, we observed that the average naira exchange rate over the period was N440.0/1$, while the wide range of N165.86/1$ to N1,524.33/1$ and the positive skewness are indication of significant naira exchange rate

fluctuation or depreciation over the estimation period. This has a lot to do with dampening investor confidence and thereby limiting investment, production, and aggregate output in the economy. However, the flip side to this massive depreciation could be it positive implications for growth from the export promotion point of view depending on the export and import price elasticity. The average level of reserve of $35.60 suggest a relatively stable value while the range of $23.80 to $47.20 demonstrates significant progress in the accumulation of external reserve as a buffer for foreign exchange rate management. The low skewness and kurtosis values of 0.08 and 2.40 respectively suggest close to normal distribution. Throughout estimation, the average rate of inflation is 15.24 percent, this is relatively high, indicating the period of persistent inflation pressure which could have slowed the pace of economic growth. This may have influenced monetary policy action of tightening policy rate to contain the inflationary pressure, the hike in interest rate in response to this high rate of inflation again has implications for economic growth, as it increases the cost of credit and reduces access to credit, investment, production, and consumption ultimately stifling growth. The wide range of inflation rate of 7.78 to 33.20 percent and a positive skewness of 1.06 emphasize the high inflation rate throughout the estimation period.

Meanwhile, statistics on oil prices show an average crude oil price of $69.62 and a wide range of $32.29 to $130.10 per barrel with a positive skewness of 0.72 indicating some period of high crude oil price and by implication more foreign exchange earnings from the sale of crude oil through the estimation period. This is expected to drive growth positively, given that increased proceeds from the sale of crude oil lead to increased government spending and thus stimulate economic activities. The statistics show an average stock market capitalization value of 17.50 trillion naira and a wide range of 8.70 to 59.10 trillion market capitalization value. however, the high positive skewness of 1.9 and kurtosis of 7.40 suggest the existence of some extremely high values which could be from the recent bullish performance recorded in the stock market between 2023 to date.

The average interest rate (MPR) was 13.86 with maximum and minimum interest rates being 11.33 to 24.75 percent respectively. The high positive skewness of 2.13 and kurtosis of 8.39 indicates some period of hike in policy rate which was necessary to contain the persistent uptick in inflation throughout the estimation period. Monetary authorities have also associated the tight monetary policy stance with the need to attract foreign capital inflows. Statistics on the money supply suggest significant growth in money supply over time and substantial volatility in money supply throughout the estimation period, this could also be linked with the inflationary pressure and thus required careful liquidity management to keep the general price level at a low and stable state.

Table 1. Descriptive Statistics

Variables	GDP growth	Exchr*	Res ($'billion)	INF	Oil_P ($'pb)	MC (N'Trn)	MPR	M3 (N'Trn)
Mean	2.0078	440.0924	35.60	15.24	69.62	17.80	13.86	36.60
Median	2.2829	348.0910	35.80	15.37	66.74	13.50	13.50	33.48
Maximum	6.5435	1524.3250	47.20	33.20	130.10	59.10	24.75	92.34
Minimum	-6.1000	165.8650	23.80	7.78	32.29	8.70	11.33	20.12
Std.Dev	2.6059	260.1059	5.74	5.82	23.26	10.50	2.66	16.42
Skewness	-0.8217	2.2852	0.08	1.06	0.72	1.19	2.13	1.58
Kurtosis	4.2327	9.3667	2.40	4.08	3.12	7.40	8.39	5.43
Observations	**41**	**41**	**41**	**41**	**41**	**41**	**41**	**41**

Source: Output from Eviews.

Table 2 presents the stationarity test result. From the result, there is a mixed order of integration among the series. Series including GDP growth, exchange rate, inflation rate, stock market total capitalization, monetary policy rate (interest rate), and broad money supply, are integrated of order one that is I (1), while external reserve and crude oil price are integrated at I (0). Based on this mixed order of integration and the need to examine the dynamic relationships between the variables, the ARDL model is adopted in this study.

Table 2. Augmented Dickey-Fuller Test of Unit Root

Variables	@Levels	@First diff	Remark
Gdp_grwt	-2.3730	-6.1236 ***	I(1)
Exchr*	1.2600	-6.7852 ***	I(1)
Lres	-3.3710***	-	I(0)
Inflation	0.8240	-3.3560***	I(1)
Oil_P	-2.0130	-5.6850***	I(0)
LnMC	1.3370	-4.3280***	I(1)
MPR	0.4430	-2.6120***	I(1)
Lm3	1.2810	-2.9830***	I(1)

Note that, ***, **, * denotes statistical significance at 1%, 5%, and 10% respectively

Source: Output from Eviews.

The results of the test for the long-run relationship between the predicted and predictor variables and the Error Correction Model are displayed in Table (3). From the bound test, it is evident that there is a long run cointegrating relationship between the variables. Following the criteria by

Pesaran et al. (2001), cointegration exist if the F-statistic value is above the upper bound, and absent when it is below the lower bound but indecisive when it falls within the lower and the upper bounds. A cursory look at the F-statistic; 5.174732 it is evident that the estimate is above the upper bound of I (1) critical values at all levels of significance, this satisfies the condition for the existence of a long-run relationship between the explained and explanatory variable. This confirmed the empirical evidence that in the long run, there is a sort of co-movement over time between the variables. This implies that the variables maintain a stable equilibrium relationship such that any short-term fluctuation that arises will fizzle out and the variables will converge to a long-run equilibrium. It also suggests that changes in any variable exert a last effect on the others. Thus, policymakers could influence long-term economic growth outcomes by targeting the cointegrating variables (all the explanatory variables in this study), given that this long-run relationship can be used to make accurate long-term forecasts of economic growth.

The ECM test result as shown in Table 3, with a coefficient of -0.2711, which is statistically significant at a 1.0 percent level of significance, suggests that the model meets the requirement, as the sign is negative and statistically significant *as* expected. This also confirms the validity of the long-run relationship between the variables.

Thus, the result indicates that the system moves back toward equilibrium following every deviation. Conventionally, the *ECT* represents the shock to the system that is not due to any specified explanatory variable, it is the speed of adjustment to a long-run equilibrium path after a short-run shock. Thus, the result suggests that in each quarter, approximately 27.11 percent of disequilibrium in GDP growth is corrected. Thus, on average, it would take about 3.69 quarters for full adjustment back to equilibrium following a shock, assuming no further shock occurs. Thus, the economy does not stay in disequilibrium for long but rather corrects itself over time. This result is important for policymakers as it suggests that interventions might have relatively quick effects, but also that the economy has some built-in stability mechanisms.

4.2 Long-run Relationship (ARDL)

Table 3. Bounds Test for Cointegration Test Result

F-statistics	**5.174732**	**ECM_{-1}**	**-0.27111*** **	**-8.201922**	
Significance Level		10%	5%	2.50%	1%
F-Bounds Test	Lower bound	1.92	2.17	2.43	2.73
	Upper bound	2.89	3.21	3.51	3.9

Source: Output from Eviews12.

4.3 Short-run Autoregressive Distributed Lag Model (ARDL) Analysis

The short-run ARDL result provides significant insight into the immediate or contemporaneous relationship between the predicted and predictor variables, it typically demonstrates the short-term dynamics in terms of how changes or shocks to the explanatory variables affect or impact the explained variable in the short-run.

Results in Table 4 suggest that in the short run, there is a strong persistence in GDP growth with about 72.89 percent of the previous quarter's growth accounting for the current quarter's growth. This implies that policies targeted at stimulating economic growth can have a lasting effect beyond the immediate term. The exchange rate in the current period shows a positive and significant sign at a 1.0 percent level of significance but the lagged effect shows negative but mostly insignificant. This result implies that a depreciation of the naira exchange rate is associated with higher GDP growth in the short run, however, this effect may reverse in the subsequent quarters. Thus, naira exchange rate depreciation might boost short-term growth, possibly through increased exports, but the effect is not sustained. This result is consistent with Marshall-Lerner's condition, a concept in international economics particularly in the study of trade balance and exchange rates. It postulates that the sum of the absolute values of the price elasticities of demand for imports and exports must be greater than 1 for a currency devaluation to have a positive effect on the trade balance. Thus, if a country's currency depreciates, its exports become cheaper for foreign buyers and imports become more expensive to domestic consumers, the resulting increased demand for domestic goods leads to increased production and by implication improvement in growth.

The coefficient of inflation (-0.6684) in the current period is negative and statistically significant at a 1.0 percent level of significance but with one period lag the coefficient is positive (0.6855) at a 5 percent level of significance. This implies that a rise in the inflation rate in the current quarter exerts a decreasing effect on GDP growth, but this effect is largely offset in the following quarter. Thus, because inflation stifles growth in the short run, bringing inflation under control is non-negotiable for short-term growth to be achieved, but again it appears that the Nigerian economy adjusts very quickly to inflationary pressure. Economic agents in Nigeria seem to adjust to the inflation dynamics so quickly and go about their economic activities in a manner that the long-run effect of inflation is not felt so much, although inflation creates uncertainty which affects investment decisions, especially foreign investment as it plays a significant role in the real return on investment but domestic investors in Nigeria appear to be resilient and yet conduct their economic activities in such a manner that the inflationary impact is not so pronounced on growth in the long run.

The coefficient of oil price (-0.0303) in the current period is negative and statistically significant at a 10 percent level of significance but with one period lag, the coefficient (0.0852) is statically significant at a 1 percent level of significance, suggesting that oil price increases initially exert a small negative effect on growth, but this is more than offset by a positive effect in the following

quarter. Nigeria's economic response to oil price fluctuations is complex due to its dual role as both an importer of refined oil and an exporter of crude oil. As a net importer of refined petroleum products, which are crucial inputs for many industries, an increase in crude oil prices can raise production costs for firms. This, in turn, can limit production and consumption, potentially slowing economic growth. However, Nigeria also benefits significantly from higher crude oil prices through increased foreign exchange earnings from its oil exports. When these oil revenues are monetized and distributed by the Federation Account Allocation Committee (FAAC), it triggers a chain of events. Various government arms initiate expenditure projects, injecting money into the economy. This increased government spending stimulates economic activities across sectors, often leading to improved growth in the subsequent quarter.

This dual impact explains why Nigeria's economic growth doesn't always respond to oil price changes in a straightforward manner. The coefficient of the monetary policy rate (-1.6831) is negative and statistically significant at a 1.0 percent level of significance. This implies that an increase in interest rate which is the cost of credit to economic agents, is associated with a significant decrease in GDP growth. This suggests that monetary policy has a strong and immediate impact on economic growth in Nigeria. Tightening monetary policy can significantly slow economic growth in the short term. When the central bank increases the monetary policy rate, which serves as the benchmark rate for the economy, it triggers a series of cascading effects. Both wholesale and retail interest rates in the economy rise, making access to credit more expensive for businesses and consumers alike. This increased cost of borrowing directly affects the daily operations of firms, particularly those in fast-moving industries that rely on frequent cash flow. Moreover, companies find it increasingly difficult to finance the expansion of their productive capacity, as the higher interest rates make investment projects less viable. Consequently, these combined effects constrain the growth of aggregate output across the economy. As higher borrowing costs ripple through various sectors, overall economic growth is limited, demonstrating the powerful impact that monetary policy decisions can have on short-term economic performance.

The coefficient for money supply and stock market capitalization and external reserve was each not statistically significant in this model, suggesting the changes in money supply and developments in the stock market do not have a statistically significant immediate effect on GDP growth in the short-run, they may influence growth in the long-run. external reserve does not have direct impact on growth; this could explain why it is not significant in the short-run model.

In summary, Monetary policy appears to be a powerful tool for short-term economic management in Nigeria, with interest rates having a strong, immediate impact on growth, while exchange rate policy can affect short-term growth, but effects may be short-lived. A balanced approach to exchange rate management is advisable. The study also show that Inflation control is important, but the economy shows some ability to adjust to inflationary pressures. The result, suggest that the economy demonstrates resilience to oil price shocks, suggesting successful diversification or effective energy policies. It further showed that there is a strong growth

persistence, indicating that policies to stimulate growth have lasting effects. However, the traditional monetary expansion through increasing money supply as well as stock market development might not be effective for short-term economic growth stimulation. These results thus suggest a need for a balanced policy approach with careful use of monetary policy tools attention to exchange rate movements and continued focus on economic diversification and resilience to external shocks.

The long-run coefficients at levels equation as shown in Table 5 above confirm that the exchange rate (1.4174) demonstrates marginal statistical significance at 10 percent. Indicating that a 1 percent appreciation in the naira exchange rate is associated with a 1.42 percent increase in the GDP growth rate in the long run. This is especially true given the country's high dependence on imported productive input, thus an appreciation of the naira lowers the cost of imported capital goods and technology, potentially boosting domestic productivity.

Table 4. Short-run Impact

Variables	Coefficient	t-Statistic	Prob.*
Gdp_grwth (-1)	0.72889***	5.807328	0.0000
Dexchr	0.86914***	3.460501	0.0028
Dexchr (-1)	-0.026131	-0.105431	0.9172
Dexchr (-2)	-0.458782*	-2.024301	0.0580
DLRES	1.67015	0.455085	0.6545
Dinf	-0.668446***	-2.935635	0.0088
DINF(-1)	0.685454**	2.481651	0.0232
DOIL_P	-0.030267*	-1.795212	0.0894
DOIL_P(-1)	0.085176***	4.26518	0.0005
DLMC	-3.243627	-1.214814	0.2401
DLMC(-1)	-1.881477	-0.829295	0.4178
DLMC(-2)	2.324148	1.172882	0.2561
DMPR	-1.683081***	-3.861564	0.0011
DLM3	8.857533	1.154534	0.2634
C	-0.08148	-0.218293	0.8297

Note that, ***, **, * denotes statistical significance at 1%, 5%, and 10% respectively

Source: Output from Eviews.

Furthermore, following the pass-through effect of the exchange rate on the country's inflation dynamics, appreciation of the naira exchange rate reduces inflation as imported consumer goods become much cheaper thereby improving the overall standard of living which indirectly supports economic growth through enhancing macroeconomic stability. As the value of the naira appreciates relative to global currencies, this increases investor confidence in the economy in the long run. Consequently, this leads to the attraction of more investment and consumption and thus an accumulation or accretion to foreign exchange reserves which again is another indicator that foreign investors consider in making investment decisions. An increased inflow of investment creates room for economic activities including employment, production, consumption, and ultimately aggregate output level in the long run.

Other explanatory variables including reserve, inflation, oil price, stock market, interest rate, and money supply confirm no statistically significant long-run relationship with economic growth in the long run. The sign for interest rate aligns with expectation, although not statistically significant. The negative sign seems to suggest that a higher interest rate is associated with lower GDP growth in the long run, implying that a higher interest rate in Nigeria slows down economic growth in the long run. therefore, in setting interest rates monetary authority must be mindful of its long-run impact on growth.

In summary, the existence of a long-run relationship is confirmed suggesting that the variables exhibit some degree of co-movement in the long run. However, the exchange rate demonstrated the most notable long-run effect on GDP growth, indicating that the naira exchange rate depreciation is associated with higher growth. This could suggest potential benefits from improved export competitiveness. The monetary policy rate, while not significant at conventional levels, shows a substantial negative coefficient, hinting at the potential long-term growth impacts of monetary policy. Many variables that do not show significant long-run effects do have significant short-run impacts, indicating that they may be more relevant for short-term economic management. The lack of significance for many long-run coefficients could indicate that other factors not included in the model might be important for long-run growth, or that the economy is quite resilient to changes in these variables over the long term. Therefore, Policymakers might wish to focus on exchange rate management and careful consideration of monetary policy for long-term growth strategies, while using a broader set of tools for short-term economic management.

4.3.4 Long-run Autoregressive Distributed Lag Model (ARDL) Analysis

Table 5. Long-run Impact

Variables	Coefficient	t-Statistic	Prob.*
Dexchr	1.417239 *	1.77686	0.0925
DLRES	6.160419	0.466543	0.6464
DINF	0.062734	0.067786	0.9467
DOIL_P	0.202532	1.323776	0.2021
DLMC	-10.33144	-0.606161	0.5520
DMPR	-6.208117	-1.723442	0.1019
DLM3	32.67139	1.067052	0.3001
C	-0.300541	-0.209663	0.8363

EC = GDP_GRWT - (1.4172* Dexchr + 6.1604*DLRES + 0.0627*DINF + 0.2025*DOIL_P -10.3314*DLMC -6.2081*DMPR + 32.6714*DLM3 - 0.3005)

Note that, ***, **, * denotes statistical significance at 1%, 5%, and 10% respectively

Source: Output from Eviews.

The Breusch-Godfrey test is used to detect the presence of serial correlation (autocorrelation) in the residuals of a regression model. Serial correlation violates one of the key assumptions of many regression models. From Table 6 above the observed R square probability as well as the F-statistics values are individually greater than a 5 percent level of significance, suggesting that we fail to reject the null hypothesis that there is no evidence of serial correlation in the model. Therefore, the model is well-fitted, and the error terms are likely to be independent of each other. This is a very desirable proper for quality statistical analyses. Thus, the statistical evidence on which basis the conclusions from this study are derived, are very reliable.

Post-estimation test.

Table 6. Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test: Null hypothesis: No serial correlation at up to 2 lags			
F-statistic	0.236141	Prob. F(2,16)	0.7924
Obs*R-squared	**0.946152**	**Prob. Chi-Square (2)**	**0.6231**

Source: Output from Eviews.

Again, the Breusch-Pagan-Godfrey test is used to detect the presence of heteroskedasticity in a regression model. Heteroskedasticity occurs when the variance of the errors is not constant across all levels of the independent variables. Thus, from Table 7, we fail to reject the null hypothesis, suggesting that we accept that there is strong evidence of homoskedasticity in the

model, which implies a constant error term. Thus, all three test statistics suggest that we failed to reject the null hypothesis of homoskedasticity at the 5% significance level. This means that there is no strong evidence of heteroskedasticity in your model.

Table 7. Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey Null hypothesis: Homoskedasticity			
F-statistic	1.993711	Prob. F (14,18)	0.0845
Obs*R-squared	20.06219	Prob. Chi-Square (14)	0.1282
Scaled explained SS	**7.275242**	**Prob. Chi-Square (14)**	**0.9236**

Source: Output from Eviews.

The CUSUM graph above suggests overall, that the model's parameters are stable over time, and there's no strong evidence of structural breaks that would require adjusting the model or splitting your data into different periods for analysis. The CUSUM of Squares test, which is a variation of the CUSUM Test, suggests that the model's variance is stable over time. Therefore, there are no significant structural breaks in terms of variance that would require adjusting your model or splitting your data into different periods for analysis. In summary, the combination of both CUSUM and CUSUM of Squares tests staying within their respective boundaries provides strong evidence for the overall stability of the model in terms of both its parameters and variance structure.

Stability Test.

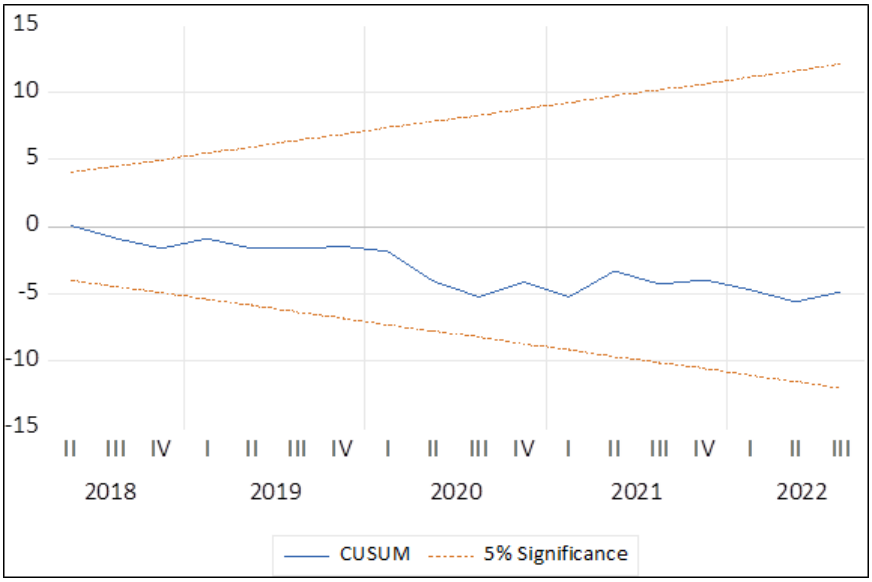
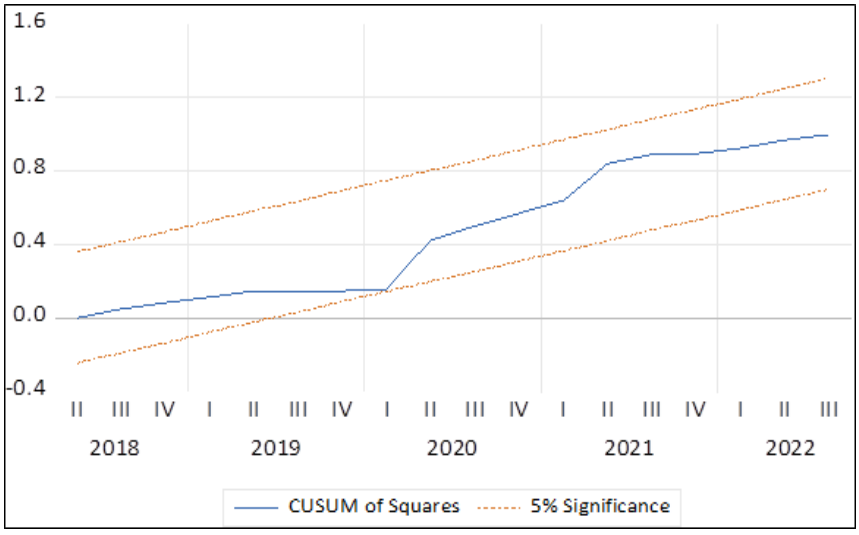


Figure 1. The CUSUM Test

Source: Output from Eviews.



F

Figure 2. CUSUM Squared Test

Source: Output from Eviews.

5. Summary of Findings, Conclusions, and Recommendations

5.1 Summary of Findings

This study examined the exchange rate, external reserve, and economic growth nexus in Nigeria and recommended appropriate policy actions towards improving economic growth in Nigeria. The paper conducted empirical analysis using the ARDL approach to examine the dynamic relationship between these variables. Appropriate data were sourced from the CBN statistical data warehouse and the NBS database. The result emanating from the estimation confirmed evidence of a long-run relationship between GDP growth and various economic factors including exchange rate, inflation, oil price, and monetary policy rate. However, among these variables, the exchange rate was found to be the most significant factor driving economic growth in the long run, suggesting that an appreciation of the exchange rate is associated with higher growth in Nigeria.

In the short run, Nigeria's economic growth demonstrated significant persistence, indicating the presence of a self-reinforcing growth cycle. This suggests that a virtuous circle of economic expansion is actively functioning in the country, where growth begets further growth. In addition, the result revealed that exchange rate depreciation boosts short-run growth, but the effect is not sustained. As for inflation and oil price, the empirical evidence suggests that both inflation and oil price exert an initial negative impact on growth, but this effect is largely offset in the following quarter as the economy demonstrates a very strong resilience to inflationary pressure

and oil price shocks. The result confirmed that monetary policy (interest rate) has a strong immediate impact on growth.

5.2 Discussion of Findings

The study reveals a dynamic and multifaceted relationship between macroeconomic variables and GDP growth in Nigeria. The descriptive statistics highlight significant volatility in economic growth over the study period, driven by external shocks such as oil price fluctuations, the COVID-19 pandemic, and policy reforms. Exchange rate depreciation was particularly pronounced, with wide fluctuations suggesting instability that dampens investor confidence. However, the potential for growth through export competitiveness remains contingent on the elasticity of trade. Inflation remained persistently high, influencing monetary policy tightening, which in turn constrained access to credit and stifled growth.

Empirical results from the ARDL model confirm a long run cointegrating relationship among the variables, with exchange rate emerging as the most influential factor on GDP growth in the long term. A 1% appreciation in the naira is associated with a 1.42% increase in GDP growth, underscoring the importance of exchange rate stability for macroeconomic performance. Other variables such as inflation, oil prices, interest rates, and money supply did not show statistically significant long-run effects, suggesting that their influence may be more pronounced in the short term or that the economy has built-in resilience to these shocks. The Error Correction Model further supports the existence of a stable long-run equilibrium, with about 27% of deviations corrected each quarter.

In the short run, the findings show strong growth persistence and significant impacts from exchange rate movements, inflation, oil prices, and monetary policy rate. Notably, exchange rate depreciation boosts short-term growth, while inflation and interest rate hikes negatively affect it. The dual role of oil prices, initially dampening growth due to higher input costs, then stimulating it through increased government spending, reflects Nigeria's complex economic structure. Interestingly, money supply, stock market capitalization, and external reserves did not exhibit significant short-run effects, indicating that traditional monetary expansion and capital market development may not be effective tools for immediate growth stimulation. These insights suggest that a balanced policy mix, with emphasis on exchange rate management and prudent monetary policy, is essential for both short- and long-term economic stability.

5.3 Conclusions

Overall, this paper found evidence to support the argument that the Nigerian economy demonstrates strong resilience against inflationary pressures and oil price volatility. While interest rate adjustments serve as an effective short-term economic management tool, and whereas exchange rate policies can only influence growth temporarily, traditional monetary expansion and stock market development appear less impactful for short-run growth stimulation.

Despite external challenges, the economy demonstrates inherent stability, with relatively swift adjustment mechanisms in response to shocks.

6. Policy Recommendations

1. Strengthening the Nigerian financial market by promoting accountability, transparency, and disclosure. These will demonstrate the capital market's functioning, which will help to increase investor confidence, attract capital inflow, and boost the country's foreign reserves.
2. Diversifying the Nigerian economy from mono-product to multi-product exchange economy through export promotion and tax incentives.
3. Improving output for exportable goods by developing the agricultural and manufacturing sectors through modernization, technology, and mechanization to drive value chain in the ecosystem. This would further prepare the SMEs for export thus attracting foreign exchange earnings.
4. Determining the optimal threshold for foreign exchange market intervention to further stabilize the exchange rate and improve external reserve levels.

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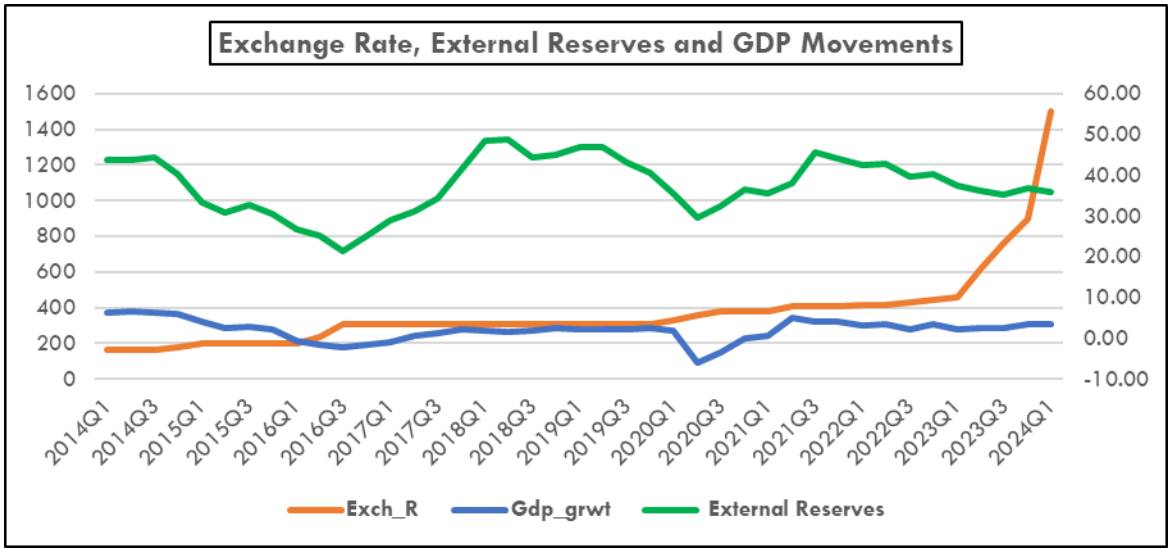
Appendix 1

Trend of Exchange Rate, External Reserves and Economic Growth from Q12014-Q12024.



Source: CBN Statistical Database

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N/A

Author Contributions

Author contributions follow the CRediT (Contributor Roles Taxonomy). Use only the contributor roles applicable to this manuscript.

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Supervision: Dr. Victor, Ugbem Oboh

Other CRediT Roles: Data curation, Funding acquisition, Project administration, Resources, Software, Validation, Visualization

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The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed Consent

Not applicable.

Ethics Approval

Ethics approval was not required because the paper did not make use of any sensitive or confidential data. All used data is sufficiently available in the public domain and thus accessible for all interested researchers.

Data Availability Statement

Public repository: The datasets generated and/or analyzed during the current study are publicly available in the Central Bank of Nigeria Statistical Bulletin.

Use of Artificial Intelligence

N/A

Supplementary Materials

All literatures used are very much available online for reference.

Journal Information

Ethics Statement

The journal follows publication-ethics policies informed by current COPE guidance.

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