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Exchange Rate Volatility and its Impact on International Trade Performance in the Nigerian economy from 1990 to 2024

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***Abstract*—This study examined exchange rate volatility and its impact on international trade performance in the Nigerian economy from 1990 to 2024. The study was motivated by the persistent instability of the Nigerian exchange rate and its implications for exports, imports and the broader external sector. Specifically, the study investigated the dynamic relationship between exchange rate movements and international trade performance while accounting for other important macroeconomic variables, including crude oil prices, gross domestic product (GDP), foreign direct investment (FDI), inflation and electricity distribution. Annual secondary data were obtained for the study period, and descriptive statistics, the Augmented Dickey-Fuller (ADF) unit-root test, Johansen cointegration test, Vector Error Correction Model (VECM), impulse-response function (IRF) and forecast error variance decomposition (FEVD) were employed for the empirical analysis.**

The descriptive results revealed considerable instability in the Nigerian exchange rate, with a standard deviation of 270.948, positive skewness of 3.374 and kurtosis of 16.895, indicating substantial volatility and extreme observations. Inflation also exhibited considerable variability and non-normality. The ADF results showed that crude oil prices, exports, imports, GDP, FDI and electricity distribution were integrated of order one, I(1), while inflation was stationary at level, I(0). The exchange-rate series did not become stationary after first differencing under the reported ADF specification, suggesting the need for further investigation of its integration properties and possible structural breaks. Notwithstanding this limitation, the Johansen cointegration tests identified two long-run cointegrating relationships, indicating stable long-run equilibrium relationships among the exchange rate, oil prices, exports, imports, GDP, FDI and electricity distribution.

The VECM results showed that the exchange rate did not significantly adjust to deviations from the long-run equilibrium at the 5 percent level, whereas exports significantly adjusted to one of the cointegrating relationships. The short-run exchange-rate equation further indicated that the lagged changes in exports, imports, oil prices, GDP, FDI and electricity distribution did not significantly explain exchange-rate changes. However, the impulse-response analysis revealed that an exchange-rate shock produced a persistent negative response in imports throughout the ten-year horizon.

Exports also responded negatively to exchange-rate shocks, although the effect was smaller and became weaker over time. The FEVD results reinforced these findings: at the tenth horizon, exchange-rate shocks explained 24.28 percent of import forecast variance but only 2.68 percent of export forecast variance. Oil-price shocks accounted for 39.52 percent of import forecast variance.

The study therefore concludes that exchange-rate volatility affects Nigeria's international trade performance asymmetrically, exerting a considerably stronger influence on imports than exports. Exchange-rate depreciation tends to compress imports but does not automatically stimulate export expansion. The study recommends policies to excessive exchange-rate volatility, diversifying the export base, strengthening domestic productive capacity, improving electricity and trade infrastructure, reducing dependence on imported production inputs, enhancing foreign-exchange access for productive sectors and maintaining macroeconomic stability. A coordinated exchange-rate, trade and industrial policy framework is therefore essential for achieving sustainable improvements in Nigeria's international trade performance.

***Keywords*— Exchange rate volatility, inflation rate, Vector Error Correction Model (VECM), impulse-response function (IRF) and forecast error variance decomposition (FEVD) export proceeds, diversification, long run equilibrium, macroeconomic variables and multi-cultural foreign exchange rate.**

I. INTRODUCTION

Exchange rate stability is an important component of macroeconomic management and international economic performance, particularly in developing economies, that influences the domestic prices of imported goods, the international competitiveness of exports, the profitability of firms engaged in cross-border transactions and the purchasing power of households. Consequently, persistent exchange-rate volatility can create uncertainty for producers, exporters, importers and investors, thereby affecting investment decisions, trade flows and ultimately economic growth.

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These issues have been a particular case in Nigeria because of the country's long-standing dependence on crude-oil exports, substantial import requirements, limited export diversification, recurrent foreign-exchange market pressures and consistent policy changes in the country. (Akinrele, A. (2016).

Nigeria has experienced several exchange-rate regimes since the introduction of the Structural Adjustment Programme (SAP) in 1986. The country has moved between fixed, managed and more flexible exchange-rate arrangements in response to changing external conditions, oil-price movements and foreign-exchange shortages in the bid to settle the balance-of-payments pressures. (Frankel, J. (2017). These macroeconomic swing have generated considerable fluctuations in the value of the naira and have frequently caused inflationary pressures in the economy and uncertainty in the foreign-exchange market. (Abina, A. P. (2023).

The significance of exchange-rate management increased considerably after the decline in foreign-exchange earnings and the emergence of persistent liquidity constraints in the foreign-exchange market, thereby creating difficulties for the importation of machinery, raw materials and intermediate goods while also affecting the competitiveness of Nigerian exports.

In June 2023 the Central Bank of Nigeria (CBN) introduced significant reforms to the foreign-exchange market to unifying previously segmented exchange-rate windows and moving toward a market-determined exchange-rate system. (Oluwaniyi, T.G., et al, (2026). This reform represented a substantial departure from the previous system of multiple exchange rates and was intended to improve transparency, strengthen price discovery, reduce distortions and enhance the efficiency of foreign-exchange allocation. However, this immediate adjustment also resulted in substantial naira depreciation and increased exchange-rate volatility. The implications of the reform therefore extend beyond the foreign-exchange market itself because changes on the exchange rate can affect imports, exports, domestic prices, investment and production. (Corden, W. M. (1994).

It also examines whether the nature and strength of these relationships changed following the 2023 foreign-exchange reform. The study therefore moves beyond a simple examination of whether the naira appreciates or depreciates by focusing on the broader consequences of exchange-rate uncertainty for international economic performance.

It does so by providing evidence on incorporated foreign-exchange policy changes introduced from 2023.

Second, it distinguishes the effects of exchange-rate volatility on international trade from the effects of exchange-rate levels. Third, it considers both the short-run and long-run relationships among exchange-rate volatility, trade and economic growth. Fourth, by examining the post-reform period alongside the preceding regime, the study provides evidence on whether Nigeria's movement toward a more market-oriented foreign-exchange system has altered the country's trade-growth dynamics. Finally, enable the provision of useful policy implications for exchange-rate management, export diversification, import dependence and sustainable economic growth. The study examined macroeconomic variables including foreign direct investment (FDI), crude oil prices, export value, import value, inflation rate, and electricity distribution. The study employed statistical and econometric tools such as descriptive statistics, the Augmented Dickey–Fuller (ADF) test to determine unit roots, Johansen cointegration techniques to establish the relationship between the variables in the study, and a Vector Error Correction Model (VECM) to capture both long-run equilibrium relationships and short-run adjustment dynamics.

1.1 Problem Statement

To comply with the conference paper formatting requirement, use this document as a template and simply type your text into it. Nigeria has suffered several foreign exchange regimes based on different macroeconomic policies implemented by different governments but has always struggled with foreign exchange has generated mixed impacts on the economic growth of the country, and this has created a cause for worry for researchers, economists and academicians. This has also created the gap necessary for this research study in order to carefully study the impact of volatile exchange rate and how this affects the international trade business of the country in terms of the Gross Domestic Product (GDP) of the country, export rate, import rate, inflation rate as well as infrastructural development of the country within the periods of 1990 to 2024, since this period cover several foreign exchange regimes that has existed in the country and the present economic reform.

1.2 Significance of the Study

The importance of this research study Is to review the empirical literature on foreign exchange volatility and to explore the effects of foreign exchange volatility on the import trade and export performance of developing economies, specifically for Nigeria.

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Secondly, to study the causes of foreign exchange volatility in the country as well as offer relevant policy findings that can guide government strategies towards achieving stable foreign exchange regime in Nigeria. Thirdly, the study seeks to provide framework to assess improved foreign exchange policies align with Nigeria's long-term development goals, especially in the context of the African Continental Free Trade Area (AfCFTA) and other international bodies. Finally, to serve as a reference point for academics, policymakers, and development practitioners seeking to understand the complexities of foreign exchange mechanism for economic trade-growth

1.3 Limitation and the Scope of the Study

The study is subject to several limitations. First, data availability, consistency and reliability remain challenges, particularly for infrastructure, FDI, foreign exchange and trade indicators. Differences in definitions, measurement methods, reporting standards and subsequent data revisions may affect comparability across the 1990–2024 period.

Second, isolating the independent effect of foreign exchange volatility is difficult because exchange rates, inflation, GDP, interest rates, imports, exports, FDI and oil prices are highly interconnected. Similarly, distinguishing the effects of individual exchange-rate regimes from those of fiscal, monetary and trade policies presents an empirical challenge.

Third, Nigeria experienced significant structural and policy changes, including the Structural Adjustment Programme, banking reforms, trade liberalisation and successive foreign exchange reforms. These changes may have created structural breaks that the econometric model do not fully capture.

Fourth, major domestic and international shocks, including oil-price fluctuations, the global financial crisis, COVID-19, supply-chain disruptions and the Russia–Ukraine war, affected several economic indicators simultaneously.

Finally, recent foreign exchange pressures, currency depreciation, high inflation, infrastructure deficiencies, insecurity and Nigeria's dependence on crude-oil exports and imported inputs may influence trade performance beyond exchange-rate effects. Despite these limitations, robust time-series econometric techniques are employed to obtain credible results, although findings should be interpreted within Nigeria's evolving economic environment.

II. Literature Review

2.1 Conceptual Review

2.1.1 Exchange Rate and Exchange Rate Volatility

The exchange rate represents the price of one country's currency in terms of another currency. For Nigeria, the naira–US dollar exchange rate is particularly important because the United States dollar is widely used for international trade, external debt obligations, foreign investment transactions and the pricing of crude oil and many internationally traded commodities. Changes in the exchange rate consequently affect domestic prices, production costs, export competitiveness, import demand and investment decisions.

Exchange-rate volatility refers to the degree of variability and uncertainty in the exchange rate over time. It differs from a simple depreciation or appreciation of the domestic currency. Volatility causes uncertainty and unpredictability surrounding exchange-rate movements. These unpredictable fluctuations can discourage firms from entering international markets.

Nigeria has experienced several exchange-rate regimes since the 1980s. Nigeria's foreign-exchange system has undergone several major reforms since the early 1980s, moving from tight administrative exchange controls, through market liberalisation and auction systems, to the more market-oriented Nigerian Foreign Exchange Market (NFEM) framework. The major reforms and their implementation years are summarized below.

In 1982 the foreign exchange reform referred to as Comprehensive exchange control regime was implemented by the then government to correct the growing foreign exchange shortage in Nigeria due to the falling oil revenue, so the government decided to ration the foreign currencies through the system so as to contribute to the growth of a parallel market due to the increasing distortions caused by the foreign exchange shortage.

In September, 1986 during the Structural Adjustment Programme (SAP) when the country was suffering form serious foreign exchange challenge as the economy of the country was suffering a downturn. The military government introduced the Second-Tier Foreign Exchange Market (SFEM) to handle more market-oriented mechanism in which the exchange-rate and allocation of foreign change and allocation of foreign exchange were determined by demand and supply and was later in 1987 transformed to Unified Foreign Exchange market whose objective was to reduce distortions and establish a more consistent exchange-rate determination mechanism.

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By 1989 due to the frequent movement of foreign exchange lead to the measure of trying to fix or stabilise the exchange rate by introducing Bureaux De Change (BDC) to help provide foreign exchange to small users and deepen the retail FX market. But, the foreign exchange persisted so in 1994 the then government temporarily moved back toward tighter control of naira by formally pegged exchange rate by the centralized system, the CBN and BDCs acting as CBN agents. The processes were referred to as pegging and control method.

In 1995 the Autonomous Foreign Exchange Market (AFEM), this represented another move toward liberalisation, where authorised dealers could sell foreign exchange to end-users at market-determined rates and BDCs were again recognised as authorised buyers and sellers. As the need for foreign exchange continue to increase the need to increase dealers so in 1999 banks were also included as authorised dealers so the expansion of the market created Interbank Foreign Exchange Market (IFEM) to strengthen market-based, deepen and creating a more competitive foreign exchange market in the country. The market continued to metamorphoses therefore, it was necessary to increase transparency in the market. In July, 2002 the Retail Dutch Auction System (RDAS) was introduced by the Central bank of Nigeria where authorised dealers submitted customer-based bids, with the system intended to improve transparency, reduce arbitrage and stabilise the exchange rate.

The RDAS was becoming slow and dealer's complaint had to be addressed with the introduction of the Wholesale Dutch Auction System (WDAS) in 2006 to allow banks to purchase foreign exchange on their own accounts and subsequently sell to customers. This process sought to improve allocation efficiency and deepen the FX market. The auction-based approach formed part of the broader 2002–2015 foreign exchange-management period.

In June 2016 the Central Bank of Nigeria introduced the Managed Floating Exchange-rate Regime and Investors' & Exporters' (I&E) Window, where the I&E Window was introduced to provide a more transparent, market-driven platform for eligible foreign exchange] transactions and to improve liquidity and investor confidence, in furtherance to this the CBN and FMDQ introduced naira-settled FX futures to provide a mechanism for hedging exchange-rate risk and improve foreign exchange-market liquidity.

In 2023 the Central Bank of Nigeria (CBN) introduce the Willing buyer – Willing seller market system under the Nigerian Foreign Exchange Market (NFEM), the objective is for price unification, price discovery, elimination of multiple exchange rates, reduction of arbitrage and as such allowing demand and supply to play a greater role in determining the naira rate. However, CBN retains the ability to intervene through foreign exchange sales to authorised dealers and other market operations to manage liquidity and disorderly market conditions.

2.1.2 International Trade and Economic Growth

International trade provides Nigeria with access to foreign markets, foreign exchange, technology, capital goods and intermediate inputs, all of which can enhance productive capacity. Exports can stimulate production and investment, while imports can provide essential machinery and productive inputs. Trade openness can further encourage competition, specialisation and integration into global value chains.

Nevertheless, Nigeria's experience indicates that the quality, composition and structure of trade are as important as the volume of trade. The continued dominance of crude oil and gas in exports has made the economy vulnerable to international commodity-price fluctuations. The World Trade Organisation reported that hydrocarbons accounted for more than 90% of Nigeria's goods exports in 2023, while the World Bank has emphasised the volatility associated with Nigeria's oil-dependent export structure.

Consequently, Nigeria's long-term growth strategy requires a shift from dependence on primary commodity exports to diversified, value-added exports, particularly manufactured and agro-processed products. This should be complemented by imports of productive capital goods and intermediate inputs, improved infrastructure, stable macroeconomic policies, efficient ports and customs procedures, competitive exchange-rate conditions, and stronger domestic productive capacity. Such an approach would enable international trade to function not merely as a source of foreign exchange but as an instrument for structural transformation and sustainable economic growth.

Trade openness refers to the degree to which an economy participates in international trade. It is often represented as below equation:

$$\text{Trade Openness} = (\text{Exports} + \text{Imports}) / \text{GDP} \times 100$$

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A higher trade-openness ratio indicates greater integration into the global economy.

Theoretically, greater trade openness can stimulate economic growth by expanding market access, increasing competition, facilitating technology transfer and encouraging specialisation according to comparative advantage. Openness can also attract foreign direct investment because multinational firms may establish production facilities in countries that provide access to regional and international markets.

However, trade openness does not automatically generate economic growth. Its benefits depend on domestic productive capacity, infrastructure, human capital, institutional quality and macroeconomic stability. In Nigeria, constraints such as inadequate infrastructure, unreliable electricity, exchange-rate instability, high logistics costs and policy uncertainty limit domestic firms from exploiting international market opportunities.

The World Bank's assessment has highlighted that Nigeria's trade openness has remained relatively low compared with several comparator economies and that export diversification has stagnated. The World Trade Organisation (WTO) similarly argues that trade facilitation, infrastructure improvements, regulatory reforms and greater competitiveness are important for Nigeria to obtain greater benefits from international trade.

2.1.3 Exchange Rate Volatility and Export Performance

Exchange-rate volatility can affect exports through price competitiveness, revenue uncertainty and production costs. Depreciation of the naira can make Nigerian exports cheaper in foreign-currency terms and potentially increase foreign demand. However, if exporters depend heavily on imported machinery, raw materials or intermediate goods, depreciation can increase production costs and reduce the expected gains from improved export competitiveness.

Exchange-rate volatility can also increase the risk associated with international contracts. Exporters may be uncertain about the domestic-currency value of future foreign-currency receipts, while importers may be uncertain about the future cost of imported inputs. These risks can discourage firms from entering long-term international trade relationships.

Empirical evidence for Nigeria is mixed. Duru et al. (2022), using quarterly data from 2005-Q1 to 2020-Q4 and ARCH, GARCH, TARCH and EGARCH models, found evidence of exchange-rate volatility but reported that volatility had a negative and statistically insignificant effect on exports. The authors therefore argued for policies that promote exchange-rate stability and an enabling environment for export production.

More recent evidence presents a somewhat different picture. Gelle et al. (2025), using annual data from 1990–2024, examined exchange-rate volatility and Nigerian non-oil exports using ARCH/GARCH techniques. Their results indicated a significant relationship between exchange-rate movements and non-oil exports, although the study also emphasised the importance of exchange-rate stability for maintaining export competitiveness.

The conflicting findings suggest that the effect of exchange-rate volatility may depend on the period under examination, the measure of volatility, the type of exports considered and the exchange-rate regime during the period.

2.1.4 Exchange Rate Volatility and Imports

Exchange-rate volatility can affect import operations through both prices and uncertainty. Naira depreciation increases the domestic-currency price of imported goods. This can reduce demand for imported consumer goods but can also increase the cost of imported machinery, raw materials and intermediate inputs.

This is particularly important for Nigeria because manufacturing and other productive sectors depend on imported capital and imported intermediate goods. Consequently, exchange-rate depreciation can produce contradictory effects: it may discourage non-essential consumption imports while simultaneously increasing the cost of productive investment.

Exchange-rate volatility can also discourage importers from entering forward contracts or making long-term commitments because future naira costs become uncertain. Thus, excessive volatility may reduce imports, exports and international trade businesses by increasing transaction risk.

2.1.5 Exchange Rate Volatility and Economic Growth

The exchange-rate-growth relationship is theoretically ambiguous. A stable and appropriately valued exchange rate can facilitate investment, international trade and macroeconomic planning. Conversely, excessive volatility can increase uncertainty, inflation and production costs and therefore reduce economic growth.

The empirical literature on Nigeria has produced mixed results. Ugochukwu (2015), using annual Nigerian data for 1980–2012 and a GARCH-generated measure of exchange-rate volatility, investigated the relationship between exchange-rate volatility and economic growth. The study found evidence of exchange-rate volatility and a long-run relationship among the variables examined.

Ayadi and Jeremiah (2016), using Nigerian data covering 1970–2010, also employed GARCH techniques to measure exchange-rate variability and Johansen cointegration and ECM approaches.

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Their findings suggested that exchange-rate instability did not necessarily discourage investment and economic growth during the period studied.

More recent evidence, however, suggests that volatility can have adverse short-run effects. Ekiran, Afolabi and Olasehinde (2023), using data from 1981–2021 and ARDL and Granger-causality techniques, found a long-run relationship among exchange-rate volatility, trade openness and economic growth, while exchange-rate volatility had a negative and significant short-run effect on economic growth.

Similarly, Nkwa et al. (2025), examining 1990–2023 with an ARDL approach, found a relationship between exchange-rate movements and economic growth and emphasised the importance of exchange-rate stability for sustainable growth.

These findings suggest that exchange-rate volatility may have different effects in the short and long run. It is therefore important for the present study to distinguish between short-run adjustment and long-run equilibrium relationships.

2.2 Theoretical Literature

2.2.1 Purchasing Power Parity Theory

In 1918, Gustav Cassel proposed the theory Purchasing Power Parity (PPP), where he explained that exchange rates should reflect the relative price levels between countries. Under the absolute version of PPP, identical goods should have the same price when expressed in a common currency.

PPP is relevant to this study because persistent differences between domestic and international prices can influence the real exchange rate and Nigeria's international competitiveness. If domestic inflation is substantially higher than that of trading partners, the real value of Nigerian goods may increase relative to foreign goods, potentially reducing export competitiveness.

However, PPP may not hold fully in Nigeria because of transportation costs, trade barriers, market imperfections, non-tradable goods and persistent structural differences in the economy.

2.2.2 Interest Rate Parity Theory

The Interest Rate Parity (IRP) theory was formally propounded by John Maynard Keynes in 1923 and the concept provides another explanation of exchange-rate movements by linking exchange rates to differences in interest rates between countries. Changes in domestic interest rates relative to foreign interest rates can influence capital flows and consequently exchange-rate movements.

For Nigeria, this relationship is important because monetary-policy decisions can influence capital inflows, foreign-exchange liquidity and exchange-rate stability. Higher domestic interest rates may attract capital inflows under certain conditions, while lower rates may contribute to capital outflows and exchange-rate pressure.

The theory is therefore useful in explaining why exchange-rate volatility cannot be considered independently of monetary and financial conditions.

2.2.3 Purchasing Power and the Real Exchange Rate Competitiveness Approach

The Real Exchange Rate Competitiveness (RERC) approach was propounded by several economists in the 1980s and it provides a more appropriate measure of international competitiveness than the nominal exchange rate alone because it incorporates differences in domestic and foreign prices.

A real depreciation can make domestic goods relatively cheaper and improve export competitiveness. However, the extent to which this translates into higher exports depends on supply capacity and the price responsiveness of foreign demand.

This is particularly relevant to Nigeria because depreciation may not automatically generate increased exports if domestic firms face electricity shortages, inadequate transport infrastructure, high financing costs and dependence on imported inputs.

2.4 Elasticity Approach and the Marshall–Lerner Condition

The Elasticity Approach was propounded by Joan Robinson in the 1930s and it provides an important theoretical basis for examining the relationship between exchange rates and balance of trade. It focuses on how changes in the exchange rate affect export and import quantities and consequently, the balance of trade.

While, the Marshall–Lerner condition was propounded by Alfred Marshall and Abba P. Lerner in 1944. The condition states that currency depreciation is expected to improve the trade balance when the sum of the absolute values of the price elasticities of export and import demand exceeds one.

The implication for Nigeria is that depreciation will improve exports only if foreign demand responds sufficiently to lower foreign-currency prices of Nigerian goods. If export demand is relatively inelastic, depreciation may have only a limited effect.

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The Nigerian case is complicated by crude oil. Since Nigeria is a major oil exporter and crude oil is internationally priced, exchange-rate depreciation may have a different effect on oil exports than on manufactured or agricultural exports.

2.2.5 J-Curve Theory

The J-curve hypothesis was propounded by James C. Davies in 1962 and he proposes that a currency depreciation may initially worsen the trade balance before improving it in the longer term.

Immediately after depreciation, the domestic currency value of imports can rise because import contracts and quantities cannot adjust instantly. Over time, however, consumers may reduce import demand while exporters increase production, potentially improving the trade balance.

This theory is highly relevant to Nigeria because the country's dependence on imported goods and inputs means that the immediate effect of naira depreciation may be an increase in the domestic cost of imports. Whether export competitiveness subsequently offsets these effects is an empirical question.

2.2.6 Export-Led Growth Theory

Export-Led Growth (ELG) theory was propounded by Bela Balassa and Anne O. Krueger in 1978 and theory proposes that exports can serve as an engine of economic growth. Export expansion can increase aggregate demand, foreign-exchange earnings, economies of scale, productivity and technological development.

The theory is especially relevant to Nigeria's objective of diversifying away from crude-oil dependence. If exchange-rate depreciation increases non-oil exports, it could support manufacturing, agriculture, employment and broader economic growth.

However, the export-led-growth mechanism may be weakened when export growth is concentrated in crude oil rather than diversified manufacturing and agricultural products.

2.2.7 Endogenous Growth Theory

Endogenous growth theory was propounded by Paul Romer in 1986 and he was further supported by Rober E. Lucas in 1988, and the framework emphasises human capital, technological progress, knowledge accumulation and innovation as determinants of long-run growth.

International trade can contribute to endogenous growth by exposing domestic firms to foreign technology, knowledge and competitive pressures. Imports of capital goods can also increase productive capacity.

However, exchange-rate volatility can interfere with this process by increasing the cost of imported technology and machinery. Thus, exchange-rate instability may weaken the ability of Nigerian firms to use international trade as a mechanism for technological upgrading and long-run growth.

2.3 Empirical Review

2.3.1 Evidence on Exchange Rate Volatility and Nigerian Exports

Duru et al. (2022) investigated exchange-rate volatility and exports in Nigeria using quarterly data from 2005-Q1 to 2020-Q4. The researchers employed ARCH, GARCH, TARCH and EGARCH models and an ARDL bounds-testing framework. Their findings confirmed the existence of exchange-rate volatility but indicated that its effect on exports was negative and statistically insignificant.

This finding suggests that volatility may create uncertainty without necessarily producing a statistically measurable reduction in aggregate exports. However, the study's sample ended in 2020 and therefore did not cover the major 2023 foreign-exchange reform.

Gelle et al. (2025) extended the period to 1990–2024 and examined non-oil exports, including food-crop, cash-crop and solid-mineral exports. Their use of ARCH/GARCH techniques represents an important contribution because it captures the time-varying nature of exchange-rate uncertainty. Their findings indicate that exchange-rate movements significantly influence non-oil export performance.

A sectoral study by Ebeh and Halilu (2026) similarly examined Nigerian trade performance using monthly data from January 2004 to December 2024 and generated exchange-rate volatility through a GARCH(1,1) model. The study's sectoral approach reinforces the importance of distinguishing between different export categories rather than relying exclusively on aggregate exports.

2.3.2 Exchange Rate Volatility and Crude-Oil Exports

Exchange-rate volatility may operate differently in Nigeria's crude-oil sector. Olubusoye et al. (2020) examined exchange-rate volatility and Nigeria's crude-oil exports to seven trading partners using monthly data from 2006-M1 to 2019-M12. Exchange-rate volatility was estimated using GARCH, while ARDL was used to assess the effects on crude-oil exports. The study found that exchange-rate volatility significantly influenced crude-oil exports, although the magnitude differed across trading partners.

This finding is significant because it challenges the assumption that oil exports are completely insulated from exchange-rate uncertainty simply because crude oil is priced internationally in dollars. Exchange-rate relationships with trading partners can still influence export volumes and bilateral trade outcomes.

2.3.3 Exchange Rate Volatility, Trade Openness and Economic Growth

Ekiran, Afolabi and Olasehinde (2023) examined exchange-rate volatility, trade openness and Nigerian economic growth over 1981–2021. Using ARDL and Pairwise Granger causality, the study found a long-run relationship among the variables and reported a negative short-run effect of exchange-rate volatility on economic growth.

Gimba, Omale and Anaba (2025) extended the literature by explicitly treating exchange-rate volatility as a moderating variable between trade openness and economic growth. Using quarterly data for 2002–2022, TGARCH and ARDL techniques, they found that exports had a positively significant effect on economic growth when moderated by exchange-rate volatility, while imports had a negative and significant effect.

This study is particularly relevant because it demonstrates that exchange-rate volatility should not necessarily be treated only as a direct determinant of growth. It may also change the strength of the relationship between international trade and economic growth.

2.3.4 Exchange Rate Volatility and Overall Macroeconomic Performance

Oyadeyi's study, first published online in 2024 and subsequently appearing in *Foreign Trade Review*, examined exchange-rate volatility in Nigeria using quarterly data from Q1 1986 to Q4 2023. The study employed ARCH, nonlinear GARCH and dynamic ARDL techniques. It found evidence of ARCH and nonlinear GARCH effects in Nigerian exchange-rate volatility, demonstrating that volatility is not simply random noise but has systematic dynamic characteristics.

This finding has important implications for the present research because it supports applying conditional-volatility models such as GARCH when constructing an exchange-rate-volatility variable.

It is worth noting that most studies employ conditional volatility measures. Moreover, some show that exchange rate time series do not exhibit Gaussian behavior (Atlan et al. 1992) and thus, criticize the use of the standard deviation and the coefficient of variation.

The current paper measures exchange rate volatility based on the GARCH conditional variance using the following two equations:

$$ext = \beta 0 + \Sigma i{=}1p\ \beta i\ ext\text{-}i + \varepsilon t \text{ - - - -- } (1)$$

$$hmt = 2mt = \lambda 0 + \Sigma i{=}1\ p\ \ \lambda 0\ \varepsilon 2t\text{-}1 + \mu\ 0\ 2t\text{-}i \text{ -} (2)$$

where *ext* and *hmt* denote the logarithm of nominal and real exchange rates and the conditional variance, respectively. The latter represents our monthly exchange rate volatility. The construction of the monthly exchange rate volatility indices using the GARCH (1,1) model is based on the estimation of Equations (1) and (2).

By estimating Equations (1) and (2) for each country, we obtain monthly exchange rate volatility time series. Figures 1 and 2 plot the evolution of monthly nominal and real exchange rate volatility by country (hmt).

Finally, we compute the annual exchange rate volatility as follows:

$$vex\ t = 1/12 \times (hm1 + hm2 + ... + hm12) \text{ - - - - - - - - - - - - - - - - - - } (3)$$

However, to estimate the foreign exchange volatility against economic growth the following model as equation (4) is applied

$$yit = \alpha + \beta yit\text{-}\ 1 + \varphi vexit + \delta' Xit + \mu i + \lambda t + \varepsilon it \text{ - - - - - - -- } (4)$$

where
yit = the logarithm of real per capita GDP
βyit = lagged logarithm of real per capita GDP
α = the matrix of control variables
φvexit = the conditional exchange rates volatility of Xit
δ'Xit = is a matrix of control variables
μi, λt and εit = the country-specific effects, the time specific effect, and the error term respectively

III. Research Methodology

This section deals with the steps by which data for the research work is collected and the various analysis technique used for the processes are applied. The secondary data is collected from Central Bank Nigeria (CBN) annual reports, National Bureau Statistics (NBS) annual report, World Bank quarterly reports and United Nation Conference on Trade and Development (UNCTAD). A complete description of the research design, data collection instruments utilised to achieved the research objective are elaborated carefully under this section.

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3.1 Research Design

For this research study, the chosen research design is the ex-post facto research design. The selected research design is to use systematic method where the researcher cannot manipulate data collected due to its occurrence as it is an annual report published by reputable organ of government in Nigeria and internationally.

3.2 Justification of Methodology

The secondary data to be used in the research study will be on the economic indexes of Nigeria within the period of study which is from 1990 to 2024. Furthermore, it was chosen over other possible alternatives due to its accessibility and reliability after due considerable analysis and verification of the data collection.

3.3 Data Sources and Collection Instrument

The research Secondary data span from 1990 to 2024 extracted from the Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics Annual reports, WDI Annual Report and related research studies reports. The secondary data collected include; the Total Foreign Direct investment (TFDI), the contribution to the Nigerian Total Gross Domestic Product (TGDP) which serve as a proxy for economic growth of the country, the country's annual Import value, Nigeria annual export value, the average annual exchange rate, average annual inflation rate, annual crude oil price per barrel and average electricity distribution. The choice of the secondary data is informed by the fact that data cannot be obtained through the primary source because they have to be collected over a longer period. The data were analysed using the descriptive analysis to identify the frequency distributions, means, and standard deviations. Regression analysis was also employed in determining the magnitude and direction of impact of the changes of exchange rate on international trade performance on the country's economy. The trend of the data collected are also related to the existing policies implemented within the said periods, so as to be able to understand the effect of the policies and related shocks associated with the processes. The variables used in the study include:

- Total Annual Gross Domestic Products(TGDP)
- Total Foreign Direct Investment (FDI) inflows
- Average annual exchange rate in dollars (Fx)
- Average annual inflation rate (Infl)
- Export value (Expt) — annual export value in US dollar
- Import value (Impt) — annual import value
- Crude oil price per barrel — annual crude price per barrel
- Electricity Distribution (INFR) — annual average infrastructural development

3.4 Technique for Data Analysis

The study will be considering time series data and as such the following time series econometric procedure allows for distinguishing between short-run fluctuations and long-run relationships between the stated variables which enable us to achieve some of the objectives of the study using E-views 14 software or SPSS software to run the statistical tests as well as the econometric tests.

IV. Data Presentation And Discussion

This section of the study deals with the data collected during the research work and it presence the various data in tabular form in which they can easily assist the researcher in achieving the objective of the paper as well as perform analysis so as to answer articulately all the research questions.

Below are the **descriptive statistics** for Nigeria's annual macroeconomic variables (1990–2024), followed by an **economic interpretation** of the results and the implied relationships among variables

TABLE-IV
DESCRIPTIVE STATISTICS FOR ANNUAL VARIABLES FROM 1990-2024

Variable	Mean	St. Deviation	Skwness	Kurtosis
Exchange Rate	217.63	270.95	3.38	16.89
Crude Oil Price	52.93	32.48	0.43	1.86
Export	73.34	46.40	0.36	1.97
Import	29.87	20.35	0.16	1.29
Inflation Rate	18.17	15.87	2.16	7.24
GDP	246.96	182.85	0.035	1.33
FDI	2.96	2.53	1.05	3.04
Electricity Distribution	48.48	8.64	-0.37	2.50

General Interpretation:

The descriptive statistics reveal **substantial differences in the behaviour and volatility of Nigeria's macroeconomic variables between 1990 and 2024**. The exchange rate exhibits the greatest instability, with a standard deviation of **270.95**, together with pronounced positive skewness and exceptionally high kurtosis. Inflation also demonstrates considerable instability and non-normality, as evidenced by its skewness of **2.16**, kurtosis of **7.24**, and Jarque–Bera statistic of **53.59**.

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In contrast, **crude oil prices, exports and electricity distribution** have relatively moderate skewness and comparatively low Jarque–Bera statistics, indicating distributions closer to normality. **GDP** is particularly noteworthy because its skewness (**0.035**) is almost zero, indicating an approximately symmetric distribution despite its substantial variation. FDI shows moderate positive skewness, reflecting periods of unusually high investment inflows.

Overall, the results suggest that **exchange rate and inflation are the most volatile and non-normally distributed variables**, while crude oil prices, exports and electricity distribution exhibit comparatively more stable distributional characteristics. These differences matter for the subsequent econometric analysis because substantial skewness, extreme observations and changing variability may influence the behaviour of the time-series variables and should therefore be considered when conducting unit-root, cointegration and VECM analyses. The underlying observations span 1990–2024.

Augmented Dickey–Fuller (ADF) Unit Root Test Results (1990–2024)

Sample:1990–2024
Method:ADF-Test
Deterministic-Component: Intercept
Lag Length: Automatic (AIC)

Table 4.3: Augmented Dickey-Fuller (ADF) Unit Root Test, 1990–2024

TABLE IV C
AUGMENTED DICKEY-FULLER UNIT ROOT TEST (1990-2024)

Variable	Level ADF Statistic	p-value	1st Difference ADF Statistic	p-value
Exchange Rate	1.7012	1.0000	4.5847	1.0000
Crude Oil Price	-2.2691	0.4511	-5.3369	0.0000
Export	-1.6019	0.7917	-5.2902	0.0000
Import	-1.9924	0.6056	-4.9362	0.0000
Inflation Rate	-4.0483	0.0075	-4.6603	0.0001
GDP	-2.4413	0.3579	-3.5122	0.0077
FDI	-1.1949	0.9115	-6.5842	0.0000
Electricity Distribution	-2.2771	0.4466	-5.3954	0.0000

Decision rule: At the 5% significance level, reject the null hypothesis of a unit root when the p-value is less than 0.05. Thus, rejection indicates stationarity.

Interpretation

The ADF results indicate that **crude oil price, exports, imports, GDP, FDI and electricity distribution are non-stationary at levels but become stationary after first differencing**. These variables are therefore integrated of order one, **I(1)**.

The **inflation rate is stationary at level**, with an ADF statistic of **-4.0483** and a p-value of **0.0075**. Since 0.0075 < 0.05, the null hypothesis of a unit root is rejected. Inflation is therefore **I(0)**.

The exchange-rate series does **not become stationary after first differencing**. Its first-difference ADF statistic is **4.5847**, with a p-value of **1.0000**. This means it cannot legitimately be classified as I(1) from this particular ADF specification.

The exchange-rate result is likely influenced by the **very large movement in the reported exchange rate in 2024**, from 760 in 2023 to 1,478.61 in 2024. Such a large movement can substantially affect an ADF test, particularly with only 35 annual observations. It would therefore be appropriate in the study to investigate the exchange-rate series further using a **structural-break unit-root test** (for example, Zivot-Andrews) or to verify the 2024 observation against the original CBN/NBS source.

V. SUMMARY OF STATIONARITY

TABLE IV A
STATIONARY TEST CLASSIFICATION

Variables	Summary of Stationary		
	Stationarity at Level	Stationarity at 1st Difference	Classification
Exchange Rate	NO	NO	Further investigation
Oil Price	NO	Yes	I(1)
Export	NO	Yes	I(1)
Import	NO	Yes	I(1)
Inflation	Yes	Yes	I(0)
GDP	NO	Yes	I(1)
FDI	NO	Yes	I(1)
Electrity	NO	Yes	I(1)

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Implication for your econometric model

The results show a mixture of I(0) and I(1) variables, particularly because inflation is I(0), while most of the other variables are I(1). This is important for selecting the appropriate estimation technique.

- ARDL/Bounds testing is suitable when variables are a mixture of I(0) and I(1), provided none is I(2).
- VECM/Johansen cointegration is appropriate if the variables entering that system are all I(1) and cointegration is established.
- The exchange-rate variable needs to be resolved before proceeding with a conventional VECM based on the assumption that all endogenous variables are I(1).

TABLE IVA
JOHANSEN TRACE TEST

Hypothesis Nos.	Johansen Trace Test		
	Trace Statistics	**5% Critical Value**	**Decision**
r = 0	**149.74**	125.62	Reject H_0
(r ≤ 1)	**98.61**	95.75	Reject H_0
(r ≤ 2)	**58.37**	69.82	Do Not Reject
(r ≤ 3)	33.74	47.85	Do Not Reject
(r ≤ 4)	14.98	29.80	Do Not Reject
(r ≤ 5)	5.27	15.49	Do Not Reject
(r ≤ 6)	0.03	3.84	Do Not Reject
Trace-test conclusion: 2 cointegrating relationships (r = 2).			

TABLE IVB
JOHANSEN MAXIMUN – EIGEN VALUE TEST

Hypothesis Nos.	Johansen Maximum-Eigenvalue Test		
	Max Eigenvalue	**5% Critical Value**	**Decision**
r = 0	**51.12**	46.23	Reject H_0
(r ≤ 1)	**40.25**	40.08	Reject H_0
(r ≤ 2)	24.63	33.88	Do Not Reject
(r ≤ 3)	18.76	27.59	Do Not Reject
(r ≤ 4)	9.72	21.13	Do Not Reject
(r ≤ 5)	5.24	14.26	Do Not Reject
(r ≤ 6)	0.03	3.84	Do Not Reject

Maximum-eigenvalue conclusion: 2 cointegrating relationships (r = 2).

Thus, both Johansen tests identify two cointegrating vectors.

The existence of **two cointegrating relationships** means that although the exchange rate, oil prices, exports, imports, GDP, FDI and electricity distribution may individually exhibit substantial fluctuations over time, **two stable long-run equilibrium relationships link these variables**.

This is important for the Nigerian economy because the variables are closely connected through the country's external-sector structure.

In particular:

Exchange-rate movements, exports and imports do not operate independently in the long run. They form part of a broader equilibrium relationship involving oil prices, domestic output, foreign investment and infrastructure/electricity distribution.

For Long-run cointegrating relationships

For the seven-variable system, the estimated Johansen procedure produces **two cointegrating vectors**.

Using logarithmic variables and normalising the first vector on the exchange rate gives approximately:

ELECln EXR = -3.433ln OIL +4.639ln EXPORT +7.954ln IMPORT -1.602ln GDP -2.609ln FDI -17.124ln ELEC

The coefficients should **not be interpreted as simple causal elasticities**. They are cointegrating coefficients and depend on the normalization selected.

Nevertheless, the equation demonstrates that exchange-rate movements are embedded in a long-run equilibrium involving exports, imports, oil prices, GDP, FDI and electricity distribution.

This is consistent with Nigeria's structural characteristics: foreign exchange earnings are strongly connected to petroleum exports, while domestic production and investment depend on access to imported machinery and intermediate goods.

This supports proceeding to a Vector Error Correction Model (VECM) rather than estimating only a VAR in differences, provided the exchange-rate integration issue discussed below is satisfactorily addressed.

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TABLE V
VECM ERROR-CORRECTION/ADJUSTMENT COEFFICIENTS

Equation	ECT1 coefficient	p-value	ECT2 coefficient	p-value
Exchange Rate	-0.1133	0.217	0.3614	0.084
Oil Price	**0.4044**	**0.000**	**-0.8451**	**0.000**
Export	**0.2920**	**0.020**	-0.4996	0.082
Import	0.0468	0.493	-0.0218	0.889
GDP	-0.0211	0.659	0.1269	0.246
FDI	-0.0451	0.796	-0.0986	0.805
Electricity	0.0130	0.517	-0.0283	0.535

Interpretation

The amended data produce an important change from the previous analysis.

The exchange-rate equation does not have a statistically significant adjustment coefficient at the 5% level. ECT1 has a coefficient of -0.1133 (p = 0.217), while ECT2 has a coefficient of 0.3614 (p = 0.084).

Therefore, although the exchange rate is part of the long-run cointegrating system, the evidence does **not** indicate that the exchange rate itself significantly corrects short-run deviations from the estimated long-run equilibrium.

This is different from the earlier result and demonstrates why correcting the 1999 FDI observation was important.

Exports, however, significantly adjust to ECT1:

ECT1 =−0.2920
with p = 0.020.

This indicates that the export sector responds to deviations from one of the long-run equilibrium relationships.

Oil prices exhibit particularly strong adjustment to both long-run relationships.

For Long-run cointegrating equations

TABLE VI
ESTIMATED COINTEGRATING VECTORS

Variables	Estimated Cointegration Vector Analysis		
	Cointegration Vector 1	Cointegration Vector 1	p-value
LExchange Rate	1.000	nil	0.00
LOil	0.000	1.000	0.00
LExport	-4.73837	-2.1489	<0.001
Limport	-5.8783	-3.1167	<0.001
LGDP	-3.1598	-1.3047	0.009
LFDI	5.2327	1.9086	<0.001
LElectricity	27.3100	13.8521	<0.001
Constant	-58.2243	-32.6032	<0.001

The first cointegrating relationship is normalised on the exchange rate:

LEXR −4.7837LEXPORT −5.8783LIMPORT −3.1598LGDP +5.2327LFDI +27.3100LELEC −58.2243 = 0

The second is normalised on crude oil price:

LOIL -2.1489LEXPORT -3.1167LIMPORT -1.3047LGDP +1.9086LFDI +13.8521LELEC -32.6032 = 0

Important: These coefficients are cointegrating-vector coefficients and are sensitive to normalisation. They should therefore not be presented as conventional causal elasticities.

For Short-run exchange-rate equation

This is the most relevant equation for your research question.

TABLE VII
VECM SHORT-RUN EXCHANGE-RATE EQUATION

Variables	VECM Short-Run Exchange-Rate Equation Dependent variable: ΔLEXR		
	Coeffic.	p-value	Decision
ΔLEXR(-1)	0.0474	0.827	Not Signif
ΔLOIL(-1)	-0.2566	0.221	Not Signif
ΔLEXP(-1)	0.0317	0.816	Not Signif
ΔLIMP(-1)	0.1497	0.516	Not Signif
ΔLGDP(-1)	-0.233	0.430	Not Signif
ΔLFDI(-1)	0.0098	0.927	Not Signif
ΔLELEC(-1)	-0.4716	0.550	Not Signif
ECT 1(-1)	-0.1133	0.217	Not Signif
ECT 2(-1)	0.3614	0.084	Not Signif

Interpretation

There is no statistically significant short-run determinant of exchange-rate changes among the variables included in the model.

In particular, neither exports nor imports significantly explain short-run movements in the exchange rate.

This means that the large exchange-rate movements observed in Nigeria over 1990–2024 cannot be adequately explained by the previous year's export and import changes alone.

Instead the exchange rate appears to be influenced by broader structural and institutional factors that are not fully captured by the lagged variables in this relatively small annual dataset.

For Impulse-Response Function Results

The IRF traces the response of one variable (Export) to a one-standard-deviation innovation in another variable (Import) over ten years.

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TABLE VIII
RESPONSE TO AN EXCHANGE RATE SHOCK

Horizons	Response to an Exchange Rate Shock		
	Exchange Rate	Export	Import
1	0.2375	-0.1062	-0.1392
2	0.2932	-0.0661	-0.1045
3	0.3048	-0.0197	-0.1170
4	0.3049	-0.0513	-0.1250
5	0.3194	-0.0545	-0.1331
6	0.3245	-0.0328	-0.1328
7	0.3239	-0.0177	-0.1218
8	0.3215	-0.0208	-0.1171
9	0.3206	-0.0306	-0.1201
10	0.3224	-0.0301	-0.1220

Interpretation

The exchange rate responds positively and persistently to its own shock. The response rises from **0.2375 in the first period** to about **0.32 by the fifth year** and remains positive through the tenth year. This indicates considerable persistence in exchange-rate disturbances.

More importantly, an exchange-rate shock produces a **negative response in imports throughout the ten-year horizon**. The import response is -0.1392 in the first year, reaches approximately -0.1331 in the fifth year, and remains negative at -0.1220 by the tenth year.

This supports the earlier VECM result that **naira depreciation tends to reduce imports**. The effect is persistent rather than being confined to the first year.

The export response is also predominantly negative, although considerably smaller and less stable. Following an exchange-rate shock, exports fall by **0.1062 in the first period**, the negative response weakens substantially by the third period, and remains modestly negative thereafter.

This is particularly important. The IRF does **not** show the conventional strong export-expansion response expected from currency depreciation. Instead, the response suggests that depreciation does not automatically translate into higher Nigerian export performance.

For Response of Exchange Rate to Export and Import Shocks

TABLE IX
EXCHANGE RATE RESPONSE TO EXTERNAL SECTOR SHOCKS

Exchange Rate Response to External Sector		
Horizon	Export Shock - Exchange Rate	Import Shock - Exchange Rate
1	-0.0053	-0.0414
2	-0.0071	-0.0664
3	-0.0030	-0.0667
4	-0.0041	-0.0837
5	0.0010	-0.0864
6	0.0004	-0.0837
7	-0.0034	-0.0837
8	-0.0039	-0.0846
9	-0.0025	-0.0858
10	-0.0018	-0.0850

Interpretation

Export shocks have a **very small effect on the exchange rate**. The response fluctuates close to zero throughout the ten-year horizon.

Import shocks, in contrast, produce a more noticeable negative exchange-rate response. The response becomes increasingly negative from -0.0414 in the first year to approximately -0.0864 in the fifth year and remains around that level thereafter.

This suggests that **import-side developments have a stronger dynamic association with exchange-rate movements than export-side developments**.

However, this should not be interpreted as proof of structural causality because the IRF is generated from the estimated system and depends on the identification ordering.

Overall Conclusion for IRF Result

The impulse-response analysis was conducted to examine the dynamic response of the endogenous variables to one-standard-deviation innovations within the VECM over a ten-year horizon. The analysis applied the 1990–2024 dataset.

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The variables were specified in logarithmic form, while the VECM retained two cointegrating relationships. Orthogonalised impulse responses were obtained using Cholesky decomposition, with the ordering of exchange rate, crude oil price, export, import, GDP, FDI and electricity distribution.

The impulse-response results reveal a persistent response of the exchange rate to its own shock. Following a positive exchange-rate innovation, representing a depreciation of the naira, the exchange-rate response increases from 0.2375 in the first period to approximately 0.32 by the fifth year and remains positive through the tenth year. This indicates that exchange-rate disturbances are highly persistent in the Nigerian economy and are not rapidly eliminated.

The most important result concerns the response of imports to an exchange-rate shock. A positive exchange-rate shock generates a negative response in imports throughout the ten-year period. The response is -0.1392 in the first year and remains approximately -0.12 by the tenth year. This indicates that naira depreciation tends to reduce import demand over time. The result is consistent with the VECM short-run coefficient, which showed a statistically significant negative effect of exchange-rate changes on imports. The persistence of the negative response indicates that exchange-rate depreciation has effects on import demand beyond the immediate adjustment period.

The response of exports to an exchange-rate shock is also predominantly negative. The export response is -0.1062 in the first period and subsequently becomes smaller in magnitude, remaining modestly negative through the tenth period. Thus, the impulse-response analysis does not provide evidence of a strong export-expansion effect arising from naira depreciation. Rather, the response suggests that depreciation may initially place pressure on export performance.

This result is particularly relevant to Nigeria because the country's export structure is highly concentrated and strongly influenced by crude-oil prices and petroleum production. Furthermore, domestic manufacturers and other productive sectors often depend on imported machinery, intermediate inputs and raw materials. Consequently, depreciation can increase production costs and may offset the competitiveness gains that would ordinarily be expected from a weaker domestic currency.

The response of the exchange rate to export shocks is very small throughout the forecast horizon, remaining close to zero. This suggests that export disturbances have little dynamic influence on exchange-rate movements. Import shocks, however, generate a larger negative response in the exchange rate, reaching approximately -0.086 by the fifth year and remaining around this level thereafter.

The results therefore suggest that the interaction between the exchange rate and imports is considerably stronger than that between the exchange rate and exports.

Overall, the impulse-response results reveal an asymmetric external-sector adjustment mechanism in Nigeria. Exchange-rate depreciation has a persistent negative effect on imports but does not generate a corresponding positive response in exports. This suggests that exchange-rate adjustment operates more effectively through import compression than through export expansion.

For Forecast Error Variance Decomposition

FEVD determines how much of the forecast uncertainty in each variable is attributable to shocks originating from itself and from the other variables.

Table 10: Variance Decomposition of Exchange Rate

TABLE X
VARIABLES DECOMPOSITION OF EXCHANGE RATE

Variables	**Horizon**		
	1	**5**	**10**
Exchange Rate	100	89.68	87.03
Oil Price	0.00	1.97	2.81
Export	0.00	0.03	0.01
Import	0.00	4.18	5.20
GDP	0.00	0.54	0.70
FDI	0.00	0.75	1.04
Electricity Distribtion	0.00	2.87	3.21

Interpretation

The exchange rate is overwhelmingly explained by its own innovations.

After five years, approximately **89.68%** of exchange-rate forecast variance is attributable to exchange-rate shocks themselves. By the tenth year, this declines only slightly to **87.03%**.

The largest external contributor is the **import shock**, accounting for about **5.20%** at the tenth horizon.

Electricity contributes about **3.21%**, while oil prices account for **2.81%**.

Exports contribute virtually nothing—only **0.01%** at the tenth horizon.

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This provides strong evidence that **export shocks do not materially explain exchange-rate forecast variability**, whereas import shocks have a modest but more noticeable contribution.

For Variance Decomposition of Exports

TABLE XI
VARIABLE DECOMPOSITION OF EXPORTS

Variables	Horizon		
	1	5	10
Exchange Rate	7.68	4.40	2.68
Oil Price	13.52	2.75	1.67
Export	78.80	86.7	89.18
Import	0.00	0.14	0.62
GDP	0.00	0.64	0.45
FDI	0.00	4.90	4.16
Electricity Distribution	0.00	0.46	1.25

Interpretation

Export forecast variance is predominantly explained by its own innovations.

At the first horizon, exports explain 78.80% of their own forecast error variance. This rises to 86.70% at five years and 89.18% at ten years.

The contribution of exchange-rate shocks declines from 7.68% initially to 2.68% at the tenth horizon.

Similarly, oil-price shocks decline from 13.52% initially to only 1.67% by year ten.

FDI is the largest non-own contributor at the tenth horizon, accounting for 4.16%.

Thus, the FEVD strongly reinforces the IRF finding:

Exchange-rate shocks have relatively limited explanatory power for Nigeria's export dynamics.

For Variance Decomposition of Imports

Table 12: Variance Decomposition of Imports

TABLE XII
VARIABLES COMPOSITION OF IMPORTS

Variables	HORIZON		
	1	5	10
Exchange Rate	0.92	24.97	24.28
Oil Prices	34.03	34.98	39.52
Export	4.77	3.36	2.36
Import	60.28	29.81	25.50
GDP	0.00	1.85	3.09
FDI	0.00	4.74	0.30
Electricity Distributn	0.00	4.87	0.38

Interpretation

Imports show a substantially different pattern from exports.

At the first horizon, 60.28% of import forecast variance is explained by its own innovation, while oil-price shocks account for 34.03%.

Over time, however, the importance of oil prices increases. At the tenth horizon, oil-price shocks explain 39.52% of import forecast variance.

Exchange-rate shocks explain 24.28% at the tenth horizon.

Thus, together:

39.52% + 24.28% = 63.80%

of the long-horizon import forecast variance is attributable to oil-price and exchange-rate shocks.

This is a very important finding for Nigeria's external sector.

It indicates that imports are considerably more sensitive to macroeconomic external-sector shocks than exports.

For Comparative FEVD Result

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TABLE XIII
MAJOR FORECAST VARIANCE CONTRIBUTORS AT HORIZON 10

Type of Shocks	VARIABLES		
	Exchange Rate	Export	Import
Own Shock	87.03%	89.18%	25.5%
Exch Rate Shock	Nil	2.68%	24.28%
Oil Price Shock	2.81%	1.67%	39.52%
FDI Shock	1.04%	4.16%	4.87%

The contrast is striking.

Exports

Nearly 90% of export forecast variance is explained by export-specific shocks.

Imports

Only 25.50% of import forecast variance is explained by its own shocks. Oil-price and exchange-rate shocks together explain almost 64%.

This means that imports are substantially more exposed to macroeconomic and external-sector disturbances than exports.

Overall Conclusion for FEVD Result

The forecast error variance decomposition was employed to determine the relative contribution of innovations in the endogenous variables to the forecast variability of exchange rate, exports and imports over a ten-year horizon. The results provide additional evidence concerning the relative importance of exchange-rate, oil-price and trade shocks in explaining Nigeria's external-sector dynamics.

The variance decomposition shows that exchange-rate movements are primarily driven by their own innovations. At the tenth forecast horizon, exchange-rate shocks account for approximately 87.03% of the forecast error variance of the exchange rate. The contribution of import shocks is 5.20%, while electricity, oil prices, FDI and GDP account for smaller proportions. Export shocks contribute only 0.01% at the tenth horizon. This indicates that export disturbances have virtually no explanatory power for exchange-rate forecast uncertainty, whereas import disturbances have a modest influence.

The export equation displays a similarly high degree of own-shock dominance. At the tenth horizon, export innovations account for approximately 89.18% of export forecast error variance. Exchange-rate shocks explain only 2.68%, while oil-price shocks account for 1.67%. FDI contributes 4.16%, with the remaining variables contributing relatively small proportions. The relatively small contribution of exchange-rate shocks confirms the impulse-response finding that exchange-rate depreciation does not constitute a major source of export fluctuations in the Nigerian economy.

The import decomposition produces a substantially different result. At the tenth horizon, oil-price shocks account for approximately 39.52% of import forecast error variance, while exchange-rate shocks account for 24.28%. Import's own innovations explain 25.50%, FDI contributes 4.87% and

GDP accounts for 3.09%. Therefore, oil-price and exchange-rate shocks jointly explain approximately 63.80% of import forecast variability at the tenth horizon.

The large contribution of oil-price shocks to import variability reflects the structure of the Nigerian economy. Higher oil prices generate foreign-exchange earnings and can increase government and private-sector purchasing capacity, thereby facilitating imports. Conversely, lower oil prices can reduce foreign-exchange availability and constrain imports. The substantial contribution of exchange-rate shocks further indicates that the cost of foreign goods and the availability of foreign currency are important determinants of import dynamics.

The contrast between exports and imports is particularly important. Nearly 90% of export forecast variance at the tenth horizon is attributable to export-specific innovations, whereas only 25.50% of import variance is explained by import-specific shocks. Imports are therefore considerably more responsive to external macroeconomic disturbances, particularly oil-price and exchange-rate shocks. This finding supports the view that Nigeria's import sector is strongly conditioned by foreign-exchange availability and international oil-market conditions, while export performance is more strongly determined by structural factors within the export sector.

Taken together, the variance decomposition results indicate that exchange-rate movements have a much stronger role in explaining import dynamics than export dynamics. This further supports for the conclusion that exchange-rate depreciation in Nigeria primarily operates through import adjustment rather than through a strong expansion of exports.

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VI. Conclusion And Discussion

This study empirically examined the relationship between exchange rate volatility and international trade performance in Nigeria economy using annual data spanning 1990–2024, incorporating key macroeconomic variables including foreign direct investment (FDI), crude oil prices, export value, import value, inflation rate, and electricity distribution. The analysis employed descriptive statistics, Augmented Dickey–Fuller (ADF) unit root tests, Johansen cointegration techniques, and a Vector Error Correction Model (VECM) to capture both long-run equilibrium relationships and short-run adjustment dynamics. The descriptive statistics reveal substantial variation among the variables, with the exchange rate exhibiting the highest degree of instability. Its standard deviation of 270.948, positive skewness of 3.374 and kurtosis of 16.895 demonstrate the exceptionally volatile nature of the naira exchange rate during the study period. Inflation also displayed considerable volatility, with a standard deviation of 15.871, skewness of 2.164 and kurtosis of 7.241.

The unit-root analysis established that crude oil prices, exports, imports, GDP, FDI and electricity distribution are integrated of order one, I(1), while inflation is stationary at level, I(0). The exchange-rate series, however, did not become stationary after first differencing under the reported ADF specification. This result suggests that the exchange-rate series requires additional investigation, particularly because of the very large movement recorded in 2024. Consequently, the exchange-rate integration result should be interpreted cautiously when drawing conclusions from conventional cointegration and VECM estimates.

Despite this limitation, the Johansen cointegration tests identified two cointegrating relationships under the reported system. Both the Trace and Maximum-Eigenvalue tests rejected the null hypothesis of no cointegration and supported two long-run equilibrium relationships. This indicates that exchange-rate movements, exports, imports, crude oil prices, GDP, FDI and electricity distribution is interconnected in the long run. The finding is particularly relevant to Nigeria because the country's external sector is closely connected to oil revenues, foreign-exchange availability, imports of capital and intermediate goods, domestic production and foreign investment.

The VECM results provide an important insight into the adjustment process. The exchange-rate equation does not exhibit a statistically significant adjustment coefficient at the 5 percent level.

ECT1 has a coefficient of −0.1133 ($p = 0.217$), while ECT2 has a coefficient of 0.3614 ($p = 0.084$). Thus, although the exchange rate participates in the long-run equilibrium relationships, the evidence does not indicate that it significantly corrects short-run deviations from those relationships. In contrast, exports significantly adjust to one of the long-run equilibrium relationships, with an ECT coefficient of −0.2920 ($p = 0.020$). Oil prices also demonstrate strong adjustment to both long-run relationships.

Most importantly for the central objective of the study, the short-run exchange-rate equation indicates that none of the reported lagged changes in crude oil prices, exports, imports, GDP, FDI or electricity distribution significantly explains changes in the exchange rate at the 5 percent level. The result implies that Nigeria's exchange-rate movements cannot be adequately explained by previous-year changes in exports and imports alone. Rather, the behaviour of the exchange rate appears to reflect broader structural and institutional factors that are not fully captured by the relatively small annual dataset.

The impulse-response analysis provides stronger evidence concerning the asymmetric effect of exchange-rate disturbances on international trade. An exchange-rate shock produces a persistent negative response in imports, beginning at −0.1392 in the first period and remaining negative at approximately −0.1220 by the tenth period. This indicates that naira depreciation tends to reduce import demand and that the effect persists over time. However, the response of exports to an exchange-rate shock is also predominantly negative, beginning at −0.1062 in the first period and remaining modestly negative thereafter. Therefore, the study does not find evidence that currency depreciation automatically generates the conventional export-expansion effect.

The findings from the response of the exchange rate to external-sector shocks reinforce this conclusion. Export shocks have only a very small effect on exchange-rate movements, whereas import shocks produce a considerably larger response. By the fifth year, the response of the exchange rate to an import shock reaches approximately −0.0864 and remains around that magnitude over the subsequent periods. This suggests that the relationship between exchange-rate movements and imports is stronger than that between exchange-rate movements and exports. However, because the impulse responses depend on the identification ordering, they should be interpreted as dynamic system responses rather than definitive evidence of structural causality.

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The FEVD results further strengthen the asymmetric nature of the relationship. At the tenth forecast horizon, approximately 87.03 percent of exchange-rate forecast variance is explained by its own innovations, demonstrating substantial persistence in exchange-rate disturbances. Import shocks account for about 5.20 percent, while export shocks account for only 0.01 percent. For exports, approximately 89.18 percent of forecast variance is explained by their own innovations, while exchange-rate shocks account for only 2.68 percent. This indicates that exchange-rate volatility is not a major independent source of export fluctuations in the estimated system.

In contrast, imports are substantially more exposed to exchange-rate and oil-price disturbances. At the tenth horizon, oil-price shocks explain approximately 39.52 percent of import forecast variance, while exchange-rate shocks account for 24.28 percent. Together, these two shocks account for approximately 63.80 percent of import forecast variability. This constitutes one of the most important findings of the study because it demonstrates that Nigeria's import performance is highly sensitive to developments in the foreign-exchange market and international oil market.

Overall, the study concludes that exchange-rate volatility affects Nigeria's international trade performance asymmetrically. Its influence is substantially stronger on imports than on exports. Exchange-rate depreciation appears capable of compressing imports, but it does not generate a corresponding expansion in exports. Consequently, exchange-rate adjustment in Nigeria appears to operate more effectively through import compression than export expansion. This outcome suggests that depreciation alone is insufficient to improve Nigeria's trade performance. The weak export response points to the importance of structural constraints such as export concentration, production capacity, dependence on imported inputs and other supply-side limitations.

VII. Recommendations

Based on the empirical findings, the study makes the following recommendations:

1. Promote exchange-rate stability and reduce excessive volatility

The Nigerian authorities should pursue a more stable and credible foreign-exchange policy. The finding that approximately 87.03 percent of exchange-rate forecast variance is attributable to its own shocks demonstrates considerable persistence in exchange-rate disturbances.

Exchange-rate policy should therefore aim not necessarily at maintaining a permanently fixed exchange rate, but at reducing excessive and unpredictable fluctuations. Greater transparency in foreign-exchange management, improved market confidence and a more predictable policy framework would help firms make better decisions concerning imports, exports and investment.

2. Reduce excessive dependence on oil for foreign-exchange earnings

The strong contribution of oil-price shocks to import variability demonstrates the vulnerability of Nigeria's external sector to international oil-market conditions. Oil-price shocks account for 39.52 percent of import forecast variance at the tenth horizon. The government should therefore intensify economic and export diversification by promoting non-oil sectors such as manufacturing, agriculture, agro-processing, solid minerals and tradable services. A broader export base would reduce the vulnerability of foreign-exchange availability to fluctuations in crude oil prices.

3. Strengthen productive capacity to make depreciation support exports

The finding that exports respond negatively rather than positively to exchange-rate shocks indicates that depreciation by itself does not guarantee improved export performance. Exchange-rate policy should therefore be complemented by supply-side policies that increase domestic productive capacity. Government should improve access to reliable electricity, transport infrastructure, finance, technology and productive inputs so that Nigerian firms can expand output and compete effectively in international markets.

4. Reduce manufacturers' dependence on imported inputs

The negative response of imports to exchange-rate shocks shows that depreciation can compress imports, but excessive dependence on imported machinery, raw materials and intermediate goods may simultaneously increase domestic production costs. Policies should therefore encourage the domestic production of intermediate inputs, machinery and other productive materials. Import substitution should be pursued selectively, particularly where domestic production can be achieved efficiently and competitively, rather than through blanket restrictions on imports.

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5. Develop an export-oriented industrial policy

Since exchange-rate shocks explain only 2.68 percent of export forecast variance at the tenth horizon, policies aimed solely at manipulating the exchange rate are unlikely to produce sustained export growth. The government should instead adopt an export-oriented industrial strategy focusing on product quality, international standards, value addition, market access and competitiveness. Export incentives should be targeted at firms with demonstrated production and export potential, while customs and trade procedures should be simplified to reduce the cost and time associated with exporting.

6. Improve foreign-exchange access for productive sectors

Because exchange-rate shocks account for 24.28 percent of import forecast variance at the tenth horizon, access to foreign exchange is an important component of import dynamics. Foreign exchange should therefore be made more predictable for firms importing essential capital goods, machinery, intermediate inputs and production technology. This should be accompanied by appropriate monitoring mechanisms to minimise speculative demand and ensure that scarce foreign exchange supports productive economic activities.

7. Strengthen infrastructure, particularly electricity supply

The study includes electricity distribution as an important structural variable in the long-run relationships. Improving electricity distribution would reduce production costs, increase industrial productivity and strengthen the ability of domestic firms to compete internationally. Government should therefore prioritise investment in generation, transmission and distribution infrastructure while encouraging private-sector participation and improvements in the efficiency of the electricity market.

8. Maintain macroeconomic stability and control inflation

The descriptive results show substantial inflation volatility, with skewness of 2.164 and kurtosis of 7.241. High and unstable inflation can erode domestic competitiveness and increase the cost of production. Monetary and fiscal authorities should therefore coordinate policies that promote price stability while avoiding measures that unnecessarily undermine productive investment and economic activity. Stable inflation would improve the predictability of production costs and support firms engaged in international trade.

9. Strengthen export diversification and value addition

Nigeria should move beyond reliance on a narrow range of primary exports by promoting value-added products.

The relatively weak response of exports to exchange-rate shocks suggests that Nigeria's export performance is driven more by structural factors than by exchange-rate movements alone. Greater investment in agro-processing, manufacturing and other non-oil export industries would enable the country to capture more value from its natural and productive resources.

10. Strengthen foreign-exchange and trade-policy coordination

The study demonstrates that exchange rates, oil prices, exports and imports are interconnected within the Nigerian external sector. Consequently, exchange-rate policy should not be designed independently of trade, industrial, fiscal and petroleum policies. Coordinated policy-making would help ensure that exchange-rate reforms support rather than undermine export development, domestic production and macroeconomic stability.

11. Improve the quality and consistency of macroeconomic data

Finally, the study recommends continued improvement in the quality, consistency and coverage of Nigeria's macroeconomic statistics. The ADF results revealed an unusual exchange-rate integration outcome, while the 2024 exchange-rate observation represents a very large movement relative to the preceding year. The study therefore recommends that future empirical work verify such observations against the original official sources and apply structural-break unit-root tests where appropriate.

VIII. Final Policy Implication

The central policy implication of this study is that Nigeria should not rely on exchange-rate depreciation as a stand-alone strategy for improving international trade performance. The empirical evidence indicates that depreciation is more effective in reducing imports than in stimulating exports. Therefore, a sustainable improvement in Nigeria's trade position requires a combination of exchange-rate stability, export diversification, domestic productive capacity, reliable infrastructure, reduced dependence on imported inputs, macroeconomic stability and effective foreign-exchange management. Such a comprehensive approach would allow exchange-rate policy to complement, rather than substitute for, the structural reforms required to strengthen Nigeria's international trade performance.

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