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Exchange Rate Volatility And External Shocks Nexus

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Abstract
This study investigates the relationship between exchange rate volatility and external shocks in Nigeria, with a focus on the country's vulnerability to global economic fluctuations. Using data from the Central Bank of Nigeria's statistical bulletin January 2009 to May 2024, the research employs a Vector Autoregression model to analyze the dynamic interactions between exchange rate volatility (EXV) and key external factors, including oil prices, Foreign Direct Investment (FDI), trade balances, and global uncertainty. The findings reveal that oil prices and trade balance shocks have significant immediate effects on exchange rates, while FDI shows sensitivity to oil price fluctuations, underscoring the reliance of foreign investment on Nigeria's oil-dependent economy. The Global Uncertainty Index (GUI) demonstrates a self-reinforcing effect, with initial shocks to global uncertainty further exacerbating economic instability, although this effect diminishes over time as markets adjust. Policy recommendations include diversifying Nigeria's economy to reduce dependence on oil revenues, strengthening exchange rate management to mitigate the effects of trade imbalances, and implementing measures to stabilize FDI inflows by reducing exposure to oil price volatility. Additionally, policymakers should enhance their capacity to monitor and manage global uncertainty shocks by building economic resilience and fostering stronger ties with international partners to buffer against external fluctuations. These strategies can enhance macroeconomic stability and reduce Nigeria's vulnerability to external shocks.

Keywords: *Exchange Rate Volatility, External Shocks, Oil Price, Foreign Direct Investment and Global Uncertainty Index*

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I. Introduction

Exchange rate volatility is a critical aspect of economic stability, particularly for emerging economies like Nigeria, which are susceptible to external shocks due to their integration into the global economy (Obstfeld & Rogoff, 1996). Nigeria, as an oil-dependent nation, faces significant challenges in maintaining exchange rate stability amidst fluctuations in global oil prices, foreign investment flows, and other external factors (Akinbobola & Adenikinju, 2020).

The exchange rate serves as a crucial link between domestic economic activities and the global market. Volatility in the exchange rate can have profound implications for various sectors of the economy, including trade, investment, inflation, and overall economic growth (Engel, 2003). Nigeria's experience with exchange rate volatility is particularly pertinent due to its reliance on oil exports, vulnerability to commodity price fluctuations, and exposure to global financial markets.

External shocks, such as changes in global oil prices, shifts in international capital flows, and fluctuations in global economic conditions, significantly impact Nigeria's exchange rate stability (Akinbobola & Adenikinju, 2020). These shocks often propagate through various channels, including trade balances, fiscal policy responses, and monetary policy adjustments. Understanding the nexus between external shocks and exchange rate volatility is crucial for policymakers, businesses, and investors to formulate effective strategies to mitigate risks and enhance economic resilience.

Also, the recent decision by the Nigerian government to float the naira, abandoning its fixed exchange rate regime, has brought renewed attention to the issue of exchange rate volatility in the country. The move signifies a significant shift in Nigeria's exchange rate policy and has profound implications for the economy, making an in-depth study of exchange rate volatility and its determinants more relevant than ever. Firstly, the decision to float the naira underscores the need for a comprehensive understanding of exchange rate dynamics in Nigeria. Floating the currency exposes it to market forces, potentially leading to increased exchange rate volatility as prices adjust to supply and demand dynamics (Olamide, Ogujiuba and Maredza, 2022). Therefore, analyzing the factors driving exchange rate volatility becomes essential for policymakers to effectively manage the transition and mitigate potential adverse effects on the economy.

Furthermore, Nigeria's reliance on oil exports and its susceptibility to fluctuations in global oil prices highlight the importance of studying exchange rate volatility in the context of external shocks (Akinbobola & Adenikinju, 2020). The recent volatility in global oil markets, exacerbated by geopolitical tensions and shifts in demand patterns, underscores the vulnerability of Nigeria's economy to external factors beyond its control (Aliyu & Audu, 2020). Understanding how external shocks influence exchange rate volatility is crucial for devising appropriate policy responses to mitigate their impact and ensure economic stability.

Moreover, exchange rate volatility can have significant implications for various sectors of the Nigerian economy, including trade, investment, inflation, and overall economic growth (Jahan & Papageorgiou, 2018). A deeper understanding of the determinants of exchange rate volatility is essential for businesses to manage currency risk effectively, investors to make informed decisions, and policymakers to formulate appropriate macroeconomic policies.

Additionally, the recent floatation of the naira provides a unique opportunity to assess the effectiveness of the new exchange rate regime in managing volatility and promoting economic stability (Olamide, Ogujiuba and Maredza, 2022). By studying the impact of the policy change on exchange rate dynamics and its interaction with external shocks, this research can provide valuable insights into the strengths and weaknesses of the new exchange rate framework and inform future policy adjustments.

The aim of this study is to analyze exchange rate volatility in Nigeria with a specific focus on the role of external shocks, particularly in the context of recent policy changes such as the floating of the naira. The study will identify the key external shocks affecting exchange rate volatility in Nigeria, including changes in global oil prices, international capital flows, and global economic conditions. To assess the impact of external shocks on exchange rate stability and economic performance in Nigeria; and provide recommendations for policymakers, businesses, and investors on strategies to enhance exchange rate stability and promote sustainable economic development in Nigeria amidst external shocks.

II. Literature Review

This study employs the Mundell-Fleming model, a foundational framework for analyzing the interplay between monetary and fiscal policies in an open economy. Combining the insights of the Mundell and Fleming models, it offers a rigorous approach to understanding how macroeconomic policies influence key variables such as exchange rates, interest rates, inflation, and output (GDP). The model assumes an open economy with active participation in international trade and capital flows, allowing financial markets to significantly affect domestic economic conditions. It emphasizes the determination of exchange rates through the lens of monetary and fiscal policy changes, assuming perfect capital mobility, which enables investors to seek optimal returns across borders (Fleming, 1962; Mundell, 1963).

The Mundell-Fleming framework provides a robust tool for analyzing exchange rate volatility in response to external shocks in Nigeria. First, with respect to monetary policy shocks, changes in domestic interest rates set by the Central Bank of Nigeria (CBN) have substantial implications for exchange rate dynamics. According to Obstfeld and Rogoff (1996), interest rate adjustments can trigger capital flows and subsequent currency fluctuations. For example, a reduction in interest rates by the CBN aimed at stimulating economic activity may prompt capital outflows, leading to currency depreciation and heightened exchange rate volatility.

In addition to monetary shocks, fiscal policy also plays a crucial role in shaping exchange rate behavior. As Akinbobola and Adenikinju (2020) explain, government spending and taxation policies have direct effects on exchange rate volatility. Expansionary fiscal policies, such as increased public spending, can stimulate domestic demand but may also widen the trade deficit, resulting in currency depreciation and increased volatility. Conversely, contractionary fiscal measures may stabilize the exchange rate but could suppress economic growth, illustrating the delicate balance between fiscal discipline and exchange rate stability.

Nigeria’s exposure to external demand shocks, particularly fluctuations in global commodity prices, further complicates its exchange rate stability. Given Nigeria’s dependence on oil exports, volatility in global oil prices exerts significant pressure on the exchange rate (Aliyu & Audu, 2020). A decline in oil prices reduces export earnings, worsens the trade balance, and leads to currency depreciation, thereby intensifying exchange rate volatility. The Mundell-Fleming model aptly captures these dynamics, highlighting how external shocks reverberate through the economy and affect exchange rates.

Capital mobility and financial market conditions are also integral to understanding exchange rate volatility in Nigeria. Akinbobola and Adenikinju (2020) emphasize that shifts in investor sentiment, changes in risk appetite, and global financial market fluctuations can drive capital flows, influencing exchange rate movements. These elements underscore the interconnected nature of domestic and international financial markets, a feature well encapsulated by the Mundell-Fleming model’s treatment of capital mobility.

From a policy perspective, the Mundell-Fleming model offers valuable insights into the efficacy of monetary and fiscal policies in mitigating exchange rate volatility in response to external shocks. Nigerian policymakers can utilize the model to evaluate the potential consequences of policy interventions on exchange

rates and develop strategies to manage external pressures Obstfield & Rogoff, 1996). By accounting for the interrelationship between monetary and fiscal policies, external demand fluctuations, and financial market dynamics, policymakers can devise more effective approaches to foster exchange rate stability and support sustainable economic growth.

The study of exchange rate volatility and external shocks is particularly pertinent to Nigeria, given the economy's vulnerability to global economic fluctuations. Nigeria's dependence on oil exports makes it susceptible to volatile commodity prices, while its openness to trade and capital flows further exposes it to external economic shocks. External factors, such as shifts in global oil prices, changing global economic conditions, and financial market disruptions, can have profound effects on exchange rate volatility and broader macroeconomic stability. Consequently, the analysis of exchange rate volatility in the context of external shocks is critical for understanding the challenges facing Nigeria's economy and developing appropriate policy responses to enhance economic resilience.

Several studies have employed econometric techniques and theoretical models to investigate the impact of external shocks on exchange rate volatility in Nigeria. These studies have underscored the complex dynamics between external factors and exchange rate behavior, highlighting the importance of understanding the transmission mechanisms that drive these interactions.

Aliyu and Audu (2020), for instance, analyzed the relationship between oil price volatility and exchange rate dynamics in Nigeria. Their study found a significant correlation between global oil price shocks and exchange rate volatility, arguing that fluctuations in oil prices directly influence Nigeria's export revenues and trade balances, which in turn affect exchange rate stability. This result is consistent with the notion that oil-dependent economies, such as Nigeria, are particularly vulnerable to external commodity price shocks, which transmit to exchange rates through their impact on the trade balance and current account.

Akinbobola and Adenikinju (2020) extended this analysis by examining the role of capital flows and financial market conditions in propagating external shocks to Nigeria's exchange rate. They found that changes in global financial market conditions, investor sentiment, and risk perceptions exacerbated exchange rate volatility. Their findings highlight the importance of capital mobility and suggest that external financial shocks can induce large exchange rate fluctuations, particularly in emerging markets like Nigeria, where financial markets are sensitive to global capital movements.

Domestic policy factors, notably monetary policy decisions by the Central Bank of Nigeria (CBN), also play a pivotal role in shaping exchange rate volatility. The effectiveness of monetary policy in mitigating the effects of external shocks on exchange rates has been a subject of considerable debate. Studies employing Vector Autoregressive (VAR) models, such as Adekunle et al. (2018), have explored the relationship between monetary policy variables and exchange rate volatility. These studies typically find that changes in the policy rate and other monetary tools influence exchange rate behavior through interest rate differentials, which attract or repel capital flows.

Ezeaku et al. (2018) also investigated the effects of monetary policy across different sectors of the Nigerian economy using Johansen cointegration and error correction models. Their findings highlight sector-specific responses to monetary policy changes, reflecting the heterogeneous effects of policy on exchange rate volatility across various industries.

Ndekwu (2013) further examined the transmission mechanisms of monetary policy, utilizing a VAR model with dynamic logarithmic form and ordinary least squares (OLS) estimations. The study found that the CBN's policies exert significant influence over key economic indicators, including exchange rate movements, thereby reinforcing the critical role of domestic policy in managing exchange rate volatility.

Olorunfemi et al. (2020) advocated for a more comprehensive understanding of monetary policy transmission mechanisms, emphasizing the need for path analysis to assess how monetary policy variables affect exchange rates through interest rate channels. They proposed a mediation approach to evaluate the causal pathway of monetary policy effects, suggesting that indirect channels of policy transmission could be as important as direct interventions in influencing exchange rates.

Further insights into the interaction between economic uncertainty and exchange rates come from Anderl & Caporale (2023), who examined the asymmetric effects of economic policy uncertainty and oil price uncertainty on inflation using a Nonlinear Autoregressive Distributed Lag (NARDL) model. Their findings revealed that economic policy uncertainty shocks had a stronger impact on inflation compared to oil price uncertainty shocks. This suggests that uncertainty surrounding monetary policy could dampen the effectiveness of interest rate changes and underscores the importance of transparent communication from monetary authorities to anchor inflation expectations.

Overall, the literature on exchange rate volatility in Nigeria demonstrates the intricate interaction between external shocks, domestic policies, and financial markets. By leveraging econometric techniques such as VAR, NARDL, and cointegration models, researchers have provided a deeper understanding of the factors that

drive exchange rate volatility. These insights are crucial for policymakers aiming to mitigate the adverse effects of external shocks and ensure exchange rate stability in the context of Nigeria's open economy.

III. Data And Methodology

Data

This study utilizes data[1] on key economic variables such as the Real Effective Exchange Rate (REER), oil prices (Oil), Foreign Direct Investment (FDI), trade balances, and the Global Uncertainty Index[2] (GUI) for Nigeria. To investigate the relationship between exchange rate volatility and external shocks, the study employs a Vector Autoregression (VAR) model, which is well-suited for capturing the dynamic interrelationships among the variables. Preliminary econometric analysis is conducted using the Augmented Dickey-Fuller (ADF) test to verify the stationarity properties of the time series data. If non-stationarity is detected, appropriate differencing is applied to ensure stationarity, a necessary condition for reliable VAR[3] estimation. The estimation of the VAR model coefficients is done using standard econometric techniques, implemented through statistical software. Post-estimation diagnostics are performed to assess model adequacy, including tests for serial correlation, heteroskedasticity, and stability of the system. The study also incorporates impulse response functions (IRFs[4]) to analyze the dynamic effects of external shocks on exchange rate volatility.

Model

A Variance autoregressive (VAR)[5] model is used to fit the relationship between exchange rate volatility[6] and external shocks in Nigeria. In a VAR model, each variable is regressed on its lagged values as well as the lagged values of other variables in the system. This allows us to capture the dynamic interactions and feedback effects among the variables over time.

The general form of Structural Vector Autoregressive model is given as:

$$Y_t = C_i + A_1 Y_{t-1} + A_2 Y_{t-2} + \cdot \quad \cdot \quad \cdot + A_p Y_{p-1} + \mu_t \qquad (1)$$

$$\begin{pmatrix} EXV_t \\ TB_t \\ FDI_t \\ OIL_t \\ GUI_t \end{pmatrix} = \begin{pmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \end{pmatrix} + \begin{pmatrix} 1 & b_{12} & b_{13} & b_{14} & b_{15} \\ b_{12} & 1 & b_{23} & b_{24} & b_{25} \\ b_{31} & b_{32} & 1 & b_{34} & b_{35} \\ b_{41} & b_{42} & b_{43} & 1 & b_{45} \\ b_{51} & b_{52} & b_{53} & b_{54} & 1 \end{pmatrix} \begin{pmatrix} EXV_{t-1} \\ TB_{t-1} \\ FDI_{t-1} \\ OIL_t \\ GUI_{t-1} \end{pmatrix} + \begin{pmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \\ \mu_{4t} \\ \mu_{5t} \end{pmatrix} \qquad (2)$$

From equation (2), b_{ij} are the coefficients on the lagged variables while μ_{ij} are the shocks, EVT_t is exchange rate volatility at time, t; OIL_t is oil price at time, t; FDI_t is Foreign Direct Investment at time, t; TB_t = trade balance at time, t; and GUI_t Global Uncertainty Index at time, t. $\mu_{it}, i = 1,2 \ldots 5$ represents the error term for each equation.

Before estimating a Vector Autoregression (VAR) model, it is crucial to conduct pre-tests to ensure the time series variables are stationary[7] and do not exhibit unit roots. The presence of unit roots can lead to spurious regression results and invalidate the VAR model estimation. After differencing the variables, it's important to retest stationarity using the ADF test or other unit root tests to ensure that the differenced series are stationary. Once stationary series are obtained, VAR model can then be estimated.

After estimating the VAR model, it is essential to conduct post-estimation diagnostics to evaluate the adequacy of the model and assess its goodness-of-fit. Common post-estimation diagnostics for VAR models

[1] Data is sourced from the Central Bank of Nigeria (CBN) statistical bulletin, covering the period from January 2009 to May 2024

[2] The World Uncertainty Index (WUI) is calculated by measuring the frequency of the word "uncertain" (or its variants) in Economist Intelligence Unit (EIU) country reports. Specifically, the WUI is derived by expressing the occurrence of the word as a percentage of the total words in the report. To standardize the index, this percentage is multiplied by 1,000,000. A higher WUI value indicates greater uncertainty, while a lower value reflects reduced uncertainty. For instance, a WUI value of 200 indicates that the word "uncertain" constitutes 0.02% of the total words, which—considering that the average EIU report contains approximately 10,000 words—translates to about two instances of the word "uncertain" per report. (see: https://worlduncertaintyindex.com/).

[3] The model specification involves determining optimal lag lengths based on criteria such as the Akaike Information Criterion (AIC) or Schwarz Criterion (SC),

[4] IRFs provide a detailed understanding of how exchange rate movements respond to innovations in external variables, such as oil price shocks or shifts in global uncertainty

5 See Herwartz and Plödt (2016); Kilian, (2009), Kilian & Murphy, (2012), Carstensen et al. (2013) for details

6 The exchange rate volatility (EXV) series was generated using a GARCH(1,1) model.

[7] The Augmented Dickey-Fuller (ADF) test was used to test for stationarity.

include residual analysis, model selection criteria, impulse response analysis, and forecast evaluation. This analysis helps to understand how shocks propagate through the system over time. Finally, forecast evaluation involves assessing the forecasting performance of the VAR model by comparing its out-of-sample forecasts to actual data.

IV. Results And Discussion Of Findings

The Vector Autoregression (VAR) model[8] estimation with lag [9]order p=2 analyzes the relationships among exchange rate volatility (EXV), foreign direct investment (FDI), crude oil price (OIL), trade balance (TB), and global uncertainty index (GUI). The following discussion provides insights into the estimation results for each endogenous variable:

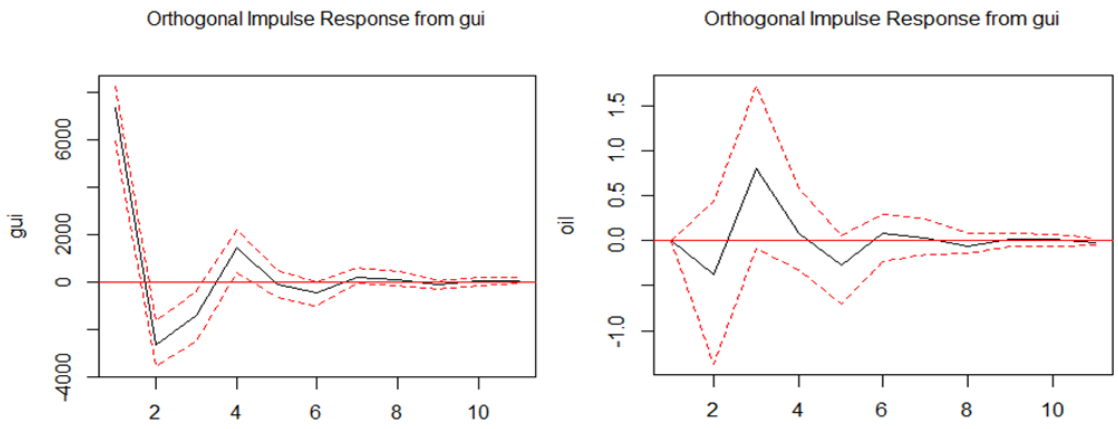
The estimation results for the exchange rate volatility (EXV) equation reveal that the second lag of EXV (EXV.l2) is statistically significant and negatively associated with current EXV, with a coefficient of −0.277 and a p-value of 0.00020, indicating that past exchange rate volatility has a strong dampening effect on current volatility. Additionally, the second lag of TB (TB.l2) shows a positive and significant relationship with EXV (coefficient = 0.0010040, p-value = 0.00150). This suggests that an improved trade balance in the past has a stabilizing influence on current exchange rate volatility. The model's overall fit, with an adjusted R^2 of 0.1017, suggests that the included variables explain a modest portion of the variation in EXV.

The FDI equation highlights that its own first and second lags (FDI.l1 and FDI.l2) have significant negative effects on current FDI, with coefficients of −0.6608 and −0.2989, and p-values less than 0.001. These results indicate that FDI follows a path-dependent pattern where past levels of investment strongly influence future inflows. Additionally, the lag of TB (TB.l2) shows a weak positive significance (p-value = 0.05040), suggesting a lagged positive impact of trade balance on FDI. The model explains a considerable proportion of the variance in FDI, as evidenced by an adjusted R^2 of 0.3105.

For the OIL equation, the first lag of OIL (Oil.l1) is significant, with a coefficient of 0.2299 and a p-value of 0.0031, indicating that past oil prices have a strong positive influence on current oil prices. The first lag of TB (TB.l1) is also significant and positively correlated with oil prices (coefficient = 0.00085490, p-value = 0.01660). This result suggests that a higher trade balance in the past is associated with higher current oil prices. However, the overall explanatory power of this equation is modest, as shown by an adjusted R^2 of 0.0695.

In the TB equation, the first lag of TB (TB.l1) is highly significant and negatively associated with the current TB, with a coefficient of −0.7309 and a p-value less than 0.001, indicating a strong reversion to the mean behavior in the trade balance. The second lag of TB (TB.l2) also shows a significant negative relationship (coefficient = −0.3142, p-value < 0.001), reinforcing the mean-reverting nature of trade balance dynamics. The model fit for TB is relatively strong, with an adjusted R^2 of 0.3632, indicating a substantial portion of the variance is explained by the included variables.

The Global Uncertainty (GUI) equation shows that the first lag of GUI (GUI.l1) is strongly significant with a negative coefficient of −0.3659 and a p-value less than 0.001. This result suggests that higher past global uncertainty tends to reduce current uncertainty levels, possibly due to adjustment or stabilization mechanisms. The second lag of GUI (GUI.l2) also has a significant negative effect on current GUI (coefficient = −0.3331, p-value < 0.001). Interestingly, the first lag of FDI (FDI.l1) also shows significance with a positive coefficient (0.00001069, p-value = 0.0366), implying a link between FDI inflows and subsequent global uncertainty. The adjusted R^2 for the GUI equation is 0.1802, indicating a moderate explanatory power.

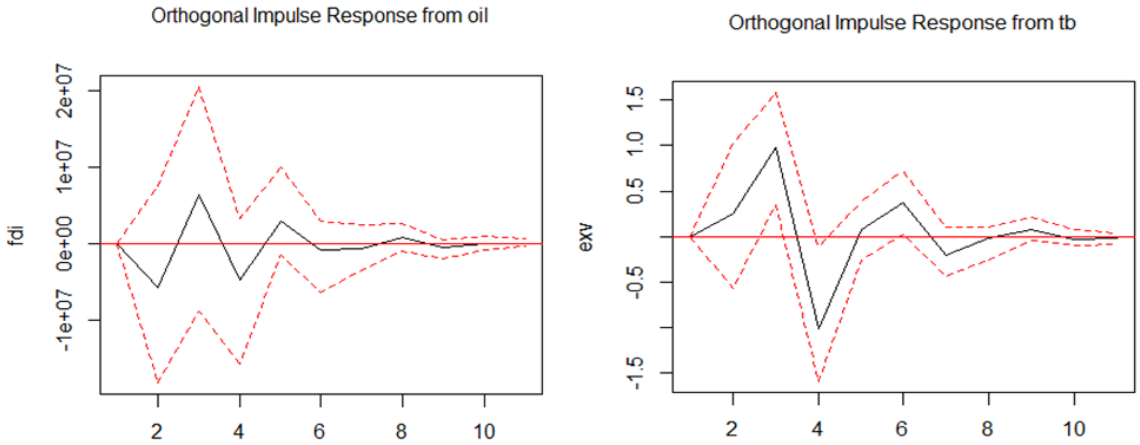


[8] All variables are stationary at first difference, at either, 1%, 5% and/or 10% significance level
[9] The p=2 was arrived at using the Automatic VAR selection model in R.

Several patterns emerge from the Impulse Response Functions[10] (IRFs), several patterns emerge across the variables. The IRF for GUI in response to its own shock initially exhibits a sharp positive spike, suggesting a strong immediate reaction to uncertainty shocks. This is followed by oscillations that gradually dampen, ultimately stabilizing around zero. The accompanying confidence intervals indicate that this positive response is statistically significant over multiple periods, highlighting the persistent impact of uncertainty on itself before waning.

In response to a shock in GUI, the IRF for oil prices begins with a negative movement, indicating that increased global uncertainty initially leads to a decline in oil prices. This negative response then reverses to positive, followed by oscillations around zero. The confidence intervals show that certain periods exhibit significant responses, reflecting the volatile nature of oil prices in reaction to global economic conditions.

The IRF of FDI in response to oil price shocks displays substantial fluctuations accompanied by wide confidence intervals. This suggests a high degree of uncertainty in how FDI reacts to changes in oil prices, potentially due to oil's critical role in the Nigerian economy and its influence on investment decisions. When FDI experiences a shock, the IRF for TB shows an initial negative response, which is then followed by smaller oscillations. The moderate width of the confidence intervals indicates a reasonable level of uncertainty, suggesting that while FDI impacts the trade balance, the effect may be subject to other influencing factors.



The IRF for EXV in response to trade balance shocks starts with a positive movement, shifts to negative, and eventually stabilizes near zero. This pattern indicates that trade balance shocks have a strong immediate effect on exchange rate volatility, which diminishes over time as other factors mitigate the initial impact.

The variance decomposition[11] results shows that Exchange rate volatility (EXV) initially explains 100% of its own forecast error variance. However, over time, this self-explanation decreases slightly to about 91%, indicating that other variables gradually begin to influence its variance. Among these, the trade balance becomes more significant, contributing about 5.8% by the 10th period. The contributions of foreign direct investment and oil prices remain minimal, each contributing less than 1%, while the global uncertainty index accounts for around 1.7% of EXV's variance in the long run.

Foreign direct investment (FDI) starts by explaining nearly 100% of its own variance. Over time, this self-explanation decreases to about 95%. Exchange rate volatility has a minimal impact on FDI, contributing around 0.13% to its variance by the 10th period. Oil prices also play a small role, contributing about 0.6%. The trade balance's influence grows more significantly to approximately 2.65%, while the global uncertainty index contributes around 1.2% to FDI's variance.

Oil prices (OIL) largely explain their own variance, with an initial self-explanation of almost 99.6%, which decreases to around 93.5% by the 10th period. Exchange rate volatility has a small but noticeable effect, contributing around 1.1%. Foreign direct investment remains a minor influence, contributing about 0.4%, while the trade balance's contribution rises to about 3.2%. The global uncertainty index also plays a role, accounting for approximately 1.8% of the variance in oil prices.

[10] The impulse response functions (IRFs) depict the reactions of each variable to shocks in another variable. The response of a variable to its own shock or to another variable's shock is essential in understanding the dynamic interactions within the system

[11] The variance decomposition results offer a detailed understanding of how each variable in the model contributes to the forecast error variance of the others, specifically focusing on exchange rate volatility (EXRV), foreign direct investment (FDI), oil prices (OIL), trade balance (TB), and the global uncertainty index (GUI).

Trade balance (TB) initially explains 95.5% of its own variance, but this decreases to about 91.5% over time. Exchange rate volatility begins to have a more significant impact, contributing around 1.5% by the 10th period. Foreign direct investment's influence increases slightly to around 2.2%, and oil prices account for about 4.1% of the variance. The global uncertainty index has a minimal effect, contributing around 0.7% to the trade balance's variance.

Global uncertainty index (GUI) primarily explains its own variance, with a slight decrease from 99.1% to 92.8% over time. Exchange rate volatility contributes minimally, around 0.6%. Foreign direct investment's contribution increases to around 3.3%, while oil prices account for about 2.1%. The trade balance's contribution remains small, at around 1.3%.

V. Conclusion

The analysis using the Time Varying Parameter Vector Autoregression model provides important insights into the interdependencies among exchange rate volatility (EXV), foreign direct investment (FDI), oil prices (OIL), trade balance (TB), and global uncertainty (GUI) within the Nigerian context. The results reveal that exchange rate volatility is significantly influenced by its own past values and the trade balance. This indicates that historical values are crucial in determining current exchange rate dynamics. Additionally, FDI shows strong path dependence, highlighting its sensitivity to historical investment trends. Both oil prices and trade balance exhibit significant autoregressive behavior, emphasizing the importance of past values in shaping their current states.

The Global Uncertainty Index (GUI) demonstrates a self-reinforcing pattern where an initial shock increases uncertainty, though this effect tends to wane over time. This persistence of uncertainty underscores its ongoing impact on economic variables, suggesting that while its immediate effects are substantial, they tend to stabilize as markets adjust. Oil prices respond to global uncertainty with an initial decline, followed by stabilization. This pattern reflects the inherent volatility of the oil market, where external economic conditions can lead to rapid adjustments in prices before they level out. This finding highlights the need for effective strategies to manage oil price fluctuations and their broader economic implications.

The volatility in FDI responses, driven by changes in oil prices, underscores the sensitive nature of foreign investment to oil market conditions. Given the significant role of oil in the Nigerian economy, policymakers must consider strategies to mitigate the risks associated with oil price volatility to support stable FDI inflows. Finally, the interaction between trade balance and exchange rate volatility indicates that while trade imbalances can lead to immediate exchange rate movements, other economic mechanisms or policy measures may help stabilize the exchange rate in the long term.

In summary, exchange rate volatility is largely self-driven but increasingly influenced by trade balance and global uncertainty. Foreign direct investment remains relatively independent, with slight effects from global factors and trade balance. Oil prices are significantly self-explanatory but are also somewhat affected by global uncertainty. The trade balance is influenced by external economic factors like oil prices and global uncertainty. Finally, the global uncertainty index is predominantly self-explanatory, with minimal influence from other variables. These insights underscore the complex interplay between these economic variables, especially the impact of global uncertainty and trade balance on exchange rate volatility and oil prices.

VI. Recommendations

Based on the findings from the study, several policy recommendations emerge to strengthen Nigeria's macroeconomic stability and resilience against exchange rate volatility, oil price fluctuations, and global uncertainty.

Given the significant role of past values of exchange rate volatility (EXV) and the trade balance (TB) in shaping current exchange rate dynamics, policymakers should enhance the management of external imbalances. A more flexible exchange rate regime, coupled with strategic interventions in the foreign exchange market, can help reduce short-term volatility and promote long-term stability.

The volatility in foreign direct investment (FDI) responses to oil price fluctuations highlights the need for economic diversification. Reducing Nigeria's dependence on oil revenues by promoting sectors such as manufacturing, agriculture, and technology can help stabilize FDI inflows and make the economy less vulnerable to global oil price shocks.

Given the self-reinforcing nature of global uncertainty shocks, Nigeria should develop strategies to mitigate their impact on the domestic economy. Policymakers should establish contingency plans that account for potential global uncertainty, such as trade disruptions or geopolitical tensions. Strengthening ties with multiple trading partners and enhancing domestic production capacity can help buffer against external shocks.

Since trade balance shocks have immediate effects on exchange rate volatility, policymakers should prioritize efforts to stabilize the trade balance. Encouraging exports, reducing import dependency through local

production, and enhancing trade agreements can reduce the frequency and severity of trade imbalances, which, in turn, will contribute to exchange rate stability.

To mitigate the adverse effects of oil price volatility on FDI, Nigeria should introduce policies that create a more predictable and favorable investment climate. Offering incentives for non-oil sector investments, improving infrastructure, and ensuring regulatory stability can help attract and retain FDI, even during periods of oil price fluctuation.

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Appendices

Table 1: Estimation results for equation exv:

	Estimate	Std. Error	t	Sig
exv.l1	1.49E-02	7.28E-02	0.204	0.838328	
fdi.l1	-1.10E-09	3.94E-09	-0.279	0.780722	
oil.l1	-8.83E-02	6.71E-02	-1.316	0.190032	
tb.l1	2.06E-04	3.10E-04	0.665	0.506998	
gui.l1	7.26E-05	5.58E-05	1.302	0.194748	
exv.l2	-2.77E-01	7.29E-02	-3.8	0.000201	***
fdi.l2	-3.27E-09	3.99E-09	-0.82	0.413136	
oil.l2	-7.39E-03	6.62E-02	-0.112	0.911247	
tb.l2	1.00E-03	3.11E-04	3.225	0.001513	**
gui.l2	7.08E-05	5.56E-05	1.273	0.204687	
const	-1.19E+00	8.73E-01	-1.359	0.175865	
trend	1.62E-02	8.17E-03	1.981	0.049228	*

Signif. codes: ***' at 0.001; '**' at 0.05 '*' at 0.1

Table 2: Estimation results for equation fdi:

	Estimate	Std. Error	t	Sig
exv.l1	-3.64E+05	1.34E+06	-0.272	0.7857	
fdi.l1	-6.61E-01	7.23E-02	-9.136	2.00E-16	***
oil.l1	-9.85E+05	1.23E+06	-0.798	0.4258	
tb.l1	4.59E+03	5.70E+03	0.805	0.422	
gui.l1	1.07E+03	1.03E+03	1.042	0.299	
exv.l2	-3.87E+05	1.34E+06	-0.288	0.7733	
fdi.l2	-2.99E-01	7.33E-02	-4.078	6.98E-05	***
oil.l2	2.78E+05	1.22E+06	0.228	0.8199	
tb.l2	1.13E+04	5.72E+03	1.971	0.0504	.
gui.l2	-4.36E+02	1.02E+03	-0.426	0.6706	
const	-1.40E+07	1.60E+07	-0.875	0.3826	
trend	1.02E+05	1.50E+05	0.677	0.4994	

Signif. codes: ***' at 0.001; '**' at 0.05 '*' at 0.1

Table 3: Estimation results for equation oil:						Table 4: Estimation results for equation tb:					
	Estimate	Std.	Error	t	Sig		Estimate	Std.	Error	t	Sig
exv.l1	-5.39E-02	8.29E-02	-0.65	0.51682		exv.l1	3.72E+01	9.38E+01	0.397	0.6918	
fdi.l1	4.71E-09	4.48E-09	1.05	2.95E-01		fdi.l1	1.07E-05	5.07E-06	2.107	3.66E-02	*
oil.l1	2.30E-01	7.65E-02	3.005	0.00306	**	oil.l1	9.11E+01	8.65E+01	1.053	0.2941	
tb.l1	8.55E-04	3.53E-04	2.419	0.01661	*	tb.l1	-3.72E-01	4.00E-01	-0.932	0.3529	
gui.l1	-5.10E-05	6.36E-05	-0.802	0.42384		gui.l1	-3.66E-01	7.19E-02	-5.089	9.47E-07	***
exv.l2	1.00E-01	8.31E-02	1.204	0.2301		exv.l2	-1.63E+01	9.39E+01	-0.174	0.8624	
fdi.l2	3.27E-09	4.54E-09	0.72	4.72E-01		fdi.l2	1.73E-06	5.14E-06	0.337	7.36E-01	
oil.l2	-1.04E-01	7.55E-02	-1.381	0.1691		oil.l2	-1.38E+02	8.53E+01	-1.611	0.1091	
tb.l2	4.72E-04	3.55E-04	1.329	0.18568		tb.l2	-3.82E-01	4.01E-01	-0.952	0.3426	
gui.l2	8.86E-05	6.34E-05	1.398	0.16387		gui.l2	-3.33E-01	7.17E-02	-4.646	6.74E-06	***
const	6.29E-01	9.95E-01	0.632	0.5281		const	4.89E+02	1.13E+03	0.435	0.664	
trend	-5.05E-03	9.30E-03	-0.543	0.58812		trend	-4.98E+00	1.05E+01	-0.473	6.37E-01	

Signif. codes: ***' at 0.001; '**' at 0.05 '*' at 0.1

Table 5: Estimation results for equation gui:					
	Estimate	Std.	Error	t	Sig
exv.l1	3.72E+01	9.38E+01	0.397	0.6918	
fdi.l1	1.07E-05	5.07E-06	2.107	3.66E-02	*
oil.l1	9.11E+01	8.65E+01	1.053	0.2941	
tb.l1	-3.72E-01	4.00E-01	-0.932	0.3529	
gui.l1	-3.66E-01	7.19E-02	-5.089	9.47E-07	***
exv.l2	-1.63E+01	9.39E+01	-0.174	0.8624	
fdi.l2	1.73E-06	5.14E-06	0.337	7.36E-01	
oil.l2	-1.38E+02	8.53E+01	-1.611	0.1091	
tb.l2	-3.82E-01	4.01E-01	-0.952	0.3426	
gui.l2	-3.33E-01	7.17E-02	-4.646	6.74E-06	***
const	4.89E+02	1.13E+03	0.435	0.664	
trend	-4.98E+00	1.05E+01	-0.473	6.37E-01	
Signif. codes: ***' at 0.001; '**' at 0.05 '*' at 0.1					

Table 6: Forecast Error decomposition -exv model						Table 7: Forecast Error decomposition -Oil model					
$exv	exv	fdi	oil	tb	gui	$oil	exv	fdi	oil	tb	gui
[1,]	1.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	[1,]	0.003766	8.20E-05	0.996152	0	0
[2,]	9.80E-01	4.42E-04	8.97E-03	1.85E-03	8.51E-03	[2,]	0.003495	4.09E-03	0.961364	0.028077	0.002973
[3,]	9.50E-01	2.98E-03	8.18E-03	2.76E-02	1.17E-02	[3,]	0.008029	4.11E-03	0.943893	0.027529	0.016442
[4,]	9.18E-01	3.58E-03	7.95E-03	5.42E-02	1.59E-02	[4,]	0.009851	4.09E-03	0.939425	0.030141	0.016495
[5,]	9.18E-01	3.97E-03	8.00E-03	5.40E-02	1.63E-02	[5,]	0.010286	4.08E-03	0.936295	0.031368	0.01797
[6,]	9.13E-01	4.36E-03	7.97E-03	5.73E-02	1.71E-02	[6,]	0.010686	4.30E-03	0.935592	0.031344	0.018081
[7,]	9.12E-01	4.36E-03	7.97E-03	5.83E-02	1.72E-02	[7,]	0.010742	4.38E-03	0.935105	0.031682	0.01809
[8,]	9.12E-01	4.48E-03	7.97E-03	5.83E-02	1.74E-02	[8,]	0.010765	4.39E-03	0.934943	0.031751	0.01815
[9,]	9.12E-01	4.52E-03	7.97E-03	5.84E-02	1.74E-02	[9,]	0.010773	4.43E-03	0.934863	0.031774	0.018158

[10,]	9.12E-01	4.52E-03	7.97E-03	5.84E-02	1.74E-02	[10,]	0.010773	4.44E-03	0.934822	0.031806	0.018162

Table 8: Forecast Error decomposition -FDI model

$fdi	exv	fdi	oil	tb	gui
[1,]	1.28E-03	0.99872	0	0	0
[2,]	8.85E-04	0.991259	0.001986	0.002035	0.003835
[3,]	0.000948	0.980446	0.004422	0.003656	0.010528
[4,]	0.001018	0.965654	0.005645	0.016369	0.011314
[5,]	0.001155	0.956423	0.006108	0.02491	0.011403
[6,]	0.001268	0.955034	0.006136	0.02565	0.011912
[7,]	0.001283	0.954645	0.006158	0.025913	0.012001
[8,]	0.001287	0.95413	0.006195	0.026394	0.011994
[9,]	0.001298	0.954016	0.006204	0.026482	0.012
[10,]	0.0013	0.954012	0.006204	0.026482	0.012002

Table 9: Forecast Error decomposition -TB model

tb	exv	fdi	oil	tb	gui
[1,]	0.014484	0.001598	0.029277	0.954641	0
[2,]	0.010093	0.007514	0.037185	0.940683	0.004525
[3,]	0.012723	0.017972	0.041499	0.922825	0.004982
[4,]	0.014613	0.019526	0.041516	0.918939	0.005406
[5,]	0.014498	0.020024	0.041391	0.917787	0.006301
[6,]	0.014771	0.021755	0.041578	0.915399	0.006496
[7,]	0.01481	0.022115	0.041581	0.914995	0.0065
[8,]	0.014814	0.022133	0.041577	0.914911	0.006565
[9,]	0.01482	0.02224	0.041574	0.914791	0.006575
[10,]	0.014819	0.022258	0.041571	0.914775	0.006577

Table 10: Forecast Error decomposition -GUImodel

gui	exv	fdi	oil	tb	gui
[1,]	0.005332	1.01E-07	0.001416	0.00214	0.991112
[2,]	0.006444	2.04E-02	0.007031	0.003968	0.962135
[3,]	0.006407	3.03E-02	0.020109	0.004907	0.938245
[4,]	0.006277	2.96E-02	0.019506	0.005569	0.939017
[5,]	0.006242	3.21E-02	0.0205	0.010175	0.930936
[6,]	0.006216	3.23E-02	0.020411	0.0117	0.929357
[7,]	0.006235	3.25E-02	0.020505	0.01176	0.929039
[8,]	0.00624	3.26E-02	0.020504	0.012381	0.928278
[9,]	0.00624	3.26E-02	0.020507	0.012518	0.928148
[10,]	0.006248	3.26E-02	0.020518	0.012533	0.928076