CHANGES IN BALANCE OF PAYMENT COMPONENTS AND EXCHANGE RATE VOLATILITY IN NIGERIA: EVIDENCE FROM TGARCH MODEL

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ABSTRACT

This study employs the TGARCH model to determine the impact of balance of payments factors on exchange rates volatility in Nigeria. Specifically, we examine the extent to which changes in trade balance, FDI, FPI, external debt, remittances and current account balance affect the volatility of the Dollar/Naira exchange rate using weekly time series data from 2010 to 2024. We find that exchange rate return is persistent while exchange volatility is mean-reverting and does not exhibit asymmetric effects. Also, exchange rate volatility is driven by changes in current account balance, foreign portfolio investment, external debt, and foreign direct investment. We therefore argue that tracking, prioritizing, and targeting the movements in current account balance, FPI, external debt, and FDI are necessary policy actions towards exchange rate stability in Nigeria.

KEYWORDS: Exchange rate volatility, balance of payments, TGARCH.

1 INTRODUCTION

Exchange rate volatility has emerged as a critical international concern due to its far-reaching implications for asset pricing, macroeconomic stability, and investment decisions. Exchange rate trends arise from cross-border trade and financial transactions, which constitute the major components of a country's BOP. Beyond reflecting nominal price swings, exchange rate movements embody the market's assessment and pricing of underlying macroeconomic risks. In this context, changes in BOP represent fundamental systematic risks that affect the supply–demand conditions in the foreign exchange market and, consequently, the exchange rate risk pricing. In Nigeria, the persistent exchange rate instability suggests that these risk

factors are neither completely understood nor efficiently priced, particularly in an environment long characterized by policy interventions and structural external imbalances.

Experiences associated with Nigeria's exchange rate dynamics has been marked by recurrent volatility, largely driven by exchange rate management practices and increased exposure to external shocks. Supply and demand shifts for foreign exchange, driven by uncertainties in the global economic space and local structural weaknesses, have accelerated exchange rate risk (Ezeokoye *et al.,* 2025). Rather than being reduced through robust market-consistent structures, these risks have often been deepened by policy distortions. Although volatility in exchange rate may generate benefits in the short term, such as improved export competitiveness or accelerated trading to hedge against future losses, such outcomes reflect speculative responses to risk rather than efficiency in risk pricing. In the absence of a well-functioning foreign exchange market, volatility becomes a sign of mispriced risk and not a mechanism for efficient adjustment.

In recent years, Nigeria has witnessed a substantial fall in foreign exchange earnings, depletion of external reserves, insufficient foreign exchange supply, and rising domestic prices, all of which have been linked with heightened exchange rate fluctuations (Guideime *et al.,* 2024). Despite numerous policy measures, exchange rate instability has been frequent, suggesting deeper structural and systemic drivers. Empirical evidence has linked much of this swings to persistent BOP deficits coming from weak export performance, rising external indebtedness, fiscal imbalances and subdued capital inflows (Romelli *et al.,* 2018). These BOP dynamics signal elevated external vulnerability and represent systematic risks that the FOREX market must internalize and price through exchange rate movements.

External borrowing has further deepened Nigeria's exposure to exchange rate risk. Recurrent fiscal deficits have compelled the country to depend heavily on external financing from foreign creditors, Paris and London Clubs inclusive (Onyele & Nwadike, 2021). Servicing external debt demands sustained access to foreign currency, thereby accelerating pressure on the naira and raising exchange rate risk. Rising debt levels also increased concerns about debt sustainability and default risk, hindering capital inflows and exacerbating currency depreciation. From a perspective of risk pricing, foreign debt constitutes a major BOP-related risk factor that affects expectations and influences exchange rate volatility (Ostry, 2016).

Moreover, Nigeria's consistent current account deficits, reducing productive capacity, and excessive reliance on imports—particularly refined petroleum products—have reinforced structural BOP imbalances. These conditions, alongside political and institutional challenges,

have intensified exchange rate volatility. Empirical studies affirmed that the BOP position is a core determinant of exchange rate volatility (Nwanekezie & Onyiro, 2018; Afolabi & Kolawole, 2020). Poor management of BOP has been shown to cause sharp currency swings, undermine foreign exchange earnings, and weakened macroeconomic performance (Arize *et al.,* 2018). Persistent trade deficits mirror deeper structural weaknesses, including low industrial production and declining competitiveness, which manifest as systematic risks priced into the exchange rate (Anyanwaokoro & Kalu, 2020; Guidime *et al.,* 2024).

Despite the relevance of these dynamics, existing empirical studies on Nigeria have largely examined exchange rate volatility in relation to isolated BOP factors, such as imports, exports, or trade flows, without explicitly recognizing these components as interconnected sources of systematic risk in the FOREX market. Studies like Oloyede and Isaac (2017), Ajao (2015), Alasha (2020), and Ihedioha *et al.* (2020) adopt partial approaches that failed to capture how multiple BOP components collectively drive the pricing of exchange rate risk. Consequently, there remains a critical gap in understanding how BOP-based risks are transmitted, priced, and reflected in exchange rate volatility.

This study employs the Zakoian's (1994) TGRACH model to explore the dynamic impact of balance of payment variables on exchange rate volatility in Nigeria. More specifically, the study seeks to provide robust empirical evidence on impact of changes in remittances, trade balance FDI, FPI, external debt and current account balance on exchange rate conditional variance using weekly data from 2010 to 2024.

The remainder of the study has four sections. The next section contains literature review, which is followed by the methodology and empirical results sections. The study is concluded in section 5.

2 Literature Review

2.1 Theoretical Foundation

2.2 Empirical Review

Lawler and Sawsan (2018) used VECM to evaluate the exchange rate volatility in Kuwait from 1980 to 2015. Exchange rates are independent variables, and FDI, trade openness, and gross domestic product are dependent proxies. The outcome showed that exchange rate volatility would rise in response to greater trade openness and FDI.

Kilicarslan (2018) investigated the variables that affect the REER exchange rate in Turkey, including the money supply, foreign direct investment, GDP, trade openness, general government spending, and general fixed capital formation. The study's findings clarified how

the REER value was adversely impacted by government spending, economic expansion, and foreign capital investment. In the meantime, the REER value was positively impacted by trade openness, money supply, and capital formation.

Oke and Adetan (2018) undertook a comprehensive investigation into the determinants of the exchange rate in Nigeria for the period encompassing 1986 to 2016. Employing the ARDL Bounds test approach, the findings revealed that GDP, interest rates, and inflation rates have a positive influence on the exchange rate, whereas the degree of trade openness exhibited a negative effect on the exchange rate. Consequently, it was concluded that GDP, interest rates, and inflation rates represent the principal determinants of the exchange rate in Nigeria.

Alabi and Ogboru (2019) examined the impact of capital flight on the exchange rate within the Nigerian economy over a three-decade period (1986-2015). An OLS regression analysis, the Augmented Dickey-Fuller unit root test, and co-integration tests were utilized to conduct a comprehensive examination of various variables, including GDP, capital flight through debt servicing, and exchange rate. The findings indicated that these variables exerted a statistically significant positive effect. This suggested that capital flight engenders an increased demand for foreign currency, which tends to apply upward pressure on the exchange rate, among other contributing factors.

Aderemi et al. (2020) investigated the association between external debt and fluctuations in the exchange rate within Nigeria during the temporal frame of 1981 to 2018. Consequently, the research employed the ARDL model to fulfil the study's objectives. The principal revelations emerging from this scholarly work are as follows: external debt, debt service payments, and foreign reserves exhibited a statistically significant positive influence on exchange rate fluctuations in the short-term context of Nigeria.

Gnangnon (2020) assessed the determinants of real exchange rate volatility by examining the effects of Aid for Trade flows on the volatility of real exchange rates within recipient nations. The study established that, across the entire sample, Aid for Trade flows exert a negative influence on real exchange rate volatility, exhibiting a comparatively lower mitigating effect on least developed countries (LDCs) in relation to non-LDCs. The mechanisms through which this impact is realized encompass export product concentration, the quality of institutions and governance, inflows of foreign direct investment, and fluctuations in terms of trade. The findings of the study clearly indicated that Aid for Trade flows are significant determinants of real exchange rate volatility.

In the case of Russia, Sohag *et al.* (2021) explored the responsiveness of exchange rates to the uncertainties surrounding economic policy. The exchange rate served as the dependent variable, while the independent variables included economic policy uncertainty, international oil prices, and trade volume, with the quantile autoregressive method employed for analysis. The findings revealed that the local currency experiences appreciation in response to heightened economic policy uncertainty in Russia across various quantiles of the managed floating exchange rate; conversely, it depreciates in the majority of quantiles during a period of floating exchange rates. The results substantiated the assertion that the Russian currency appreciates concomitantly with increases in oil prices and trade, given Russia's status as a prominent oil-exporting nation.

Ejaz *et al.* (2021) assessed the extent to which capital inflows impacted exchange rate dynamics and volatility in exchange rates within developing economies. The Generalized Method of Moments (GMM) was applied to a panel dataset encompassing 34 developing nations over the period from 1978 to 2015. The GARCH model was utilized to quantify volatility in exchange rates, while capital inflows were represented by net FDI and FPI. The results elucidated that when capital inflows were accounted for through FDI, they positively influenced the exchange rate while concurrently exerting a negative influence on exchange rate volatility. Conversely, when capital inflows were evaluated through FPI, the findings indicated adverse effects on the exchange rate, exchange rate volatility, and terms of trade.

Lestie (2021) examined the influences of capital flows on exchange rates, particularly in the context of SSA, utilizing the system-GMM estimator alongside panel data from 45 countries spanning the years 1990 to 2019. This investigation established that a relationship between capital flows and exchange rates was indeed present, with capital flows prompting an appreciation of the exchange rate when accounting for endogeneity. Furthermore, the study's findings corroborated that both portfolio flows and foreign direct investment contributed to the appreciation of the exchange rate, although the influence of portfolio flows on the exchange rate was considerably more pronounced than that of FDI.

Khairunnisa and Zuhroh (2022) conducted an empirical investigation into the determinants influencing exchange rate dynamics within European Emerging Market and Developing Economies (EMDEs), specifically targeting Albania, Bulgaria, Hungary, the Republic of Moldova, the Republic of North Macedonia, Romania, Russia, and Ukraine, spanning the years 2000 to 2019. The data utilized in this analysis was meticulously sourced from reputable organisations, including UNCTAD, the IMF, and the World Bank. A regression

analysis methodology was employed to scrutinize the time series data pertaining to each individual nation, while panel data analysis was implemented to encompass the dataset from the aforementioned eight countries. The findings elucidated that fluctuations in exchange rates across EMDEs in Europe, alongside GDP growth and Terms of Trade (ToT), exert a statistically significant positive influence on exchange rates. This indicates that an augmentation in GDP and ToT growth correlates with an appreciation of the exchange rate, whereas a decline in GDP and ToT growth corresponds with a depreciation of the exchange rate within the context of EMDEs in Europe.

Rufai *et al.* (2022) scrutinized the long-term relationship between FDI inflows and exchange rate (EXC) dynamics in Nigeria by employing the Gregory-Hansen and Bayer-Hanck cointegration methodologies, covering the period from January 1980 to December 2019. The findings indicated the existence of a long-run association between FDI and exchange rate fluctuations in Nigeria. The Dynamic OLS technique was utilized to ascertain the influence of FDI on the exchange rate. A negative relationship was identified between the two variables, suggesting that an escalation in FDI resulted in the appreciation of Naira and vice versa.

Anoruo *et al.* (2023) investigated the nonlinear dynamics characterizing the relationship between workers' remittances and real effective exchange rates within the context of the WAEMU member states, employing panel smooth transition regression (PSTR) methodology. The PSTR was estimated by incorporating a singular transition function alongside a location parameter, as dictated by the diagnostic assessments undertaken. The diagnostic evaluations indicated that the interaction between workers' remittances and real effective exchange rates is nonlinear in nature. The determined threshold value was identified at 3.07%. The findings indicated that increments in workers' remittances exert a depreciative influence on real effective exchange rates within regime one, which is associated with a threshold value below 3.07%. However, within the second regime, characterized by a threshold value equal to or exceeding 3.07%, augmentations in workers' remittances produced an appreciating effect on real effective exchange rates. These outcomes substantiated the notion that the relationship between workers' remittances and real effective exchange rates is asymmetric and thus necessitates an appropriate modelling approach. The results corroborated the existence of a Dutch disease effect in the second regime, wherein the estimated coefficient pertaining to workers' remittances was both negative and statistically significant.

Imoagwu et al. (2023) conducted an investigation into the ramifications of escalating external debt on the exchange rate within the Nigerian context, utilizing annual data spanning from 1980 to 2021. The acquired data were subjected to rigorous analysis employing the ARDL methodology, alongside stability and diagnostic assessments throughout the analytical process. The findings derived from the preliminary test analysis indicated that external debt exerted a negative yet statistically insignificant influence on the exchange rate in Nigeria. Furthermore, external debt Zhang and Hao (2023) analyzed the influence of distinct categories of capital flows on the real effective exchange rate throughout China's economic development trajectory. Utilizing a dataset encompassing three predominant forms of capital flows in China from 1994 to 2015 and employing cointegration analysis along with Granger causality assessment, the empirical investigation revealed that FDI exerted a relatively modest impact on the appreciation of the real effective exchange rate; conversely, securities investment demonstrated a significant effect on the appreciation of the real effective exchange rate; additionally, other investments exhibited a pronounced effect on the appreciation of the real effective exchange rate, with the impact of other investment being notably more substantial.

Rafie et al. (2025) evaluated the debt sustainability of Africa's lower-middle-income (LMIC) nations. It specifically looked at five African LMICs from 2000 to 2021: Morocco, Egypt, Tunisia, Benin, and Senegal. Morocco, Egypt, and Tunisia are in charge of their own monetary policies and reserve management, but Benin and Senegal, members of the Western African Economic and Monetary Union (WAEMU), are subject to further restrictions because they use the same currency. The study examined the relationship between external debt, reserves, currency rates, GDP growth, exports, and government spending using unit root tests, Johansen cointegration tests, and a VECM. The results showed that although these nations' public foreign debt fluctuates over the short term, fiscal and monetary measures tend to stabilize it over the long run. Furthermore, debt positions were greatly impacted by foreign reserves, and exchange rate agreements made in Morocco, Egypt, and Tunisia lower the danger of currency depreciation. On the other hand, Senegal and Benin's debt sustainability is limited by their shared currency.

3 Methodology

3.1 Data

This study uses weekly time series data for the period from 2010 to 2024. The dependent variable is exchange rate volatility while the explanatory variables are trade balance, FDI,
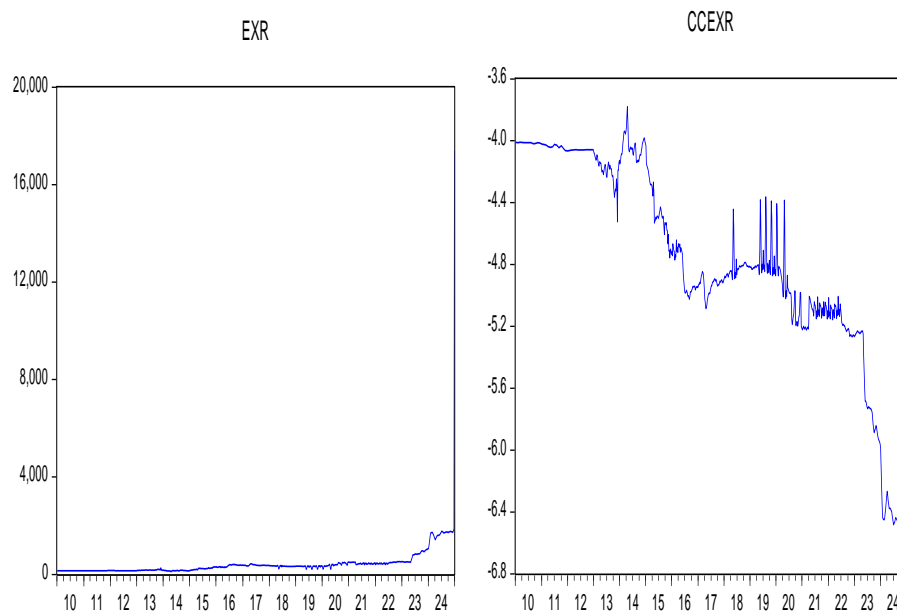
FPI, external debt, and current account balance. All data are sourced from the CBN database and statistical bulletin, while data analysis is aided by EViews.

Consistent with previous studies, we transform exchange rate data into continuously compounded returns as follows:

$$r_t = \ln\left(\frac{E_t}{E_{t-1}}\right),$$

where ln = natural logarithm, r_t = exchange rate returns at time t, E_t current exchange rate,

E_t previous exchange rate.

Figure 1 shows the graph of exchange rate and remittances. Figure 2 shows the trend in trade balance, FDI, FPI, and external debt. As expected, the Dollar/Naira exchange rate has increased overtime, its returns series fluctuates around a stable mean.
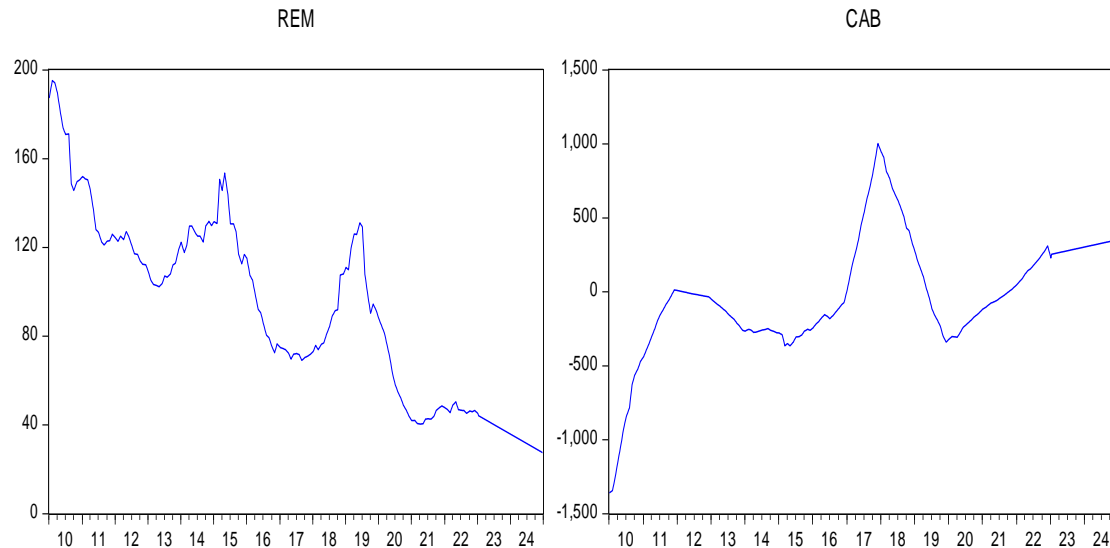

Figure 1: Trend in Exchange Rate and Exchange Rate Returns
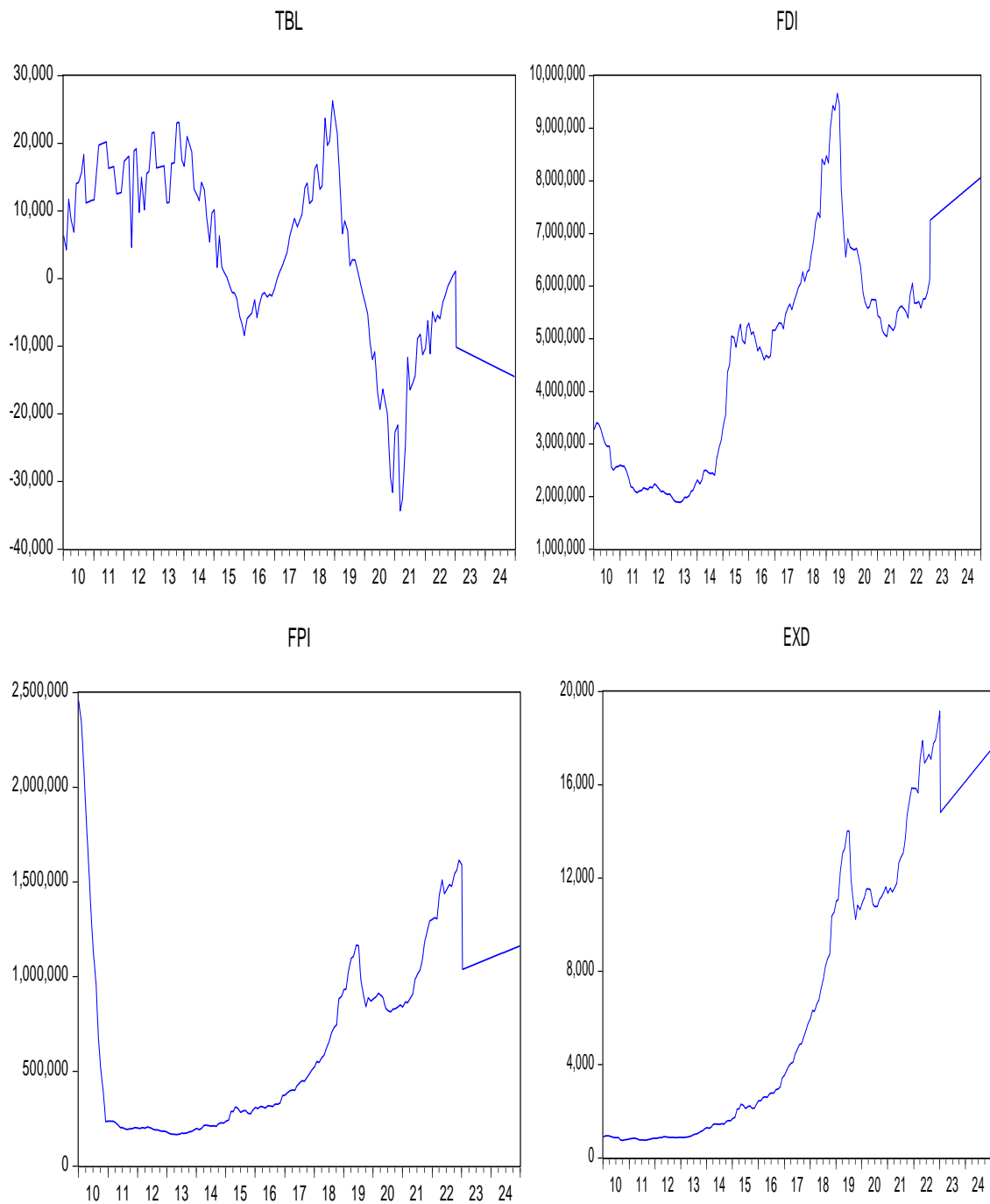
Figure 2: Trend in Trade Balance, FDI, FPI, and External Debt,

Figure 3: Trend in Remittances and Current Account Balance

3.2 Research Models

The Threshold GARCH (TGARCH) model, propounded by Zakoian (1991) and Glosten, Jagannathan, and Runkle (1993), is an extension of the GARCH model designed to capture the asymmetric impact of "good" versus "bad" news on financial market volatility, a phenomenon known as the leverage effect. Unlike the standard GARCH model, which assumes that positive and negative shocks of the same magnitude have the same effect on subsequent volatility, the TGARCH model incorporates a dummy or indicator variable to differentiate their impacts. The conditional variance equation for a TGARCH (1,1) model is typically expressed as:

$$EXRR_t = \phi_0 + \phi_1 EXRR_{t-1} + \epsilon_t \tag{1}$$

$$\sigma_t^2 = \alpha_0 + \alpha_1 \epsilon_{t-1}^2 + \gamma.d_{t-1}\epsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \lambda_1 X_t + \tag{2}$$

From the mean equation at (1), ϕ_0 is the model intercept, ϕ_1 captures the persistence in exchange rate returns, and ϵ_t is the model error terms.

Froom the variance equation at (2), σ_t^2 is the conditional variance at time t, ω, α, γ, and β are parameters to be estimated, and ϵ_{t-1}^2 is the squared error term (shock) from the previous period. The key component is the indicator variable D_{t-1} which equals 1 if $\epsilon_{t-1}^2 < 0$ (a negative shock or "bad news") and 0 if $\epsilon_{t-1}^2 \geq 0$ (a positive shock or "good news"). If a shock

is negative, the total impact on the next period's variance is $(\alpha + \Upsilon)\epsilon_{t-1}^2$, while a positive shock of the same magnitude only contributes $\alpha\epsilon_{t-1}^2$, allowing the model to more accurately reflect the empirical finding that negative shocks typically induce greater volatility in stock returns than positive ones.

4 Empirical Results

Table 2 presents the TGARCH estimation results for the impact of balance of payment components on exchange rate volatility.

Table 2: TGARCH Estimation Results.

Variable	Coefficient	Prob.
Mean Equation		
CCEXR(-1)	0.9980	0.0000
C	-0.0109	0.7307
Variance Equation		
C	0.0022	0.0000
RESID(-1)^2	0.2102	0.0000
RESID(-1)^2*(RESID(-1)<0)	0.0197	0.7971
GARCH(-1)	0.4354	0.0000
TBLC	-0.0003	0.3056
FDIC	-0.0286	0.0968
FPIC	0.0150	0.0000
EXDC	-0.0537	0.0230
REMC	0.0235	0.2821
CABC	-0.0004	0.0000
Diagnostic Tests		
DOF	19.831	0.0311
ARCH-LM	0.0408	0.8398
Q-statistics	0.0412	0.8390

The mean equation showed that CCEXR (–1) was highly significant with a coefficient approximately one (0.998), showing strong persistence in returns of exchange rate. This suggested that current returns were mainly determined by past changes. The statistically insignificant constant term implied no additional predictable risk premium or drift in the mean return once past returns were accounted for. From the perspective of risk–return, this finding indicated that expected returns did not adjust in response to risk captured in the process of volatility. In other words, even though volatility changed over time, the currency

market did not reward investors with more returns for bearing this risk, indicating nonexistent or weak risk pricing in the mean equation.

The TGARCH results provided insights into how shocks were priced into exchange rate volatility. The ARCH term (0.2103) and the GARCH term (0.4355) were both statistically significant, reflecting that both recent shocks and past volatility were significant drivers of volatility, with moderate persistence. The leverage or asymmetric term, RESID($-$1)^2*(RESID(-1)<0), was statistically insignificant, indicating negative shocks (bad news) did not accelerate volatility more than good news (positive shocks). Thus, the exchange rate market did not display heightened sensitivity to downside risk or asymmetric risk pricing. Turning to BOP fundamentals, FPIC significantly increased volatility, emphasizing that speculative or short-term capital inflows through portfolio investments raised macro-financial risk. Meanwhile, EXDC and the CABC significantly reduced volatility, implying that stronger external factors lowered the extent of risk priced into the market. FDI had a weak stabilizing effect, though marginally significant. Overall, the variance equation revealed that while volatility reacted strongly to shocks and BOP fundamentals, the market did not price risk asymmetrically.

The diagnostic tests revealed that the TGARCH model was correctly specified, with no residual ARCH effects (ARCH-LM $p = 0.8398$) and no autocorrelation in residuals (Q-statistic $p = 0.8390$). The degrees-of-freedom parameter (DOF ≈ 19.83) indicated that a fat-tailed distribution was appropriate, consistent with the presence of infrequent but extreme exchange rate swings, a crucial factor of risk in currency markets. However, the non-significant leverage effect suggested that the market did not disproportionately price downside risk, which is common for financial assets but uncommon in policy-driven or heavily managed exchange rate systems. Together with the non-significant risk–return term in the mean equation, the results indicated that although exchange rate volatility was influenced by dynamics of BOP fundamentals, this risk did not yield a compensatory return premium. Thus, the TGARCH model showed that risk was present, measurable, and influenced by BOP fundamentals, but not largely priced into expected returns in this market.

5 CONCLUSION

This study employs the TGARCH model to empirically explore the impact of balance of payments factors on exchange rates volatility in Nigeria. More specifically, the study seeks to determine the extent to which changes in trade balance, foreign investments (both direct and portfolio investments), external debt, remittances and current account balance affect the

volatility of the Dollar/Naira exchange rate using weekly time series data from 2010 to 2024. The main findings of the study can be summarized as follows:

1. Exchange rate return is persistent while exchange volatility is mean-reverting and does not exhibit asymmetric effects.

2. Trade balance changes exert no significant influence on exchange rate volatility.

3. Changes in FDI exert a weakly significant negative influence on exchange rate volatility.

4. Changes in foreign portfolio investment have a highly significant positive effect on exchange rate volatility.

5. Changes in external debt exert a significant negative effect on exchange rate volatility.

6. Changes in remittances play no significant role in exchange rate volatility.

7. Changes in current account balance exert a highly significant negative impact on exchange rate volatility.

Overall, our empirical findings underscore the significance of balance of payment movements in exchange rate volatility but also show that not all balance of payment factors are active drivers of volatility in the foreign exchange market. To this end, tracking, prioritizing, and targeting the movements in current account balance, FPI, external debt, and FDI are necessary policy actions for achieving exchange rate stability in Nigeria.

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