

Asymmetric Modeling of Naira Yuan Exchange Rate with Structural Breaks

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ABSTRACT

This study investigates the impact of structural breaks on the Naira–Yuan askrate and assesses the stability and volatility (asymmetry) of the series using daily data spanning January 2015 to July 2025. Stationarity of the series was examined using the Augmented Dickey–Fuller (ADF) test, while symmetric models incorporating five structural breaks were employed to estimate the stabilized series and conditional variations in the Naira–Yuan exchange rate. Model performance was evaluated using model selection criteria. The study also provides an indepth discussion of exchange rate dynamics from the perspectives of persistence and leverage effects during the period under review. The results demonstrate that the Glosen–Jagannathan–Runkle GARCH (GJRARCH) model with five structural breaks outperforms earlier asymmetric models, achieving lower values for the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and standard error.

Keywords: AskRate, Heteroscedasticity, Exchange Rates, GJRARCH, Structural Breaks, Volatility

1.0 INTRODUCTION

One of the main challenges for econometricians is to identify appropriate methods for modelling the persistent volatility of financial time series in the presence of regime changes or shocks. Structural breaks are interpreted differently by researchers. Fasanya *et al.* (2017) define a shock as an unanticipated and unpredictable event that exerts either a positive or negative influence on an economy. However, it can also be understood as an unexpected but potentially foreseeable incident that has beneficial or adverse effects on a process or an economy, owing to the growing ability of financial experts to anticipate such events. The accuracy with which these shocks can be predicted has therefore become a major concern. This uncertainty particularly in relation to exchange rate dynamics under regime changes has become a prominent topic in national and international economic debates. To address this issue, the present study incorporates regime structural changes into its modelling framework. The primary objective is to assess the impact of structural breaks on the misalignment of the Naira–Yuan exchange rate and its implications for Nigeria's economic growth between January 2015 and July 2025, while accounting for the possible number of structural breaks.

2.0 REVIEW OF LITERATURE

2.1 Theoretical framework

This subsection introduces the Purchasing Power Parity (PPP) theory as the theoretical foundation of the study. According to Oyinlola (2018), since Cassel first proposed

the concept in 1918, a number of studies such as Officer (1976) and Rogo (1996) have examined it. Only a few, including Oyinlola *et al.* (2011) and Sollis (2005), have provided empirical validation. The PPP theory posits that the primary determinant of an exchange rate is the ratio of two countries' price levels (absolute PPP) or their price indices multiplied by the base-period exchange rate (relative PPP). In addition to these, the theory also allows for the influence of other explanatory factors and random shocks.

The core principle of PPP is that the value of a currency is determined by the quantity of goods and services that a unit of that currency can purchase in its issuing country. Consequently, PPP is regarded as one of the most important frameworks for explaining exchange rate behaviour. According to Atoi and Nkwede (2017), the theory stipulates that the exchange rate between two currencies will adjust to reflect changes in the respective countries' price levels. More specifically, after accounting for exchange rates, identical goods (measured in terms of a basket) should cost the same across countries. This rests on the "law of one price," which holds that similar goods should sell for the same price regardless of location. The real exchange rate therefore offers important insights into exchange rate behaviour.

Key variables that are susceptible to volatility affect the real exchange rate, which in turn influences the volatility of the nominal exchange rate. However, because the PPP theory assumes that goods are identical across countries and that trade barriers and transport costs are negligible,

it cannot fully explain observed behaviour. In practice, these assumptions are violated due to differences in the quality of comparable goods produced in different countries.

Moreover, PPP's failure to account for non-tradable goods and services, as well as items excluded from national price indices, has led to the emergence of the Interest Rate Parity (IRP) condition. The IRP explains the

$$j^d = j^f - \frac{\delta_{t+1}^e - \delta_t}{\delta_t} \quad (1)$$

where j^d denotes the local interest rate, j^f denotes the foreign interest rate, δ_{t+1}^e represents the mean or predicted domestic currency at time $t+1$, and δ_t represents the actual domestic currency at time t , while on the other hand, IRP is presented as:

$$\delta_t = \frac{\delta_{t+1}^e}{j^f - j^d} \quad (2)$$

2.2 Empirical review

Essien *et al.* (2017) report that failing to account for structural breaks, when they are present, leads to misspecification errors in Behavioural Equilibrium Exchange Rate (BEER) models and produces biased estimates of real exchange rate misalignment (see also Andreou, 2002; Zainudin & Shaharudin, 2011). Several Nigerian studies including Abdulganiy (2025), Aliyu (2011), Atanda and Iyekoretin (2012), and Ibrahim (2013) did not incorporate structural breaks in their models, a gap that has been shown to introduce bias into real exchange rate misalignment estimates (Essien *et al.*, 2017).

Modelling volatility alongside regime changes or change points enables researchers to capture how unstable parameters evolve over time in response to events such as pandemics, policy changes, financial crises, and political or social influences. This improves the accuracy of financial time series forecasts and enhances understanding of market behaviour. It also provides practical benefits for stock trading, portfolio and risk management, stress testing, and even applications in fields such as climatology, medical sciences, and mechanics. Consequently, economists and financial analysts have produced extensive literature on the volatility of financial time series with structural breaks.

Essien *et al.* (2017) applied structural break analysis to examine misalignment under different exchange rate regimes and found empirical support for a long-run relationship between the real exchange rate (RER) and its determinants subject to a structural break in the first quarter of 2011, similar to Ali *et al.* (2017). Fasanya and Akinwale (2022) examined the effect of exchange rate shocks on ten sectoral stock returns in Nigeria between January 2007 and December 2018 using Autoregressive Distributed Lag and Nonlinear Autoregressive Distributed Lag models. Their results showed that only

relationship between domestic interest rates, interest parity, and anticipated domestic currency appreciation. It states that domestic interest rates must equal foreign interest rates minus the expected appreciation of the domestic currency. Oyinola (2018) presents the algebraic form of the domestic interest rate under the IRP theory as follows:

the financial services sector exhibited asymmetric behaviour in the short and long run when structural breaks were ignored, and that with structural breaks none of the sectoral stock returns was asymmetric. This indicates that exchange rate movements affect sectors differently.

Oyinola (2018) modelled volatility persistence and asymmetry in the Naira–Dollar exchange rate in both the interbank and Bureau de Change (BDC) markets using monthly data from January 2004 to November 2017. Employing Generalized Autoregressive Conditional Heteroscedasticity [GARCH (1,1)], Threshold GARCH [TGARCH (1,1)] and Exponential GARCH [EGARCH (1,1)] models, the study found two substantial structural shocks in each market. Notably, the interbank exchange rate experienced breaks in December 2014 and January 2015. The results further showed that, unlike the interbank market where persistence was high but not explosive (especially under asymmetric models), persistence in the BDC market was typically explosive. This underscores the counterintuitive nature of earlier studies that failed to include structural breaks in their models.

Luguterah *et al.* (2015) analysed the volatility of the Ghana Cedi–US Dollar exchange rate using symmetric and asymmetric GARCH models on monthly returns from January 1990 to November 2013. Their findings showed persistent volatility under asymmetric models but no leverage effects, suggesting that investors hedged against future currency risk did not rely on information about market asymmetry in Ghana. Similarly, Rofael and Hosni (2015) used State Space and ARCH-type models to simulate exchange rate volatility in Egypt with daily data from January 2003 to June 2013. Their results revealed time-varying variance and volatility clustering in exchange rate returns, underscoring the importance of accounting for these features when modelling nominal exchange rates. These findings show

prolonged periods of high volatility and relative calm in the Egyptian exchange rate market.

Numerous studies have attempted to model exchange rate volatility in Nigeria. Abdulganiy's (2025) study of symmetric and asymmetric models for the Naira–Yuan exchange rate showed that the series was unstable and exhibited explosive volatility, but did not incorporate structural breaks. Adeoye and Atanda (2012) identified overshooting volatility shocks in their study but did not consider asymmetric effects, because standard ARCH and GARCH frameworks only capture symmetric impacts. However, Bala and Asemota (2013) emphasise that asymmetric effects are crucial when working with high-frequency data. This makes it essential for investors and policymakers to assess whether asymmetric shocks are present in exchange rates.

Using three segments of the Nigerian foreign exchange market the Interbank Foreign Exchange Market (IFEM), the Wholesale Dutch Auction System (WDAS), and the Bureau de Change Atoi and Nkwede (2017) conducted an asymmetric analysis of currency rate volatility. Employing an Asymmetric Threshold Generalized Autoregressive Conditional Heteroscedasticity (TGARCH) model, they found that exchange rate volatility persisted across all markets, but that interbank exchange rate volatility was both explosive and persistent.

Similarly, Yakubu and Abubakar (2014) used GARCH, GJR-GARCH, TGARCH, and TS-GARCH models and found persistent volatility with no leverage effects. By distinguishing volatility under managed float and fixed exchange rate regimes, they demonstrated that leverage effects occurred under both regimes.

Adeoye and Atanda's (2012) analysis of consistency, persistence, and intensity of volatility in the Naira–Dollar exchange rate concluded that nominal and real Naira–US Dollar exchange rates do not conform to the conventional long-run PPP model. They argued that symmetric GARCH models do not fully capture the leverage effect inherent in financial time series. Clement and Samuel (2011) also used a symmetric GARCH model to examine volatility in the Naira/US Dollar and Naira/UK Pound Sterling exchange rates and found consistently volatile returns. Olusola and Opeyemi (2013) applied parametric measures to Nigerian exchange rate volatility and found that fluctuations signal risk and uncertainty, imposing costs on risk-averse economic agents. Their Exponential GARCH model further revealed the instability of Nigeria's exchange rate due to abnormally large and small deviations.

With the exception of Abdulganiy's (2025) work on the Naira–Yuan, most studies on Nigeria's exchange rate

$$\pi_t = \lambda + \sum_i^k \delta \tau_{t-i} + \varepsilon_i; i = 1, \dots, k, t = 1, \dots, T; \varepsilon_i \sim iid(0, \sigma^2); |\delta t| < 1 \quad (3)$$

volatility have examined both symmetric and asymmetric effects for bi-currency and multi-currency models (Naira–Dollar and Naira–Dollar–Yuan).

However, Abdulganiy's study did not incorporate structural changes. This research improves upon that work by including regime changes (structural breaks) to complement earlier findings. It also considers the likely consequences of structural changes in the time series data. Thus, this study addresses this gap by employing the GJR-ARCH framework to explain exchange rate asymmetry in the Naira–Yuan series.

3.0 METHODOLOGY

3.1 Research design

This study adopts an ex post facto (after-the-fact) research design. It relies on secondary data over which the researcher has no direct control and which have already been generated by completed events. This design is appropriate for investigating the relationship between the Naira–Yuan exchange rate and structural breaks under both symmetric and asymmetric effects with a view to informing sustainable business and economic growth.

Daily data covering the period 2015–2025 were used and filtered to ensure consistency. Focusing on the stability of the Nigerian currency relative to the Yuan over more than eleven years enables the study to capture multiple regime changes such as political events and social policy shifts. All data were obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin (2025 edition).

3.2 Analytical procedure

Daily Naira–Yuan ask-rate exchange data were retrieved from the CBN's online database. In line with established literature on modelling volatile financial series, the analysis proceeded as follows:

1. Descriptive statistics of the ask-rate were computed.
2. Stationarity of the series was tested.
3. Normality of residuals and potential heteroscedasticity were assessed using the ARCH LM test.
4. The presence of structural breaks in the series was examined.

3.3 Data sources and construction

A financial time series that exhibits conditional heteroscedasticity or autocorrelation in its squared residuals is said to have autoregressive conditional heteroscedastic (ARCH) effects. To test for ARCH effects in the series under investigation, this study employed the ARCH Lagrangian Multiplier (LM) test procedure developed by Engle (1982) with a univariate model specified as follows:



where π_t represent exchange rate returns and is measure in this paper

$$AR' = 100 [\log(\text{Ask} - \text{Rate})]$$

where

AR' represents the first-differenced ask-rate in equation (2); that is, Ask-Rate' denotes the first-difference operator of the Naira–Yuan exchange rate. In this section, we examine various potential symmetric and asymmetric ARCH and GARCH modelling frameworks to capture volatility and persistence in the Naira–Yuan exchange rate market. A key contribution of this paper

(4) to exchange rate volatility modelling is the explicit inclusion of five break dates, as established by the Bai–Perron (2003) structural break test.

We begin with the ARCH model, which is particularly suitable for modelling volatility clustering around the mean error when the effects of past shocks decay quickly, as illustrated in the correlogram.

$$\sigma_t^2 = \omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 \tag{5}$$

where:

σ_t^2 = Conditional variance

ε_t =Residual at time t

ω =Constant term

α_i =Coefficients for lag squared

We build upon the symmetric ARCH framework and the GJR-ARCH model, which is an extension of the GARCH model proposed by Glosten *et al.* (1993). The model is specified as follows:

$$\sigma_t^2 = \omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 + \sum_{i=1}^q \lambda_i I_{t-i} \varepsilon_{t-i}^2 \tag{6}$$

where:

σ_t^2 = Conditional variance

$\alpha_i \geq 0$: symmetric shock impact

ε_{t-1} =Residual at time t

ω =Constant term

$\lambda_i \geq 0$: asymmetric parameter (leverage effect).

I_{t-i} = indication function for negative socks

$$I_{t-i} = \begin{cases} 1 & \text{if } \varepsilon_{t-1} < 0 \\ 0 & \text{if } \varepsilon_{t-1} \geq 0 \end{cases} \tag{7}$$

Equation (4) expresses the conditional variance as a function of information about volatility observed in the preceding period. (the ARCH term, " ε_{t-1}^2 ").

Negative shocks increase volatility persistence by $\alpha_i + \gamma_i$, and covariance stationarity requires that $\alpha_i + \gamma_i < 1$. This asymmetric effect is illustrated in this study through the use of the GJR-ARCH model, as other models encounter difficulties with log-likelihood estimation convergence.

4.0 ANALYSIS AND DISCUSSION OF RESULTS

4.1 Descriptive statistics

Table 1 presents the descriptive statistics for the ask-rate exchange rate returns in the exchange market over the entire study period. The results reveal substantial spikes and fluctuations in the exchange rate, as indicated by the large gap between the minimum and maximum ask-rate values. Throughout the sampled period, the ask-rate exhibits positive skewness, suggesting a predominance of the right tail. Likewise, the kurtosis indicates that the official exchange rate is leptokurtic.

Table 1. Descriptive Statistics of Ask-Rate in the Exchange Market

Descriptive Statistics	Ask-Rate
Mean	74.85283
Median	50.4084
Maximum	237.2658
Minimum	24.997
Std. Dev	58.21889

Skewness	1.790647
Kurtosis	4.699705
Observations	2,573

Table 1. presents the results of the pre-estimation tests for the ask-rate exchange rate returns over the entire study period. The R-squared and adjusted R-squared values indicate that the ordinary least squares (OLS) model does not adequately explain the variation in the series and thus cannot be relied upon for estimation. The Augmented Dickey–Fuller (ADF) test shows that the series is non-stationary, even after detrending, and the Phillips–Perron test yields the same conclusion. The Breusch–Pagan/Cook–Weisberg test, with a chi-square value of 767.14, leads to rejection of the null hypothesis of constant variance (homoscedasticity). In addition, the Jarque–Bera test indicates that the residuals are not normally distributed.

Table 2. Preliminary Estimation Test of Ask-Rate in the Exchange Market

Preliminary Est Tests	Test Statistics
R-squared	0.0000
Adj R-squared	0.0000
Root MSE	58.683
Dfuller	0.8774
Phillips-Perron test for unit root	0.9777
dfuller de-trend	0.5810
Breusch-pagan/cook-weisberg test	chi2(1) = 767.14
Jarque-Bera normality test	4.3e+05/ Chi(2) 0

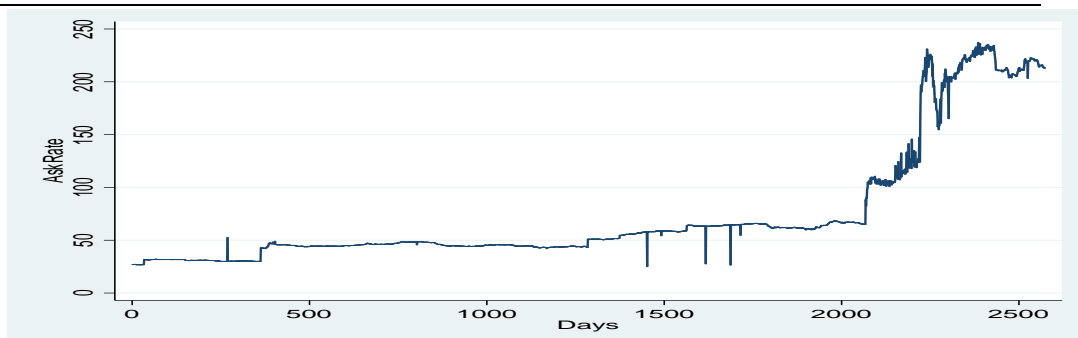


Figure1: Naira-Yuan Ask-Rate Return

Figure1 illustrates the trend of Naira–Yuan ask-rate returns in Nigeria’s exchange rate market. The trajectory shown in the figure highlights the instability of the Naira–Yuan exchange rate. It exhibits clear signs of volatility clustering: the period begins with small spikes, followed by low volatility, then renewed spikes, alternating periods of high volatility with relatively low

volatility, and continues in this pattern. This pattern supports the evidence presented in Table 1. The first noticeable spike occurs in mid-2023, when the value rises from ₦64.9993 to ₦88.4004. Subsequent fluctuations follow a similar pattern until the series reaches its maximum of approximately ₦237.2658 in late September 2024. This peak likely coincides with trade deficits, the sluggish recovery from the COVID-19 financial crisis, and falling global oil prices, all of which affected the Nigerian economy. These movements also reflect the impact of policy changes associated with economic diversification.

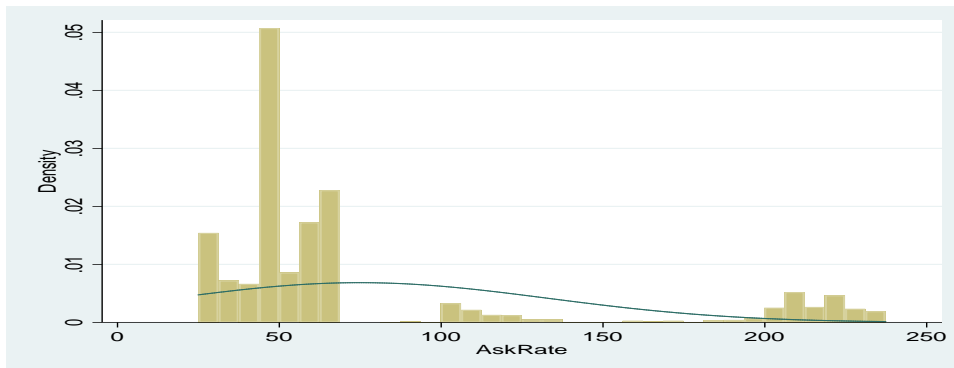


Figure 2: Skewness Plot

Figure2: shows the positive skewed Naira-Yuan Ask-Rate Returns

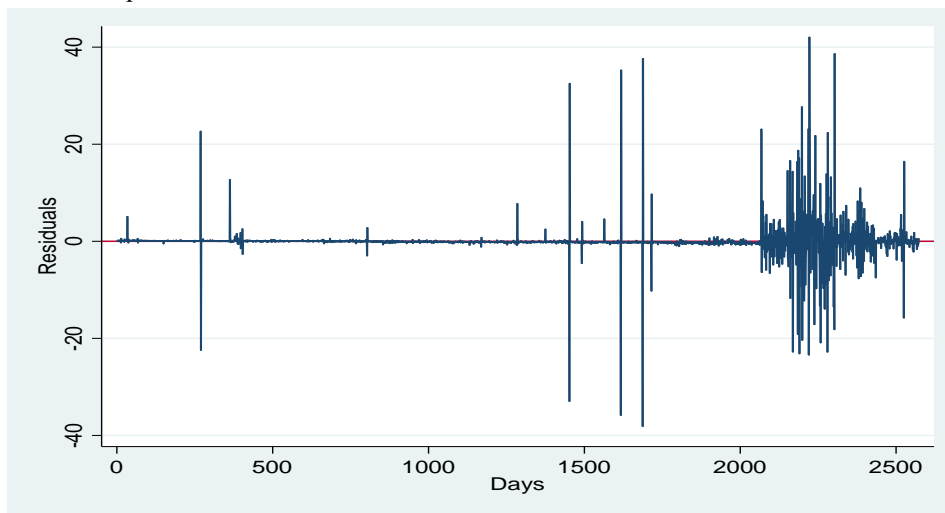


Figure 3 (Unit Root) shows the plot of residuals around the mean error.

The graph initially displays a slight cyclical decay, followed by a spike that persists for some time, and then, toward the end of the series, it exhibits alternating spikes and successful decays.

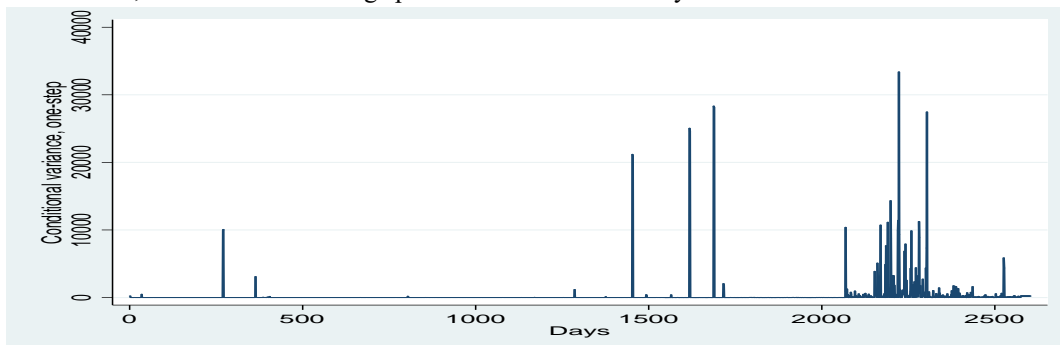


Figure 4: Graph of Conditional Variance of Naira-Yaun Ask-Rate Returns

Figure 4 illustrates the dynamics of volatility by showing how the conditional variance behaves over the study period in the returns of the foreign exchange market and its underlying data. The figure indicates that the errors are not constant, thereby confirming the non-normality of the Naira–Yuan exchange rate series.

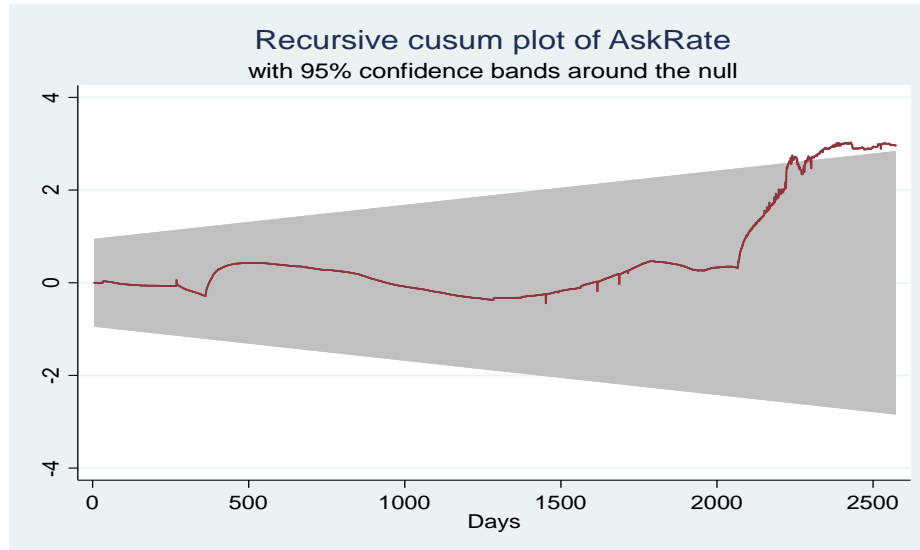


Figure 5: CUMSUM Plots

Figure 5: depicts the deviations of individual observations from the mean value. The recursive CUSUM plot reveals five (5) major shifts (structural changes) during the period under review.

4.2 Structural Break Test

The structural break analysis was conducted using the command `.xtbreak Ask-Rate SeriesNo`. This test examines multiple breaks at unknown break dates following the Bai and Perron (1998, *Econometrica*) framework. The null hypothesis (H_0) states that there are no structural breaks in the series, while the alternative hypothesis (H_1) allows for between one and five ($1 \leq s \leq 5$) potential breaks.

Table 3 Test for Multiple Breaks

Bai & Perron Critical Values				
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
UDmax	3917.65	12.37	8.88	7.46

Sequential tests for multiple breaks at unknown breakpoints were also conducted following the approach of Ditzgen, Karavias, and Westerlund (2024).

Table 4 Sequential Test for Multiple Breaks

Bai & Perron Critical Values				
	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
F(1 0)	2379.68	12.29	8.58	7.04
F(2 1)	3233.58	13.89	10.13	8.51
F(3 2)	918.72	14.80	11.14	9.41
F(4 3)	844.97	15.28	11.83	10.04
F(5 4)	1143.86	15.76	12.25	10.58

Detected number of breaks: 5 5 5

The detected number of breaks indicates the highest number of breaks for which the null hypothesis is rejected.

Estimation of break points

Number of obs = 2573
 SSR = 4.40e+07
 Trimming = 0.15

Table 5 Estimation of Break Points

#	Index	Date	[95% Conf. Interval]	
1	385	385	384	386
2	770	770	769	771
3	1155	1155	1154	1156
4	1616	1616	1615	1617
5	2182	2182	2181	2183

Tables 3 to 5 present the results of the structural break test, the sequential test for multiple breaks, and the estimation of change points, respectively. These analyses were prompted by clear indications of shifts in the historical movements of the Naira–Yuan ask-rate in the exchange rate market, as shown in Figure 1.

Specifically, the Bai–Perron test for structural breaks was applied to identify significant shifts in the series. This test provides information on the number of breaks, their locations, and their statistical significance. The daily Bai–Perron approach was chosen because it allows for up to five structural breaks in a time series (Narayan & Liu, 2015).

The Bai–Perron (2003) results show that the Naira–Yuan ask-rate exhibits at least five significant structural breaks. These breaks appear to coincide with periods of depreciation in Nigeria’s currency value, potentially linked to inadequate yuan supply under the swap agreement relative to Nigeria’s imports from China, or to low export–import ratios. Consequently, the identified break dates may reflect the market’s response to shocks triggered by monetary policy interventions aimed at mitigating exchange rate depreciation factors consistent with the aforementioned conditions.

4.3 ARCH LM Test

The Breusch–Pagan/Cook–Weisberg test for heteroscedasticity (hettest) was conducted under the null hypothesis (H_0) of constant variance in the Ask-Rate data, using the fitted values of the Ask-Rate (exchange rate) as variables. The test yielded a chi-square statistic of 767.14, leading to rejection of H_0 since the p-value was less than 0.05. This indicates that the variance of the residuals is not constant evidence of heteroscedasticity in the series.

Table 6 Cameron & Trivedi's decomposition of IM-test

Source	chi2	df	p
Heteroscedasticity	50.60	2	0.0000
Skewness	1.12	1	0.2907
Kurtosis	12.84	1	0.0003

White's test for H_0 : homoscedasticity

against H_a : unrestricted heteroscedasticity

chi2(2) = 606.94

Prob > chi2 = 0.0000

Since the (p-value (0.0000) < 0.05 which suggests that the variance of the residuals is not constant, that is indicating the presence of heteroscedasticity.

Selection-order criteria

Sample: 6 - 2573

Number of obs = 2568

Table 7 Choosing optimum Lag for Arch and Garch Models

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-6712.26		1	0.9192	5.2284	5.22922	5.23068	
1	-6565.6	293.33	1	0.000	9.74811	5.11495	5.1166	5.11951
2	-6540.91	49.381	1	0.000	9.5699	5.0965	5.09898	5.10334
3	-6528.96	23.899*	1	0.000	9.48864*	5.08797*	5.09128*	5.09709*
4	-6528.64	62472	1	0.429	9.49373	5.08851	5.09264	5.0999



Endogenous: D.Ask-Rate

Exogenous: _cons

Table 7 presents the results of the selection criteria for determining the optimal lag length for the Naira–Yuan ask-rate in the exchange rate series. The criteria are based on likelihood convergence values, likelihood ratio (LR) statistics, Akaike Information Criterion (AIC), Hannan–Quinn Information Criterion (HQIC), Schwarz Bayesian Information Criterion (SBIC), and the standard error of each ARCH model. The results show that all the criteria identify lag 3 as having the minimum values. However, this does not automatically imply that lag 3 is the most appropriate choice for volatility modelling; therefore, additional testing of ARCH model adequacy is required.

According to Engle (1982), as also cited in Abdulganiy (2025), the ARCH test is implemented in three steps. First, equation (3) is estimated using ordinary least squares (OLS) to obtain the fitted residuals. Second, the squared residuals are regressed on a constant and on lags of the squared residuals i.e., equation (9) below is estimated.

$$\hat{\varepsilon}_t^2 = q_0 + q_1\hat{\varepsilon}_{t-1}^2 + q_2\hat{\varepsilon}_{t-2}^2 + \dots + q_p\hat{\varepsilon}_{t-p}^2 + \mu_t \quad (8)$$

And the third final step involves using the Lagrange Multiplier (LM) test to assess the validity of the null hypothesis of no ARCH effects.

$$H_0: \rho_1 = \rho_2 = \dots = \rho_p = 0. \text{estat archlm,lag(1/5)}$$

LM test for autoregressive conditional heteroscedasticity (ARCH)

Table 8 ARCH LM test results

lags(p)	chi2	df	Prob > chi2
1	421.061	1	0.0000
2	441.139	2	0.0000
3	477.624	3	0.0000
4	484.829	4	0.0000
5	486.691	5	0.0000

H0: no ARCH effects vs. H1: ARCH(p) disturbance

Table 8 shows that ARCH effects are evident from lag 1 through lag 5, with p-values at each lag below the 0.05 level of significance. This leads to rejection of the null hypothesis in all cases and confirms the presence of ARCH effects. Accordingly, we reject the null hypothesis of homoscedasticity and affirm that the Ask-Rate series of the exchange rate exhibits ARCH effects.

This finding underscores the necessity of modelling exchange rate volatility under both symmetric and asymmetric scenarios to gain a better understanding of exchange rate dynamics for effective policy formulation and informed investment decisions. Specifically for the Naira–Yuan exchange rate, Engle’s LM test statistic (Obs*Chi-squared) records a minimum value of 421.061 at lag 1 and a maximum value of 486.691 at lag 5, with probability values of 0.000 at each lag, all below the 0.05 significance threshold.

Table 9 provides a comparison of the current study’s results with those of previous research.

STATUS Models	II(Model)	Df	Std error	AIC	BIC
GJR-ARCH (Current)	-14156.53	1	.0015695	28315.06	28320.91
GJR-ARCH (PREVIOUS)	-3214.087	1	1.645018	6438.175	6463.554
PARCH(PREVIOUS)	-3055.648	1	1.653754	6121.296	6146.675

4.4 Discussion of results

4.4.1 Discussion with structural Breaks

This discussion is organised in two main parts. First, we consider modelling with structural breaks, where the GJR-ARCH(1,1) model (coefficient = 1.2290401) is employed to capture asymmetric volatility incorporating five structural breaks. This model outperforms both the asymmetric PARCH model (Abdulganiy, 2025) and the earlier GJR-ARCH model without structural breaks

(Abdulganiy, 2025). Model fitness was assessed using likelihood convergence, standard error, and information criteria (AIC and BIC). In this study, the lag-selection criteria identified Lag 1 as the optimal choice, having the minimum values across all measures.

Second, when modelling volatility, Tables 6.1 to 6.4 present the performance of different ARCH models. Among the three ARCH lags considered, ARCH(1) performed best. The extent of volatility persistence and

asymmetry in the series is also addressed within these results.

In summary, the GJR-ARCH model with five structural breaks offers a clearer understanding of how news affects ask-rate return volatility in the exchange rate market. These findings are not unexpected given the market's tendency to react to both positive and negative information. In particular, the results confirm market participants' responsiveness to news, with the apparent asymmetry in the interbank market's response attributed to its perceived greater market-driven nature.

5.0 CONCLUSION

The primary objective of this study has been successfully achieved. Pre-estimation tests showed that the Ask-Rate series was non-stationary; stationarity was achieved by first differencing the Naira–Yuan series. The presence of non-constant variance (heterogeneity) and non-normality necessitated estimating the leverage effect of volatility in the Ask-Rate (Naira–Yuan) exchange rate through an asymmetric GJR-ARCH model.

Analysis of five structural changes in the daily data from January 2015 to July 2025 revealed that these breaks are highly significant. Comparing our results with Abdulganiy (2025) highlights the importance of the events underlying these structural changes, as investors tend to be more sensitive during such periods. Policymakers should focus on addressing the conditions associated with these episodes such as yuan shortages, import–export imbalances, policy shifts, and economic overdependence to correct the underlying problems.

Model selection criteria incorporating structural breaks show that the GJR-ARCH model with five breaks better captures the leverage effect and conditional variance due to its minimum AIC, BIC, and standard error values. This research therefore improves upon the earlier model (Abdulganiy, 2025) by offering a better-performing asymmetric GJR-ARCH specification that explicitly accounts for structural breaks.

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