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DOES CBN INTERVENTIONS INFLUENCE EXCHANGE RATES DYNAMICS IN NIGERIA: AN ECONOMETRIC PERSPECTIVE

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ABSTRACT
The persistent naira instability and devaluation in the foreign exchange market has become a concern in many quarters, as the negative effect is being felt in the high cost of goods and services in Nigeria. Therefore, this study is concerned with the examination of the impact of CBN intervention on exchange rate volatility in Nigeria. The monthly time series data on naira\1 US dollar used covered the period of 1981M1 to 2022M12.statistical tools such as order of integration, volatility measure such as ARCH and GARCH, regression and maximum likelihood method of estimation were adopted. The order of integration result specifies that the percentage log difference of the exchange rate is integrated order zero. The comparative study of the better measure of volatility between ARCH and GARCH using BIC indicates that GARCH(2, 2) is most appropriate. The results also show that interventions such as Inter-bank Foreign Exchange Market issued which started on June 15, 2016 such that Naira Settled Over the Counter (OTC) and Regulation for the Transaction of Renminbi" released on June 7, 2018 and the renewal of the Bilateral Swap Currency Agreement (BSCA) with the Peoples Bank of China (PBoC) have no effect on the exchange rate and its volatility as the p-values are not significant both in the mean Equation and conditional variance equation. Therefore, the CBN should re-evaluate their intervention policies so as to reduce the vulnerability of naira in the mist of foreign currency exchange.
KEYWORDS: *ARCH. exchange rates, GARCH, intervention and Volatility*

1.INTRODUCTION

One of the statutory obligations of the Central bank of Nigeria is to conduct monetary policy in line with the Federal Government of Nigeria (FGN) medium-term expenditure Framework (MTEF) for the purpose of maintaining financial and price stability. The CBN also conducts exchange rate policy in Nigeria which is targeted towards preserving the value of the naira, sustain an external reserves position that is favourable to the economy and ensure both internal and external balance without compromising the the general goal of macroeconomic stability. Apart from its responsibility to ensure price stability, the CBN is responsible of boosting liquidity in the Nigerian Foreign Exchange Market via interventions from time to time,

Over the years CBN have introduced several policy measures and according to CBN(2021) monetary circular No.44 provided different policy measures such as; open market operations (OMO) for liquidity management; cash reserve and liquidity ratios(CR&LR); the net open position (NOP) that stipulates the total foreign currency borrowing of a domestic bank, excluding inter-group and inter-bank borrowing which shall not exceed 125.0 per cent of shareholders' funds unimpaired by losses, the whole essence NOP is to mitigate risk; net foreign currency trading position (NFCTP) of any authorized dealer is between 0.5 and -10.0 % of their shareholders' funds unimpaired by losses; foreign exchange interventions (FEI) is also a policy measure to enhance transparency, efficiency, and liquidity in the exchange market; foreign exchange interventions in Renminbi (FEIR) is the bilateral swap currency agreement (BSCA) the CBN entered with the Peoples Bank of China (PBoC) to maintain bi-weekly auctions for the sales of Renminbi on trade-backed transactions to authorized dealers; over-the-counter futures trade transactions (OCFTT) and discount window operations (DWO) are all policy measures for liquidity management.

In this research, we will consider only CBN interventions relative to exchange rate exchange rate particularly; foreign exchange interventions (FEI), foreign exchange interventions in Renminbi (FEIR) and net foreign currency trading position (NFCTP). The trajectories of persistent rise in inflation pressure, naira "kissing the floor" in devaluation and consistent borrowing have in no doubt, negative effects on the determinants of a developing economy. The value of a country's currency is a good measure of their economic strength, for instance, the value of US Dollar in the foreign exchange market is symbolic to the strength of the economy, so is Bristish pounds, Canadian dollar, France franc and so on.

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It was reported on the 8 August 2017 that the reasons for the steady depreciation of the naira despite different interventions by the Central Bank of Nigeria (CBN) in the foreign exchange market are the obvious devaluation of the interbank market rate and the demand for foreign exchange by pilgrims were far outstripping the supply. According to the report, the demand pressure on foreign exchange and the multiplicity rate had a negative impact on naira (The Tide 2017). Amaefula(2022) opined that the volume of trade between two countries is affected by the value of their domestic currency in exchange for a unit of foreign currency in terms of bilateral trade relationships. So, when naira is devalued, it is an edge to the foreign investors and a limitation to Nigeria's economy.

Naira exchange rate has hit its worse devaluation scenario since independence despite implementation of difference monetary policy measures and intervention. According to Tide in 2017, naira degenerated into devaluation after many weeks of appreciation as a result of belligerent interventions of the CBN at the foreign exchange market, emphasizing that naira exchanged between N360 and N365 to one dollar for approximately four months before it started depreciating, exchanging between N367 and N370 to a dollar at the parallel market (The Tide, 2017).

However, since 2017, the CBN has introduced several interventions to tame the volatility of naira exchange rate in the foreign exchange market. At end 2023, naira exchange to 1 US dollar was over N1000 at the open or black market. The question that still remains unanswered is, how far has the CBN interventions impacted on the volatility of Naira exchange rate? This is the nexus of this present research study.

The effects of intervention on exchange rate over the years have produced contradictory results. In the 80's, there is growing view that noise trading affects dollar exchange rate, for instance, Frankel and Foot(1985) used a model that considered three classes of players(fundamentalists, chartists and portfolio managers), their result showed that dollar appreciation in the mid 84 can be explained by the endogenous takeoff of a speculative bubbles. There is the view that intervention can be used to reduce volatility of exchange rate. Some others are of the opinion that intervention will course unfavorable effect of generating uncertainty and then volatility. Bailliar and Humpage (1992) found that the sum of Japan and US intervention increased the uncertainty of Yen-Dollar exchange rate in post-Louvre Accord period. Domingeuz(1993) discovered that actual US intervention caused a decline in the conditional daily and weekly exchange rate volatility while secrete intervention increased conditional volatility.

Bonser –Neal and Tannah(1994) in their study found that US intervention in general either increases Ex-ante exchange rate volatility or had no effect.

The importance of predicting exchange rates comes from the reality that the results of a given financial decision made today are dependent on the prevailing exchange rate in the upcoming period, hence, forecasting exchange rate is significant for various international financial transactions, namely speculation, hedging, as well as capital budgeting (Moosa, 2008).

The stability of the exchange rate is presently the bedrock of all economic activities Taiwo and Adesola, 2013). Therefore, central banks should pay special attention to exchange rates and the value of their domestic currency (Dilmaghani and Tehranchian, 2015).

Foreign exchange (FX) interventions are primarily used by central banks to manage financial issues that has to do with volatility of exchange rate and abrupt changes in capital inflows for the purpose financial stability(BIS, 2019). More also, Foreign exchange(FX) interventions in emerging economies are often adopted as a practice consistent with international reserve accumulation programs that aim to build reserves for precautionary reasons (Arslan and Cantú, 2019).

Several research studies have been conducted on the related subject matter across the globe. Menkhoff(2010) and Adler and Tovar (2011) highlight that FX interventions can effectively curb the exchange rate and its volatility in emerging market economies, but less so in advanced economies. Seyfi and Recep (2011) examined the effect of exchange rate volatility on Turkish stock returns using monthly data for the period 1987-2010. The squared residuals from the Autoregressive Moving Average (ARMA) models are used to generate a measure of exchange rate volatility and then tested against Turkish stock returns. The results of this study emphasized that Turkish exporters did not consider exchange rate uncertainty as a crucial problem.

Amaefula(2011) studied the effect of exchange rate dynamics on stock returns and volatility during the global financial crises in Nigeria using monthly official exchange rate of naira vis-à-vis one US dollar and All Shares Index prices of the NSE market. The method of classical multivariate generalized conditional hecteroscedasticity (CM-GARCH(1, 1)) model was used in the analysis. The results showed that exchange rate affects both stock market returns and stock returns volatility negatively while exchange rate volatility exerts no effect on stock returns, it was noted that exchange rate volatility exacted significant positive effect on the volatility of stock returns during the global financial crises.

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Appiah and Adetunde (2011) in their study focused on the prediction of the Ghana cedi's and the US dollar exchange rate using data period of January 1994 to December 2010 and their findings revealed that ARIMA (1, 1, 1) is found most appropriate, forecast values were consistent with the depreciating trend of the Ghana Cedi's against the US dollar.

As for some country-specific studies, like Mexico for instance, García-Verdúand Zerecero (2013) discovered that mixed results and emphasize that reducing exchange rate volatility may depend on the design of the intervention. Durán-Vanegas et al. (2016) shows that FX interventions effectively reduce the exchange rate volatility in Peru. Echavarría et al. (2018) , analyzing the case of Colombia, emphasize that FX interventions are more effective when they are previously announced. Kuersteiner et al. (2018) , on the other hand, looking at the same country's experience, find that the FX interventions' effects on the exchange rate are short live and tend to last between 2 to 3 weeks.

*I*n the case of Brazil, Viola et al. (2019) also obtain mixed results when studying daily or accumulated interventions increasing and reducing volatility at different quantiles. In contrast, Janot and Macedo (2016) found that unanticipated interventions in Brazil affect the exchange rate level but finds no evidence on its effect on the volatility. Finally, Disyatat and Galati (2007) find no evidence of a short-term impact on volatility in the case of FX interventions conducted by the Czech National Bank. This lack of a unified conclusion regarding the effectiveness of FX interventions reflects, among other issues, the wide variety of success criteria used in these empirical studies.

Fatum and M. Hutchison (2003) , Fratzscher (2008), Durán-Vanegas et al. (2016) and Fratzscher et al. (2019) , for example, look at the direction and smoothness of the exchange rate level after an intervention. On the other hand, several studies focus on how the interventions affect the volatility of the exchange rate (Echavarría et al., 2018; Gamboa- Estrada, 2019; Viola et al., 2019).

Viola et al. (2019) implement a quantile regressions approach to account for potential asymmetric effects on volatility. In contrast, Gamboa-Estrada (2019) estimates an extension of the GARCH model to study regime changes in volatility and the effectiveness of Latin American interventions, an approach similar to the one proposed in this article.

Fratzscher et al. (2019), in their study found that FX interventions are effective, especially when announced and accompanied by a verbal intervention. Filardo et al. (2022), based on a cross-country study of advanced and emerging economies, find that the effectiveness of FX interventions depends on the degree of economic misalignment, how illiquid is the FX market, and how long the FX interventions last. Also, these authors emphasize that FX sales are more effective than FX purchases.

The effectiveness of Foreign exchange (FX) interventions in Chile since the adoption of a fully flexible exchange rate regime in the late 1990s was investigated with a high-frequency GARCH(1,1) volatility model with Markov-Switching regimes and evaluate the effectiveness of FX interventions within a local projection setting. They found that FX interventions in Chile tend to occur during high exchange rate volatility periods, which correlate with domestic and foreign financial factors. Moreover, we show that the FX intervention that started by the end of 2019–the latest intervention included in our study–effectively reduced the exchange rate volatility and the probability of being at a high volatility state (Alejandro and Marco 2023).

2. MATERIALS AND METHODS

The materials and methods used in the study are specified in the sub-sections below;

2.1 Source of data and variable definition

The monthly data on Nigeria naira vis-avis one US dollar exchange rate is obtained from the CBN(2023) statistical bulletin and it covers the period of 1983 to 2022. The US dollar is chosen because of it's global accepted currency and predominant in the foreign exchange rate market. Interventions are policies or decisions taken by the Central banks to stabilize the domestic currency against pressure of devaluation. Interventions are used as dummy variables with zero value before intervention and one during and after intervention.

Exchange rate Naira-US dollar exchange rate is given as $Y_t = (LogER_t - LogER_{t-1}) \times 100$. Interventions shall be denoted as $I_{i,t}$.

2.2 ARCH(q) and Generalized ARCH(p,q) models

Volatility is a measured of variability around the mean and average return of a security. In this study, we will consider only two measures of volatility such as the ARCH and the GARCH and select the better model the describes the volatility of exchange rate dynamics using Akaike information criterion(AIC).

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2.2.1 Autoregressive conditional heteroascedasticity (ARCH) model

The ARCH model frame work does not only allow for the estimate of the conditional variance of a time series observation but also, helps to forecasts the future values of the conditional variance to be computed. The ARCH model developed by Engle (1982) is a model that allows the conditional variance to be time-varying, while the unconditional variance is constant. The ARCH (q) model is of the form

$$\sigma_t^2 = \varphi + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 \qquad (1)$$

In (1), the nonnegativeness and stationarity of σ_t^2 are quaranteed for $\varphi > 0$, $\alpha_i \geq 0$ for $i = 1, 2, \cdots, q,$ and $\sum_{i=1}^{q} \alpha_i < 1.$ The case where $q = 1, \sigma_t^2$ becomes a function of the previous squared shock and large shocks of either sign tend to be preceded by large shocks and vice versa. The stylized facts of volatility clustering and excess kurtosis can be captured by ARCH (1), its short coming is that, it is unlikely that the model accommodates for the features related to the autocorrelation function of squared disturbances ε_t^2 . An ARCH (q) process in many cases is not able of capturing both the height and shape dimension of the autocorrelation function, therefore, further generalization is required (Pagan, 1996).

If $\varepsilon_t = \sigma_t z_t$ then, generalized ARCH (p, q) model becomes

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-1}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-j}^2 \qquad (2)$$

where z_t is a sequence of independent and identically distributed (iid) random variable with mean zero(0) and variance 1, $\alpha_0 > 0, \alpha_i \geq 0, \beta_j \geq 0$ and $\sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j < 1$. Note that $\alpha_i = 0$ for $i > p$ and $\beta_j = 0$ for $\mathrm{j} > \mathrm{q}$. The constraint on $\alpha_i + \beta_j$ implies that the unconditional variance of ε_t is finite whereas the conditional variance σ_t^2 evolves over time. The z_t is often assumed to follow a standardized normal or standardized t-distribution or generalized error distribution. Equation (3) reduces to ARCH (p) model if $q = 0$. The α_i and β_j are referred to as ARCH and GARCH parameters, respectively.

2.3 The ARCH(q) and GARCH(p, q) models become;

$$y_1 = \varphi_0 + \varphi_1 Int_{i,t} + \varphi_2 Int_{2,t} + e_t$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i e_{i=1}^2 + \sum_{i=1}^{2} \phi_i Int_{i,t} \qquad (3)$$

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i e_{t-1}^2 + \sum_{j=1}^{q} \beta_j \sigma_{t-1}^2 + \sum_{i=1}^{2} \phi_i Int_{i,t}$$

Where ϕ_i is the coefficient of the intervention dummy variable. $\alpha_0 > 0, \alpha_i \geq 0, \beta_j \geq 0$ and $\sum_{i=1}^{p} \alpha_i + \sum_{j=1}^{q} \beta_j < 1$

2.4 Estimation techniques

In the case of univariate GARCH, for a normally distributed random error the log likelihood function for y_t assuming a sample of T is

$$l_t = -\frac{T}{2} \ln(2\pi) - \frac{T}{2} \sum_{t=1}^{T} \ln(\sigma_t^2) - \frac{T}{2} \sum_{t=1}^{T} (y_t - X_t'(\theta)) / \sigma_t^2 \qquad (4)$$

2.5 Order of integration test

Order of integration test is critical in understanding the number of unit root present in a data variable. We will adopt the auxiliary autoregressive order three order of integration test (AAR(3) OIT) attributed to Amaefula(2021), since at glance, the model estimation can reveal the number of unit root(s) present and the test is of the form,

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$$z_t = \varphi_0 + \delta tre + \sum_{i=1}^{3} \varphi_i z_{t-i} + u_t \quad (5)$$

Where, φ_0 = intercept, δ = trend coefficient, u_t = disturbance term and $\varphi_i (i = 1,2,3)$ are the coefficients of lagged dependent variable. The constrints for $\varphi's$ are summarized in the Table1 below;

Table1. AAR(3) OIT Condition and Hypothesis

Integration order I(d)	Constraints	Hypothesis
I(0)	All the values of $\varphi_i's$ must be strictly less than one; $\lvert\varphi_1\rvert<1,\ \lvert\varphi_2\rvert<1$ and $\lvert\varphi_3\rvert<1$	$H_{01}:\varphi_i<1$ *H_{a1}: atleast one of φ_i's is not less than 1*
I(1)	$\lvert\varphi_1\rvert\geq 1,\ \lvert\varphi_2\rvert<1,\ \lvert\varphi_3\rvert<1$ and $\frac{\lvert\varphi_2\rvert}{\lvert\varphi_3\rvert}>1$	$H_{01}:\varphi_1<1$ $H_{01}:\varphi_1\geq 1$
I(2)	$\lvert\varphi_1\rvert>1,\ \lvert\varphi_2\rvert\geq 1,\ \lvert\varphi_3\rvert<1$ and $\frac{\lvert\varphi_2\rvert}{\lvert\varphi_3\rvert}, \frac{\lvert\varphi_2\rvert}{\lvert\varphi_3\rvert}>1$	$H_{01}:\varphi_2<1$ $H_{01}:\varphi_2\geq 1$

3. DATA ANALYSIS AND RESULTS

This section presents the time series plot of the naira\1 US dollar exchange rate, the percentage changes in the naira\1 US dollar exchange rate, result of order of integration, comparison of volatility measure and the estimates of the specified model.

3.1 Time plot

The time series plot of naira\1 US dollar exchange rate and percentage changes in naira\1 US dollar exchange rate is as presented in Figure1 and Figure2 below.

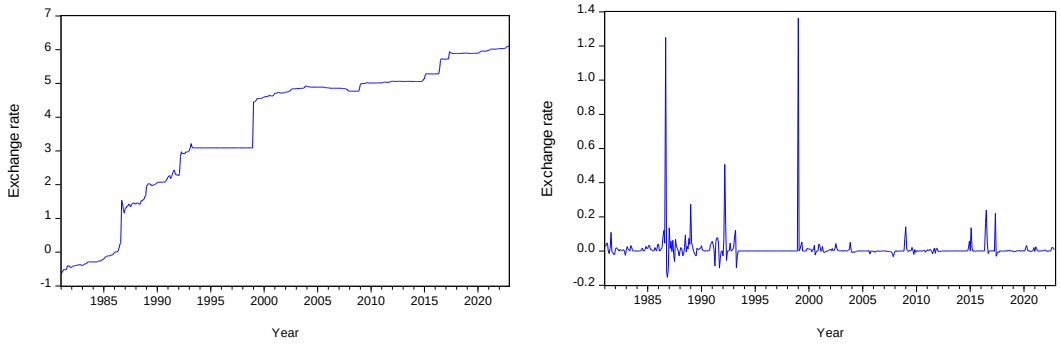

Figure1. Time plot of Naira\1 US dollar exchange rate and its percentage changes

Figure1 exhibits an appreciation of US dollar against naira as the foreign exchange (FX) rate shows a consistent rise with higher variability in 1987, 1992 and 1999. Figure1 also indicates that there are high positive changes around these variability periods.

3.2 Order of integration

Adopting Amaefula (2021) order of integration, we have

$$y_t = 0.0138 + 0.0197\, y_{t-1} - 0.0291\, y_{t-2} - 0.0286\, y_{t-3}$$
$$prob.(0.0012)\quad 0.6614)\qquad (0.5162)\qquad (0.5855) \quad (6)$$

The order of integration test analysis in Equation (6) reveals that y_t is integrated order zero (I(0)), that is, stationary as the absolute values of φ's are all strictly less than one.

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3.3 Linear Regression Model

$$y_t = 0.0143 + 0.0050Int_{1,t} - 0.0153Int_{2,t} + e_t$$

We will estimate a simple linear regression model $prob.\ (0.0013) \quad (0.6069) \quad (0.4997)$

$$R^2 = 0.0014 \ , \quad \text{Durbin - Watson stat} = 1.9621$$

(7)

Equation (7) result shows that intervention of Nigerian Inter-bank Foreign Exchange Market issued which started on June 15, 2016 such that Naira Settled Over the Counter (OTC) and Regulation for the Transaction of Renminbi" released on June 7, 2018 and the renewal of the Bilateral Swap Currency Agreement (BSCA) with the Peoples Bank of China (PBoC) are not impactful on exchange rate changes is not impactful on exchange rate changes. There is no evidence of serial correlation based on Durbin-Watson statistic.

Table2. Descriptive Summary

Mean	120.1375
Median	113.8300
Maximum	450.7075
Minimum	0.532300
Std. Dev.	126.1629
Skewness	1.083002
Kurtosis	3.167695
Jarque-Bera	99.11355
Probability	0.000000
Sum	60549.31
Sum Sq. Dev.	8006288.
Observations	504

The descriptive summary in Table2 indicates that the data is heavy tail as the skewness is skewed to the right. The kurtosis is a little bit higher than the normal. The Jargue-Bera test indicates that the exchange rate is not normally distributed. Therefore, we reject the null hypothesis of normal distribution at the 1% level.

3.4 Volatility Estimate

We will select the best measure of volatility by comparing ARCH(1), ARCH(2), GARCH(1, 1), GARCH(2, 1), GARCH(1, 2), and GARCH(2, 2) using Bayesian information criterion as shown in Table 3 below.

Table3. Comparing ARCH and GARCH models

Model	AIC	BIC	Remark
ARCH(1)	-6.8453	-6.8117	No ARCH effect
ARCH(2)	-6.1458	-6.1039	No ARCH effect
GARCH(1, 1)	-6.8923	-6.8504	No ARCH effect
GARCH(2, 1)	-7.1246	-7.0743	No ARCH effect
GARCH(1, 2)	-7.3502	-7.2999	No ARCH effect
GARCH(2, 2)	-7.3694*	-7.3107*	No ARCH effect

The result in Table3 indicates that GARCH(2, 2) is most appropriate and can capture the volatility nature of exchange rate. The generalized ARCH(2, 2) estimates with each intervention is given in Table4-Table7 below.

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Table4. Volatility of exchange rate and interventions

Dependent Variable: Y
Method: ML ARCH - Student's t distribution (BFGS / Marquardt steps)
Date: 02/02/24 Time: 03:04
Sample (adjusted): 1981M02 2022M12
Included observations: 503 after adjustments
Failure to improve likelihood (non-zero gradients) after 152 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*RESID(-2)^2 + C(7)*GARCH(-1) + C(8)*GARCH(-2) + C(9)*Int1 + C(10)*Int2

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.90E-07	1.25E-05	0.015211	0.9879
Int1	0.000277	0.001293	0.214228	0.8304
Int2	0.000483	0.001480	0.326543	0.7440
Variance Equation				
C	2.27E-06	2.63E-06	0.863824	0.3877
RESID(-1)^2	192.2486	260.6780	0.737495	0.4608
RESID(-2)^2	-6.597805	21.60174	-0.305429	0.7600
GARCH(-1)	0.340161	0.037733	9.015028	0.0000
GARCH(-2)	-0.033646	0.006214	-5.415007	0.0000
Int2	0.003625	0.006357	0.570334	0.5685
Int3	0.003662	0.005597	0.654237	0.5130
T-DIST. DOF	2.001710	0.002266	883.4230	0.0000

R-squared	-0.021644	Mean dependent var	0.013402
Adjusted R-squared	-0.025731	S.D. dependent var	0.090910
S.E. of regression	0.092072	Akaike info criterion	-7.748464
Sum squared resid	4.238669	Schwarz criterion	-7.656165
Log likelihood	1959.739	Hannan-Quinn criter.	-7.712255
Durbin-Watson stat	1.917899		

The result in Table4 shows that intervention1(int1) and intervention2 (int2); Nigerian Inter-bank Foreign Exchange Market issued which started on June 15, 2016 such that Naira Settled Over the Counter (OTC) and Regulation for the Transaction of Renminbi" released on June 7, 2018 and the renewal of the Bilateral Swap Currency Agreement (BSCA) with the Peoples Bank of China (PBoC) have no effect on the exchange rate and its volatility as the p-values are not significant both in the mean Equation and conditional variance equation.

Table5. Heteroskedasticity Test: ARCH

F-statistic	0.002116	Prob. F(1,500)	0.9633
Obs*R-squared	0.002125	Prob. Chi-Square(1)	0.9632

The ARCH test in Table5 above indicates absence of the ARCH effect on the residuals of the estimated model.

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Table6. Volatility of exchange rate and Pool effect of interventions

Dependent Variable: Y
Method: ML ARCH - Student's t distribution (BFGS / Marquardt steps)
Date: 02/02/24 Time: 03:37
Sample (adjusted): 1981M02 2022M12
Included observations: 503 after adjustments
Failure to improve likelihood (non-zero gradients) after 105 iterations
Coefficient covariance computed using outer product of gradients
Presample variance: backcast (parameter = 0.7)
GARCH = C(3) + C(4)*RESID(-1)^2 + C(5)*RESID(-2)^2 + C(6)*GARCH(-1)
+ C(7)*GARCH(-2) + C(8)*X

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	-3.11E-08	1.61E-07	-0.193308	0.8467
X	0.000635	0.000642	0.989392	0.3225
Variance Equation				
C	5.13E-13	1.40E-12	0.366771	0.7138
RESID(-1)^2	6.293523	23.54961	0.267245	0.7893
RESID(-2)^2	0.458901	4.389077	0.104555	0.9167
GARCH(-1)	0.281902	0.642216	0.438952	0.6607
GARCH(-2)	0.108390	0.318328	0.340499	0.7335
X	0.000656	0.002577	0.254749	0.7989
T-DIST. DOF	2.022977	0.088596	22.83371	0.0000

R-squared	-0.021529	Mean dependent var	0.013402
Adjusted R-squared	-0.023568	S.D. dependent var	0.090910
S.E. of regression	0.091975	Akaike info criterion	-8.179563
Sum squared resid	4.238193	Schwarz criterion	-8.104045
Log likelihood	2066.160	Hannan-Quinn criter.	-8.149938
Durbin-Watson stat	1.918102		

The result in Table6 indicates that in the mean equation, the pool effects of the intervention(X) has no effect on exchange rate and in the conditional variance equation, the pool effects of the intervention(X) has also not impacted on the volatility of exchange rate.

Table7. Heteroskedasticity Test: ARCH

F-statistic	0.001992	Prob. F(1,500)	0.9644
Obs*R-squared	0.002000	Prob. Chi-Square(1)	0.9643

The ARCH test in Table7 indicates that there is no more ARCH effect in the residuals of the estimated model.

3.5 Discussion of Findings

The impact of CBN interventions on the volatility of exchange rate is the focal point of this study. The order of integration test showed that the percentage logarithm difference of exchange rate is integrated order zero. Findings show that CBN interventions are neither impactful to exchange rate nor exchange rate volatility in Nigeria. This outcome is in-line with that of Disyatat and Galati (2007) who found no evidence of a short-term impact on volatility in the case of FX interventions conducted by the Czech National Bank and Macedo (2016) in terms of on volatility for Brazil.. But contrary to our findings are that of Fratzscher et al. (2019) and Janot and Macedo (2016) in terms of on exchange rate for Brazil.

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4. CONCLUSION

The findings indicate that the CBN interventions have no significant effect on exchange rate and exchange rate volatility. Therefore the government through the CBN should re-assess their intervention policies to see how they can reduce the vulnerability of naira in the mist of foreign currency exchange.

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