African Journal of Economics and Sustainable Development
ISSN: 2689-5080
Volume 7, Issue 1, 2024 (pp. 56-72)
www.abjournals.org

THE NEXUS BETWEEN EXCHANGE RATE VOLATILITY AND NIGERIAN STOCK PRICES: AN EGARCH APPROACH

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Cite this article:

Uguru N. E., Enwere G. M., Amos W. (2024), The Nexus Between Exchange Rate Volatility and Nigerian Stock Prices: An Egarch Approach. African Journal of Economics and Sustainable Development 7(1), 56-72. DOI: 10.52589/AJESD-ATAK411M

Manuscript History

Received: 5 Nov 2023

Accepted: 15 Dec 2023

Published: 29 Jan 2024

ABSTRACT: *The study examines the connection between exchange rate volatility and stock market performance in Nigeria from 1981 to 2022, utilizing the EGARCH model. Stock Exchange Capitalization and All-Share Index serve as indicators for the stock market. Stationarity tests initially showed a random walk in the variables, but after taking first differences, the ADF and PP unit root test statistics became significant, indicating integrated variables of the same order (I(1)). Analysis revealed autonomous negative reactions of stock prices to current year's exchange rate flux, indicating that the Nigerian Stock Exchange responded negatively to exchange rate fluctuations. It confirmed the existence of significant volatility persistence between stock prices and exchange rate flux in Nigeria, with a unidirectional relationship from exchange rate to stock market. In conclusion, findings suggest that investors should carefully examine the nature of exchange rate volatility and stock market prices to make informed investment decisions.*

KEYWORDS: Volatility, Exchange rate, EGARCH.

Article DOI: 10.52589/AJESD-ATAK411M
DOI URL: https://doi.org/10.52589/AJESD-ATAK411M

African Journal of Economics and Sustainable Development
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INTRODUCTION

The connection existing between exchange rate volatility and stock prices is still a subject of debate for researchers, scholars, investors, policy makers and the government. This is consequent upon the belief that exchange rate distortions may adversely affect the stock market performance which invariably distorts the entire economy. Stock markets have played vital roles in Nigerian economic and financial development, with major impacts recorded in financial and economic activities in the Nigerian stock market. To this effect, Claessens et al. (2002) observed that most developing country economies continue to chronically suffer from illiquidity in their financial markets, with stock exchange market integration being proposed as one of the major solutions.

Exchange rate volatility is the steady whirl or fluctuations in the foreign exchange market of a nation. The whirl has currently dominated scholars like Omoregie (2020), Gokmennoglu (2021) and others' discussions in recent national and international finance scholastic literature due to its serious implications on economic performance of developing nations Nigeria inclusive.

In Nigeria, right from the time of the structural adjusted programme (SAP), it was believed that Nigeria's policy on exchange rate consciously or deliberately encouraged overvaluation of the Naira because in 1981, ₦1 was exchanged for 0.90 cents. According to Al-Faki (2006), "a strong capital market is the backbone of growth in the economy. When the stock market is rising, it signifies a growth of the economy. The ability and health of the capital market attracts investors and financial analysts' interest to a great extent. This is because the stock market performs important key roles as financial intermediary for all economies of both developed and developing countries by organizing through channeling idle funds from surplus sectors to deficit sectors within the economy.

There is no consensus on a theoretical relationship connecting exchange rates and stock prices, nor are there any established patterns of such relationships. Scholars and researchers are of different views about the relationship. Two main models exist on these concepts: flow oriented models (FOM) and stock oriented models (SOM). Dornbusch and Fisher (1980) observed a broad disagreement. Simply put, flow oriented models prove an inverse relationship exists between stock prices and exchange rates having causality direction from exchange rates towards stock prices. Flow Oriented Models also assume that the exchange rate is determined largely by a country's current account or trade balance performance. This entails that domestic currency depreciation causes local firms to be more strong and viable and as well compete more, thus exports become cheaper and dearer in the international market. Conversely, stock oriented models (SOM) lay more emphasis on an increase or rise of domestic stock prices that triggers appreciation of domestic currency through direct and indirect conduit. The stock oriented models put much stress on the role of capital account in the exchange rates determination. It emphasizes that an increase in stock prices keeps the investors in a better position to buy more domestic assets, simultaneously selling foreign assets to obtain domestic currency indispensable for buying new domestic stocks. This is because a rise in domestic stock prices leads to the appreciation of domestic currency. Branson (1983) noted that domestic asset price increase leads to growth of wealth, and encourages investors to demand for more money, which in turn increases interest rates in the domestic economy. When a nation's interest rates are higher, it attracts more foreign capital inflow and enhances foreign demand for domestic currency, which contributes to

Article DOI: 10.52589/AJESD-ATAK411M
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appreciation of currency value. Thus, indicate a positive relationship having direction of effect or causality running from stock prices to exchange rate.

The trend in Nigerian exchange rate is depicted in the figure below. From the graph below, the exchange rate maintained a stable state from 1981 to 1986 when it witnessed a slight depreciation; it remained stable 1993 till 1999 when there was drastic depreciation in the exchange rate. The variable depreciated continuously though slightly until 2005 when it witnessed a slight increase through 2008 and fell again in 2009, it continued to depreciate slightly until 2015 when there was rate rapid fall in 2015, 2016, 2017, it remained stable till 2019 fall in value till 2020. This trend shows that the Nigerian exchange rate does not favorably support substantial capital market development and a sustained growth in the economy.

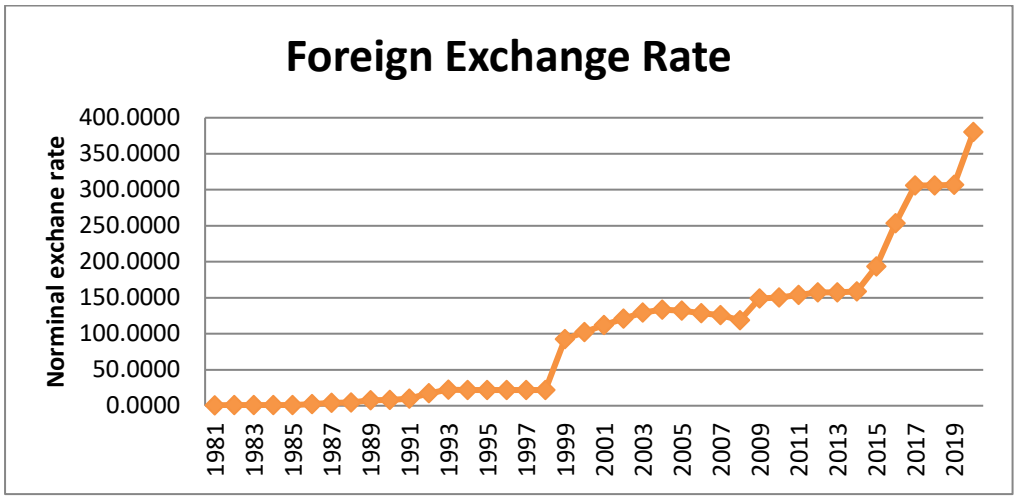

Fig. 1: Trends in Nigerian exchange rate from 1981-2020

Also the line graph below in figure 2 shows a continuous upward trend in NSE- ASI in 1989 until 2007 when it reached its all high and drop sharply between 2008 and 2009 while exchange rate depreciated progressively between 1981 and 2004 and thereafter started oscillating from 2005 to 2009.as can be seen in figure 1. Also stock market indicators (ASI) continue to oscillate from 2010 down to 2020.

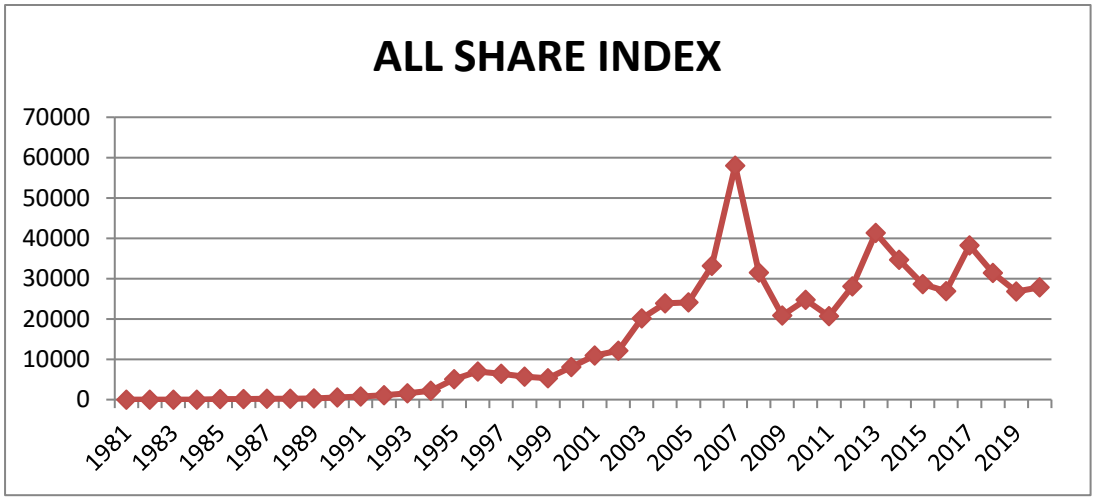

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Fig. 2: **Trends in Nigerian exchange rate and stock market indicator from 1981-2020**

We can observe from the above that between 1990 to 2004, the stock market indicator (ASI) moved in the opposite direction with the exchange rate, showing that ASI increased as the exchange rate depreciated and thus supported the FOM. But 2004 through 2008, the variables moved the same direction, supporting the SOM. They continued between 2008 and 2009 to move along the same direction but this time on a downward movement towards favoring the SOM. Between 2010 and 2013 they moved in opposite directions supporting the FOM. The movement will continue to oscillate until 2020. This shows no strong defined pattern of movement and also does not indicate the direction and leading variable. With the above trend, it becomes pertinent to ask the relationship that exists between these variables of interest?

However, empirical evidence on the influence of foreign exchange market volatility on the stock market is largely inconsistent. Some of the studies reviewed were not country specific (Mingjie & Tang, 2010; Mourad & Lotfi, 2019; Thomas, et al, 2021; Gokmennoglu, 2021). Hence their findings were mixed and show no agreement on the effect and link between exchange rate volatility and stock market also on the direction of causality between these variables of interest. This made it difficult for their findings to be generalized due to country's peculiarities, thus the demand for country specific studies on the topic. Although some studies reviewed were country specific, studies like that of Sichoongwe (2016), Perera (2016), Mwaanga and Njebele (2017), Ogbulu (2018), Olakunle and Adebisi (2018), Ifarajimi and Onyejiuwa (2018), Bala and Hassan (2018), Onyango (2018), Rabssford (2018), Saidi et al. (2021), Ajibola and Burari (2020), and Tamunowariye and Anaele (2022) are all country specific. Yet most of these studies applied GARCH (1,1); some of them used autoregressive distributed lag (ARDL) and asymmetric form of the model, some studies reviewed also employed vector autoregression (VAR) and vector error correction model (VECM). No study reviewed from Nigeria made use of the exponential generalized autoregressive conditional heteroscedasticity (EGARCH) model proposed by Nelson (1991) for their analysis. The advantage of EGARCH is that it places no restriction on the parameters because the equation is on log variance instead of variance itself. It also allows asymmetric effects between positive and negative asset returns. This gives credence to this study which tries to investigate the connection or link between exchange rate volatility and stock market prices in Nigeria through a different methodology. Following the introduction, the rest of this study is arranged as follows: sections 2 reviews related literature, sections 3 discusses methodology, section 4 analyzes the empirical results and discussions and section 5 is the summary and policy recommendations.

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LITERATURE REVIEW/THEORETICAL FRAMEWORK

- **Flow Oriented Model (FOM)**

Flow Oriented models (Dornbusch & Fisher, 1980) model posits that currency trends or movements influences international viability, competitiveness and trade balance positions which in the long run influences national real output of the country which in turn accelerate or reduces the current and future expected cash flows of the firms and their stock prices. The process follows that fluctuations in exchange rates affect the competitiveness of a firm because exchange rates flux affect the value of the earnings and cost of its funds in the domestic economy because many companies borrow in foreign currencies to finance their activities and hence its stock prices. Such firms will experience the effects in two ways depending on whether that firm is an exporting firm or a heavy user of imported inputs. In the case of an exporting firm, an increased exchange rate will increase the value of the firm's products which will in turn increase stock prices. Conversely, when local currency increases, it certainly declines profits of an exporting firm as a result of a fall in foreign or international demand for its products; also causing a fall in the stock price. An importing firm's case is directly opposite to this.

- **Stock-Oriented Model (SOM)**

The stock oriented model was proposed by Frankel in (1993). The theory emphasizes that an increase in stock return attracts flows of capital which in turn increases the demand of the local currency and causes the exchange rate to appreciate. Stock Oriented Model gives emphasis on changes in prices of listed stock which might have possible influence on exchange rate trends or movements. This model states that stock price assumes leading direction with exchange rates with a positive connection or relationship. This seems to be true because a fall in stock price also induces a reduction in domestic assets value, which invariably lowers money in the home country and market interest rates. This also discourages foreign investors from demand for domestic assets and local currency. This shift in affinity or attraction of currencies increases capital outflows and the depreciation of the local currency. On the contrary, stock prices increase, attracting foreign investors' willingness to invest in a country's stock markets which certainly leads to capital inflows and currency appreciation.

Empirical Review

Empirical studies have been carried out aimed at reviewing the divergent theoretical views and development in the nexus between exchange rates volatility and stock prices using various approaches. Some empirical studies revealed were cross country, while some were country specific. Some studies used annual data while others used high-frequency data. The empirical evidences are organized chronologically as follows:

By adopting quarterly data for Nigeria's Tamunowariye, Anaele (2022) made an examination of how exchange rate swings impact on stock market performance from the period 1981 to 2019. The data were analyzed using a three-step procedure and generalized autoregressive conditional heteroskedasticity (GARCH). The analysis reveals that exchange rate volatility was statistically significant with productivity; however, it was also revealed that volatility exchange rate is high and that shocks in exchange rate reduce the level of productivity in Nigeria and also reduces the level of stock market performance in Nigeria. They recommend amongst others that the government should employ appropriate macroeconomic policies to

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cushion exchange rate volatility effects. Using index of all stocks, inflation rate, exchange rate and foreign direct investment as variables, Anusha, Dhushanthan and Vinayagathasan (2022) examined the relationship between exchange rate and stock market performance of Sri Lanka, they employed annual data from 1985 to 2018 which was estimated using the ARDL approach. The result revealed that no relationship exists between exchange and all share index in the long run whereas there is positive and significant relationship between exchange rate and all share index in the short run. Thus, the result specified that the exchange rate can be a good tool to increase stock market performance.

Hock (2022) established the relationship which exists between symmetric and asymmetric real exchange rates on real stock prices in countries like Philippines, Malaysia, Japan, Korea, Singapore, Hong Kong, United Kingdom and Indonesia. He applied the non-linear form of autoregressive distributed lag model. The study observed that non-linear forms of real exchange rate have a positive and significant influence on real stock prices. During the COVID-19 pandemic, Kwaku, Ahmed, Adjei, Asiamah, Adela and Takyi (2022) investigated the co- movement of exchange rate and stock returns in African countries. They employed the bi- and partial wavelet and the wavelet multiple correlation techniques on daily time series data spanning from 13th February 2013 to 6th of May 2021. The study disclosed that COVID-19's effect does not increase the strength of the relationship between exchange rate and return on stock in Africa although it causes a significant difference in the lead-lag relationship between the two assets. They suggested that policy makers should have comprehensive understanding of the nature of the co- movement between the variables to ensure that timely, sensible and operative policy responses are rolled out to curtail undesirable fluctuations in stocks and the domestic currencies.

Gokmenoglu, Eren and Hesami (2021) reconsidered selected emerging countries' exchange rate and stock market returns relationship. They employed a quantile approach and presented an inclusive and detailed image of the association between the exchange rate and stock prices. They found that the exchange rate pliability plays an important role in the market returns determination depending on prevailing market conditions.

To determine the effect of exchange rate volatility and its effect on Intra-East Africa Community regional trade, Thomas, Silas, Clement and Edwin (2021) used differenced panel data fitted into a General Autoregressive Conditional Heteroscedasticity model to measure volatility. They also applied the Hausman test which applauded the fixed effect model and revealed that variables of the study significantly influenced intra-East Africa Community regional trade.

Saidi, Muthalib, Adam, Rumbia and Sani (2021) established the linear and non linear effects of the IDR/USD exchange rate and its volatility on stock prices using the monthly time series data from January 2006 to July 2019. The study adopted ARDL and NARDL models for analyses. The empirical analysis revealed that in the short run, the IDR/USD exchange rate has a linear or symmetric effect on stock prices, while for volatility; there is no such a symmetric effect. Also the two variables (IDR/USD exchange rate) affect stock prices asymmetrically.

Exchange rate and market capitalization constitute significant sources of volatility to stock prices in both the short-run and long-run was proved by Ajibode and Busari (2020) using annual data from 1986 to 2019 adopted from the Central Bank of Nigeria (CBN) annual

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statistical bulletin. They adopted Johansen and Juselius cointegration, Error Correction modeling and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) estimation technique. Ransford (2019) tried to establish if there exists a Granger-causing effect linking exchange rate and stock prices. Employing data sourced from the Bank of Ghana and the Ghana Stock Exchange. Granger-causality test result indicated that causality moves from exchange rate to change in stock price.

Mourad and Lotfi (2019) simultaneously investigated the causality and the links in exchange rates and stock market indicators. Their study identified the short and long-term influence of the US dollar on major stock market indicators of, Russia, China, India, Brazil, South-Africa (BRICS nations). ARDL estimations reveal that exchange rate movements have a significant effect on short and long-term stocks market indices of all BRICS countries' value. Employing the Autoregressive Distributed Lag (ARDL) approach, Bala and Hassan (2018) observed the connection between exchange rates and stock market in Nigeria with yearly data from 1985 to 2015. Granger causality results showed a unidirectional causality which runs from exchange rate to stock market. They advised policymakers to employ effectively existing monetary policy instruments.

METHODOLOGY

Sources of Data

In carrying out this study, we made use of time series secondary data sourced from the Central Bank of Nigeria statistical bulletin (2020). The study used monthly data which covered the period 1999 January to 2020 December from the Nigerian Stock Market Capitalization (SMC) and All Share Index (ASI) as proxies for Stock market Prices (NSMP). Nominal exchange rate of the Nigerian naira vis-à-vis the US dollar was used.

Model Specification

The autoregressive conditional heteroskedastic (ARCH) model which was introduced and applied by Engle (1982) and generalization ARCH introduced by Bollerslew (1986) are models broadly employed in measuring volatility in variables. These techniques have a major challenge of inability to capture the asymmetric response of volatility to news. To arrest this problem, the EGARCH model is helpful. The EGARCH model was first proposed by Nelson in (1991) to capture skewness and asymmetry. In the model, the conditional variance is an exponential function of the lagged conditional variances and excess return. Variants of the model that capture asymmetric effect include GJR-GARCH and Quadratic GARCH models. However, the characteristic of the EGARCH over its variants is that the log form of conditional variance guarantees the variance to be positive (Hamilton, 1994). EGARCH model is therefore stated as follows:

For model 1

$$NSMP_t^1 = \alpha_1 + \alpha_2 NSMP_t^2 + EXR_{t-1} + \varepsilon_{1t} \quad \ldots\ldots(1)$$

$$\log(\sigma_t^2) = \psi_1 + \sum_{j-1}^{2} \gamma_j log(\sigma_{t-j}^2) + \sum_{j-1}^{2} \phi_j \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} - E\frac{(\varepsilon_{t-1})}{\sigma_{t-1}} \right| + \sum_{j=i}^{n} \partial \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \quad \ldots\ldots(2)$$

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For model 2

$$EXR_t^1 = \alpha_1 + \alpha_2 \, EXR_t^2 + NSMP_{t-1} + \varepsilon_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3)$$

$$\log\left(\sigma_t^2\right) = \psi_1 + \sum_{j-1}^{2} \gamma_j \log\left(\sigma_{t-j}^2\right) + \sum_{j-1}^{2} \phi_j \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} - E\frac{(\varepsilon_{t-1})}{\sigma_{t-1}} \right| + \sum_{j=i}^{n} \partial \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \ldots\ldots(4)$$

where α 1 and 2 are the parameters to be ascertained. γ measures the persistence of volatility or fluctuation in equations 2. If long term volatility persists, γ tends to be large and significant. ∂_j Measures the leverage effect, while ϕ_j measures innovation effect in the system.

Estimation Procedure

To ensure we obtain the desired econometric results, we first established the stationarity characteristics of the variables in the model as we relied on Augmented Dickey Fuller (ADF) and Philip Perron (PP) unit root tests. The unit root test equation is stated below:

$$\Delta EXCR_t = \alpha_0 + \alpha_1 EXCR_{t-1} + \sum_{j=1}^{k} \alpha_j \Delta EXCR_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

$$\Delta NSMC_t = \alpha_0 + \alpha_1 NSMC_{t-1} + \sum_{j=1}^{k} \alpha_j \Delta NSMC_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots\ldots(6)$$

Where Δ is the first difference operator, $\mu_t \mu_t$ is an error term that is independently identically distributed, k = no of the variable. The unit root test is then carried out under the null hypothesis "α = 0 against the alternative hypothesis of α < 0" the computed statistics is weighed or compared with selected critical value for the Augmented Dickey-Fuller and Philip Perron tests. The null hypothesis of α = 0 is rejected and no unit root is present when the test statistic is greater the selected critical value of 5% or 1% level of significance, but if the variables were non stationary at level but became after the first difference, then there is presence of co-integration in the model.

Cointegrated Equation

We employed Johanson (1988) co-integration approach to establish the co-integrating relationships in the models. We adopted this approach because it is void of normalization problems (Gujarati, 2003). It requires all series in the model to be integrated in the same order. We state the cointegration equation as follows:

$$Y_t = \pi_1 Y_{t-1} + \ldots. + \pi_p Y_{t-p} + \theta X_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots(7)$$

Where Y_t is a vector of non-stationary *I*(1) variables; X_t is a vector of deterministic variables and t and ε_t is a vector of innovations. We specify the above in VAR form as:

$$\Delta Y_t = \psi Y_{t-1} + \sum_{i=1}^{p-1} \delta_i Y_{t-p} \, \pi_p \, Y_{t-p} + \theta X_t + \varepsilon_t \ldots\ldots\ldots\ldots(8)$$

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Where

$$\psi = \sum_{i=1}^{p} \pi_{t-1,} \quad \delta_i = -\sum_{j=i+1}^{p-1} \pi_p + \theta X_t + \varepsilon_t \quad \text{.....(9)}$$

If the coefficient matrix ψ has reduced rank r < k, then there exist k < r, matrices π and δ each with rank r such that $\psi = \pi\,\delta$ and δ Yt is I(0). r is the co-integrating rank and each column of δ is the co- integrating vector

RESULTS/FINDINGS

Unit Root Test Result

To avoid spurious regression results, we relied on Augmented Dickey Fuller (ADF) and Philip Perron (PP) unit root test to ascertain the stationarity of variables included in the models. The summary of Augmented Dickey Fuller and Philip Perron unit root tests results is detailed in the table 4.1 below. The result proves that all included variables are non-stationary in their level form but became stationary after 1st differences. Thus, suggesting that all the variables were integrated of order one *I*(1).

Table 4.1: Summary of ADF and PP Unit Root Test Results at 1%, 5% and 10% Critical Value

AUGUMENTEDDICKEY FULLER (ADF)				PHILIP PERRON (PP)			
Variables	**Level**	**1st Diff**	**Critical values**	**Level**	**1st Diff**	**Critical values**	**Decision**
EXR	-0.16	-7.53*	1% -3.464 5% -2.873** 10% -2.577	-0.096	-9.2901	1% -3.455 5% -2.872** 10% -2.573	Reject H_0
ASI	-2.51	-5.87	1% -3.463 5% -2.874** 10% -2.577	-2.157	-14.2133	1% -3.455 5% -2.872** 10% -2.571	Reject H_0
SMC	-0.15	-5.91*	1% -3.463 5% -2.873** 10% -2.567	-0.043	-13.3781	1% -3.455 5% -2.872** 10% -2.573	Reject H_0

*Author's computation * and ** signifies stationary at 5% respective*

Co-integration Test Result

Granger (1986) noted that co-integrating test is a necessary though not sufficient condition for variables that are integrated of the same order. We adopted Johansen cointegration test which involves two statistics tests: the trace test and the maximal Eigen-value test. As shown in table 4.2, the first row tests the supposition or hypotheses of no co-integrating relation, the second row tests the assumption of one cointegrating relation and so on, against the alternative of full rank of co-integration. The results are presented in table 4.2 below.

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Table 4.2: Co-integrating Test Result between SMC, ASI and EXR

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None	0.040620	16.71611	29.79707	0.6610
At most 1	0.018095	5.975794	15.49471	0.6984
At most 2	0.004800	1.246248	3.841466	0.2643
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None	0.040620	10.74031	21.13162	0.6732
At most 1	0.018095	4.729545	14.26460	0.7755
At most 2	0.004800	1.246248	3.841466	0.2643

Author's computation

Form table 4.2 above, the likelihood and maximal Eigen-value statistics shows no evidence of co-integrating equations at 5% significance level. This entails that exchange rate (EXR) and stock market prices (SMC and ASI) are not co-integrated.

ARCH-GARCH Test Results for Volatility

We proceed to plot the series for visualization, as shown in the figure 3 below. From the figure, it is evident that volatility exists in the series; one of the silent facts about the ARCH family models is the evidence of volatility clustering of the series. From the figure below, we can observe that there is mean reversion. Although there is volatility in the series, it reverses back to its mean. Thus the series is a stationary series of Nigerian exchange rates. From the graph below, we can deduce evidence of fluctuation or volatility in the model where small (large) changes are followed by large (small) changes.

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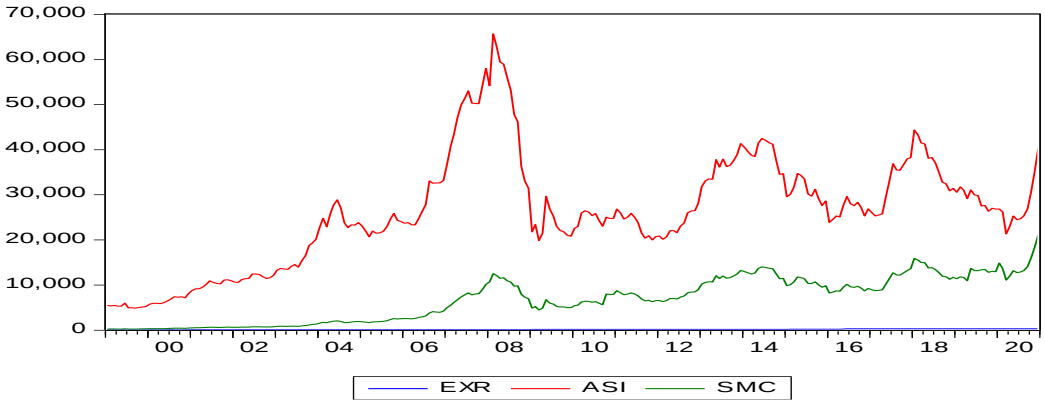

Fig 3: ARCH-GARCH volatility clustering of the series

The Jarque-Bera statistical test is useful in determining the normality distribution of a series.

It measures the difference of the skewness and the kurtosis of the variable groups or series. Its null hypothesis is that the series is normally distributed against the alternative that the series is not normally distributed. From table 4.3, the null hypothesis of normal distribution was rejected as implying that variables of the model are not normally distributed. Kurtosis indicates the peakedness or otherwise in the series. The statistic for Kurtosis shows that Nigerian exchange rate and stock market prices are normally peaked. However, both Nigeria stock exchange prices and exchange rate are platykurtic, suggesting that its distribution is flat (less than 3) relative to the normal. Finally, skewness measures how asymmetric the series are around the mean.

Table 4.3: Summary of the Descriptive Statistics of the Variables

	EXR	NSEC
Mean	173.0001	6830.108
Median	149.9957	7033.925
Maximum	309.7304	21056.76
Minimum	86.00000	222.1000
Std. Dev.	72.39714	4906.841
Skewness	1.084419	0.108868
Kurtosis	2.607223	1.831070
Jarque-Bera	53.43947	15.55187
Probability	0.000000	0.000420
Sum	45672.03	1803149.
Sum Sq. Dev.	1378474.	6.33E+09
Observations	264	264

The sample means for the included variables deviates statistically from zero. The standard deviations are very high and positive. This suggests that the markets are not stable but highly volatile. Having established volatility evidence in series, we proceed to evaluate the ARCH effect. The test for the evidence of volatility and its transmission effect in Nigerian exchange rate and stock market price relationship is modeled by the ARCH-GARCH (1,1) technique.

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Firstly, we established whether there is any ARCH effect in Nigerian exchange rate and stock market price residuals. Table 4.4 presents the heteroskedasticity test which shows the presence of ARCH effect in our models implying that variances of the residuals are not constant between the periods, this confirms or strengthens the presence of high volatility or instability in the series.

Table 4.4: Heteroskedasticity Test: ARCH

Heteroskedasticity Test: ARCH			
F-statistic	9297.872	Prob. F(1,260)	0.0000
Obs*R-squared	254.8729	Prob. Chi-Square(1)	0.0000

From table 4.4, there is strong evidence of the ARCH effect, seeing that the probability values of the F-statistic and Chi-square (1) are below 0.05. Homoscedasticity hypothesis is rejected. This result gives credence to the use of EGARCH model for estimation; we therefore proceed to determine the extent of the volatility connection in the variables using exponential generalized autoregressive conditional heteroscedasticity (EGARCH) shown in table 4.5 below

Table 4.5: EGARCH Test Result

Parameters	**Model 1**		**Model 2**	
	EXR	**NSMP**	**EXR**	**NSMP**
α_1	-3.8863** (-35.78)	-5268.33** (-31.71)	18616.46** (88.76)	92.91** (196.37)
α_2	-0.9494** (-23.17)	3.2854* (101.63)	-74.27** (-53.99)	0.0017** (69.306)
γ	-2.473** (-4.053)	7.673** (4.534)	0.583 (0.438)	-1.226** (0.4379)
ϕ	2.267** (4.193)	1.958** (4.210)	1.82 (3.591)	1.726** (4,177)
∂	0.209 (0.573)	0.0543 (0.1567)	3.160 (0.650)	-0.0039 (-0.019)
ψ	0.749** (8.354)	0.355** (3.155)	0.860** (9.664)	0.940** (13.611)

**(**) denotes the variable is significant at 5% (1%) significance level. Figures in Parentheses are t-statistics*

Article DOI: 10.52589/AJESD-ATAK411M
DOI URL: https://doi.org/10.52589/AJESD-ATAK411M

African Journal of Economics and Sustainable Development
ISSN: 2689-5080
Volume 7, Issue 1, 2024 (pp. 56-72)

www.abjournals.org

DISCUSSION

The EGARCH result shows a negative and significant coefficient in the current period of exchange rate and stock prices in the current period for model one. However, there is a positive and significant change in the current period of exchange rate for model 2. This result implies a spontaneous positive response of stock prices to exchange rate variation in the current, meaning that when a country's currency is depreciated, it triggers an increase in stock market prices in the current and the following year because depreciation suggests a rise in the nation's currency international competitiveness, which consequently enhances firms' productivity and profit and hence increase in stock prices. The result further revealed that Nigeria's stock market prices responded positively to fluctuation in exchange rate in the current year, suggesting that exchange rate increase will raise the stock market prices in Nigeria. This result is in consonant with the study done by Hock (2022) who observed that non-linear forms of real exchange rate have positive and significant influence on real stock prices in countries like Philippines, Malaysia, Japan, Korea, Singapore, Hong Kong, United Kingdom and Indonesia. It also agrees with the findings of Kwaku, Ahmed, Adjei, Asiamah, Adela and Takyi (2022) who also observed that exchange rate fluctuation causes a significant difference in the lead-lag relationship of assets in Africa. However, Anusha, Dhushanthan and Vinayagathasan (2022) observed that no relationship exists between exchange and all share index in the long run whereas there is a positive and significant relationship between exchange rate and all share index in the short run in Sri Lanka. This present study contradicts their findings in the short run but agrees with it in the long run. Furthermore, this result contradicts the study done by Tamunowariye and Anaele (2022) who observed that exchange rate reduces the level of productivity in Nigeria and also reduces the level of stock market performance in Nigeria.

The results further show negative and significant volatility and an affirmative or positive and insignificant persistence in both models. The effect of volatility persistence is larger measured by the coefficient γ in the variance equation for both models. Here, exchange rate has strong predictive power on stock market price, whereas stock market price is a weak predictor of exchange rate in the two models. ϕ Measures innovation effects and sizes of such effects is positive and considerably significant for the both models. ∂_j Which indicates the presence of leverage effect is positive and insignificant in the both models. Since the value is greater than zero, it connotes that negative news about exchange rate results in high volatility in stock market more than positive news about exchange rate. Finally, the variance equation indicates that a unidirectional volatility relationship exists which runs from foreign exchange to the stock market. The plot of the residual, actual and fitted graph of the series is shown below:

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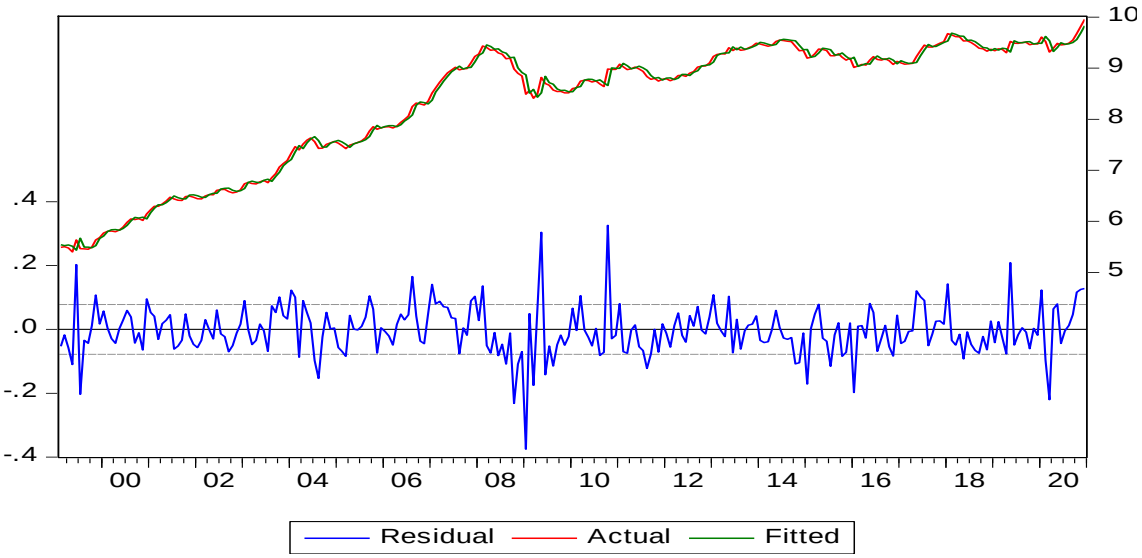

Fig. 4.4: The plot of the residual, actual and fitted graph of the series

IMPLICATION TO RESEARCH AND PRACTICE

The study provides valuable insights into the relationship between exchange rate volatility and stock market performance, helping investors in Nigeria make more informed decisions regarding risk management. Understanding how exchange rate fluctuations impact the stock market can assist investors in developing strategies to mitigate risks and optimize their portfolios.

Findings from the research could have implications for macroeconomic policy formulation in Nigeria. Policymakers may use the results to design and implement measures that address the impact of exchange rate volatility on the stock market. This could involve implementing policies to stabilize the exchange rate or developing mechanisms to protect the stock market from excessive volatility.

The study may influence international investors' decisions regarding investments in the Nigerian stock market. If a strong connection between exchange rate volatility and stock market performance is identified, foreign investors may adjust their investment strategies and risk assessments when considering Nigerian assets.

CONCLUSION

This study's objective is to establish the direction of volatility between exchange rate and stock market prices in Nigeria. In this study, related literature was reviewed and observed that no study reviewed from Nigeria made use of the exponential generalized autoregressive conditional heteroscedasticity (EGARCH) model proposed by Nelson (1991) for their analysis. The advantage of EGARCH is that it places no restriction on the parameters because the equation is on log variance instead of variance itself. We therefore adopted the EGARCH model for analysis considering its appropriateness to the study. We relied on Augmented

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DOI URL: https://doi.org/10.52589/AJESD-ATAK411M

Dickey Fuller (ADF) and Philip Perron (PP) unit root test to ascertain the stationarity of variables included in the models and the result indicated that all included variables were non-stationary in their level form but became stationary after 1st differences. Johansen cointegration test was adopted to establish the long run relationship among the variables and the result showed no evidence of cointegration among the variables of the models.

Our findings revealed a self generated negative response of stock prices to changes in exchange rate of the current year, suggesting that a country's currency depreciation catalyzes an amplification or increase in stock prices. Results further show that Nigeria stock exchange responded negatively to fluctuation in exchange rate in the current year, implying that increase in exchange rate will also increase the stock market prices in Nigeria. The results further show negative and significant volatility persistence in both models. Finally, the variance equation result indicates that a unidirectional volatility relationship exists which runs from foreign exchange to stock market prices.

The study therefore recommends investors to carefully consider the nature of volatility in exchange rate and its relationship with stock market prices within the economy so as to make rational and informed business decisions regarding where to channel investments. They should consider investing whenever the home currency depreciates, because it signals that the stock market prices will likely appreciate; especially for an import dominated economy like Nigeria and other developing countries.

Suggestions for Future Research

The researcher's suggestions for future research on the topic are as follow:

- Investigate the impact of specific policy interventions or changes in economic policies on the relationship between exchange rate volatility and stock market performance. For instance, analyze the effects of monetary policy decisions, fiscal measures, or exchange rate management strategies on market dynamics.

- Explore how exchange rate volatility affects different sectors within the Nigerian stock market. Different industries may respond differently to currency fluctuations based on their exposure to international trade, import/export dependencies, and sensitivity to currency risk.

Article DOI: 10.52589/AJESD-ATAK411M
DOI URL: https://doi.org/10.52589/AJESD-ATAK411M

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