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MODELLING THE VOLATILITIES OF NIGERIA EXCHANGE RATE, INFLATION RATE, AND THE STOCK EXCHANGE USING TIME SERIES MODELS

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ABSTRACT: *This research modelled the volatilities of Exchange rate, Inflation rate and Nigeria stock exchange. The research fit time series models; Autoregressive Conditional Heteroskedastic (ARCH) model, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, and Exponential GARCH (EGARCH) model, using the monthly data on Exchange rate, Inflation rate, and Stock exchange from January 1990 to December 2017. The return series of the variables shows periods of low and high volatilities, which signify volatility clustering. The parameters of the three variables were estimated and compared using each of univariate GARCH (1, 1) model under consideration i.e. GARCH (1, 1), EGARCH (1, 1) and GJR-GARCH (1, 1) models. Furthermore, the three variables were compared using the GARCH (1, 1) model and it was discovered that Nigeria stock exchange have the best performance, followed by inflation rate and exchange rate in that order. based on the assumption of 5% level of significant for GARCH (1, 1) model, most of the parameters of the Stock exchange are significant with a p-value less than 0.05, for Exchange rate only the constant (Cst1) and a_1 parameters is significant, for Inflation both Alpha1 and Beta1 are significant. EGARCH (1, 1) indicate that Nigeria stock exchange just as GARCH (1, 1) have the best performance, followed by inflation rate and exchange rate in that order. Only Exchange Rate has leverage volatility effect out of the three variables based on the result from EGARCH model.*

KEYWORDS: exchange rate, inflation rate, stock exchange, arch, GARCH, EGARCH

INTRODUCTION

Econometrics deals with the measurement of economic relationships. It is an integration of economics, mathematical economics and statistics with an objective to provide numerical values to the parameters of economic relationships. The relationships of economic theories are usually expressed in mathematical forms and combined with empirical economics. The econometrics methods are used to obtain the values of parameters which are essentially the coefficients of mathematical form of the economic relationships. The statistical methods which help in explaining the economic phenomenon are adapted as econometric methods. The econometric relationships depict the random behaviour of economic relationships which are generally not considered in economics and mathematical formulations.

Econometrics variables consist of many variables such as stock exchange, index rate, inflation rate, exchange rate, interest rate etc. in this study, we considered only three econometrics variables the stock exchange, inflation rate and exchange rate.

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The Nigerian stock market has over the years recorded significant losses as indicated by its stock prices volatility. At the same time fluctuations have been experiencing in inflation and exchange rate. The volatility of inflation and exchange rate has shifted the attention of investors from the stock market instruments to alternative financial instruments. That is, fixed income securities- treasury bills and bonds which are risk-free. Hence, Nigerian stock market has not been able to live up to its primary obligation of meeting long-term capital needs of the deficit sectors, by effectively playing its financial intermediation role (Emeka N and Aham K U, 2016).

During recent years, there have been considerable interest in modelling the volatility of some econometrics variables using GARCH models, and other time series econometrics models.

Emeka N and Aham K.U (2016), investigated the relationship between exchange rate and inflation volatility and stock prices volatility in Nigeria, using time series quarterly data from 1986Q1-2012Q4. The volatilities of exchange rate and inflation in their study were calculated using standard GARCH (1, 1) models. The relationship between exchange rate, inflation volatility and stock prices volatility was examined using GARCH (1, 1)-S models of an extended GARCH-X models. The findings of their study show that there is a negative relationship between stock market prices volatility and exchange rate and inflation volatility in Nigeria. This result has an important implication for the investors and regulators in the stock market. Investors and regulators in the Nigeria stock market should take note of the systematic risks revealed by the exchange rate and inflation volatility when structuring their investment portfolios and diversification strategies as well as in formulating policies respectively.

Evbayiro-O and Emeni (2015), also established that changes in inflation rates, financial openness and exchange rates have no significant impact on stock returns volatility in Nigeria using ARCH and GARCH models. Osseni and Nwosa (2011), used AR (k)- EGARCH (p, q) and LA-VAR Granger Causality test techniques documented the existence of a bi-causal relationship between stock market volatility and real GDP volatility and no causal relationship between stock market volatility and the volatility in interest rate and inflation rate in Nigeria for the period 1986-2010. Mlambo et al (2013), employed GARCH (1, 1) model to explore the link between exchange rate volatility and stock market performance for South African data for the period 2000 – 2010. The findings demonstrated that a very weak relationship exists between exchange rate volatility and the stock market.

Issahaku et al (2013), investigated the interaction between macroeconomic variables and stock returns in Ghana using Vector Error Correction (VECM) model. The results of the study indicates that a significant long run relationship exists between stock returns and inflation, money supply and Foreign Direct Investment (FDI). The short-run result also established that a significant relationship exists between stock returns and interest rate, inflation and money supply except FDI. Furthermore, the causality test result showed that a causal relationship runs from inflation and exchange rate to stock returns. Khan and Ali (2015), examined the relationship between volatilities of exchange rate and stock market prices in Pakistan using Granger causality test. The result showed a bidirectional relationship between the exchange rate volatility and the variability of stock market prices.

Samadi et al (2012), investigated the relationship between stock returns in the Tehran stock exchange and macroeconomic variables of interest; exchange rates, world gold prices, inflation, liquidity and

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oil price using monthly data over the period 1979 to1989. In doing this, they employed GACH economic model. In this study, the finding showed that the gold price, inflation and exchange rate variables influenced the stock return while oil price and liquidity had no impact on the stock returns. Sichoongwe (2016), evaluated the impact of exchange rate volatility on stock returns of Zambian stock market using GARCH (1, 1) approach. The result revealed that stock market returns is negatively related to exchange rate volatility.

Zia and Rahman (2011), investigated exchange rate and stock price relationship in Pakistan by employing Co-integration technique and Engle-Granger causality. The results obtained revealed that, there is no long-run relationship between exchange rate and stock prices. Also, the result emphasized that there is no causal relationship between the variables.

This research aimed to measure the volatility in Nigeria exchange rate, inflation rate, and stock exchange. The specific objectives are to:

i. Estimate the persistence in volatility using the univariate GARCH model
ii. Compare the performances of the univariate GARCH (1,1) model, EGARCH (1,1) model, and GJR-GARCH (1,1) model.
iii. Check for leverage effect using the EGARCH model.

METHODOLOGY

Autoregressive Conditional Heteroskedastic (ARCH) Models

The Autoregressive Conditional Heteroskedastic (ARCH) models are used to capture the return of an asset. All ARCH or GARCH family models require two distinct specifications: the mean and variance equations, Engle created the first heteroskedastic model in 1982 to capture the movements of the Inflation rate in UK (Bollerslev, 2009). Because of the characteristics of the volatility for any financial time series the ARCH model is built on two assumptions. The first assumption is that high volatility appears in clusters and therefore the movement of the assets return is dependent on the previous values but for the whole time series it's uncorrelated. The second assumption is that the distribution of the asset returns (a!) can because of its dependence with the previous values be explained by a quadratic function of the former lagged values. The model is built on the information set that exists at time *t-1*. The conditional variance depends on the previous n lagged innovations:

The ARCH (n) model is given as

$$\sigma_t^2 = \omega + \alpha_1 a_{t-1}^2 + \cdots + \alpha_n a_{t-n}^2 + \mu_t \tag{1}$$

In the equation it can be seen that large values of the innovation of asset returns has a bigger impact on the conditional variance because they are squared, which means that a large shock have tendency to follow the other large shock and that is the same behaviour as the clusters of the volatility.

$$a_t = \sigma_t \varepsilon_t, \sigma_t^2 = \omega + \alpha_1 a_{t-1}^2 + \cdots + \alpha_n a_{t-n}^2 \tag{2}$$

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Where $\varepsilon_t \sim N(0,1)\, iid, \omega > 0 \, and \, \alpha_i \geq 0 \, for \, i > 0$. An assumption in the model is that ε_t are assumed to follow a standard normal, student or generalized error distribution (Tsay 2005, p. 102f).

Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Models

The conditional variance for GARCH (p, q) model is expressed generally as follow:

$$a_t^2 = \omega + \sum_{t=1}^{m} \alpha_t a_{t-i}^2 + \sum_{j=1}^{s} \beta_j \sigma_{t-j}^2 \tag{3}$$

where $\varepsilon_t \sim N(0,1)\, iid$, the parameter α_i is the ARCH parameter and β_j is the GARCH parameter and $\omega > 0, \alpha_i \geq 0, \beta_j \geq 0 \, and \, \sum_{t=1}^{\max(m,s)} (\alpha_i, \beta_j) < 1$.

In equation (3) the first part $a_t = \sigma_t \varepsilon_t$ where $\varepsilon_t \sim N(0,1)\, iid$. In GARCH with student t distribution (t innovation) the first part is written as $a_t = \sigma_t y_t$ where $y_t \sim t(d)$ and this unknown degrees of freedom (Bollerslev, 2009)

Exponential GARCH models (EGARCH)

Nelson suggested a new model in 1991, the exponential GARCH model (EGARCH) (Nelson, 1991). He proposed that there should be a weighed invention to the model that should allow for the unequal changes of the volatility in the return of the asset. Let a_t still be the innovation of the asset return at time t, and then the EGARCH (m, s) model can be written as:

$$In\left(\sigma_t^2\right) = \omega + \sum_{t=1}^{s} \alpha_i \frac{\left|a_{t-i}\right| + \theta_i a_{t-i}}{\sigma_{t-i}} + \sum_{j=1}^{n} \beta_j In\left(\sigma_{t-1}^2\right) \tag{4}$$

Then EGARCH (1, 1) is written as

$$\begin{gathered} a_t = \sigma_t \in_t, \\ In\left(\sigma_t^2\right) = \omega + \alpha\left(\left[\left|a_{t-1}\right| - E\left(\left|a_{t-1}\right|\right)\right]\right) + \theta a_{t-1} + \beta In\left(\sigma_{t-1}^2\right) \end{gathered} \tag{5}$$

where $\in_t$ and $\left|a_{t-1}\right| - E\left(\left|a_{t-1}\right|\right)$ are iid and have mean zero. When the EGARCH has a Gaussian/Normal distribution of the error term then $E\left(\left|\in_t\right|\right) = \sqrt{2/\pi}$, which gives?

$$In\left(\sigma_t^2\right) = \omega + \alpha\left(\left[\left|a_{t-1}\right| - \sqrt{2/\pi}\right]\right) + \theta a_{t-1} + \beta In\left(\sigma_{t-1}^2\right) \tag{6}$$

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There is one property that should be mentioned and this is that negative shocks of the volatility tend to have a bigger impact and therefore $\theta$is often assumed to be negative (Tsay 2005, p. 124f). Because the model uses logarithms it causes difficulties when it comes to estimate an unbiased forecast (Bollerslev, 2009).

Evaluation of GARCH models
The GARCH variants will be evaluated by Akaike's Information Criterion (AIC) and Schwarz Bayesian Information Criterion (SBIC), even though the statistical properties of the criteria in the GARCH context are yet to be known. The two criteria are given as,

$$AIC = -2N^{-1}l_t(\Theta) + 2N^{-1}k$$

and

$$SBIC = -2N^{-1}l_t(\Theta) + 2kN^{-1}In(N) \quad (7)$$

Where $l_t(\Theta)$ is the maximum likelihood function conditioned on the parameter set Θ .

DATA ANALYSIS AND RESULT

The volatility test using univariate GARCH model on all the three economic variables (Exchange rate, Inflation rate and Stock Exchange) under consideration was carried out using E-views 10 (Economics-views) student version and Ox-metrics G@rch 7.0 package.

Descriptive Statistic Measures
Table 1 presents the descriptive measures of the Exchange rate, Inflation _rate and Stock exchange data. These are used to examine the inherent characteristics of the data sets. N

Table 1. Descriptive Statistic Measures

	EXCHANGE RATE	INFLATION RATE	STOCK EXCHANGE
Mean	108.6235	18.68983	3962.633
Median	126.4624	12.60000	1429.878
Maximum	309.7304	78.50000	14027.71
Minimum	7.862100	0.900000	14.84329
Std. Dev.	75.39895	17.16493	4457.138
Skewness	0.540836	1.923211	0.742688
Kurtosis	3.312135	5.6675512	2.036164
Jarque-Bera	17.74420	306.7481	43.89455
P-value	0.000140	0.00001	0.00001
Sum	36497.51	6279.784	1331445.
Sum sq. Dev.	1904476.	98702.71	6.66E+09
Observations	336	336	336

Source: Author's computation using Eviews

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The result obtained shows that the mean of the series are 108.6235, 18.68983 and 3692.633 for Exchange rate, Inflation _rate and Stock exchange respectively with the median values of 126.7304, 12.6000 and 1429..71 in that order and the standard deviation of Exchange rate which is 75.39895, Inflation _rate is 17.16493, and Stock exchange is 4457.138. the Jarque-Bera test was employed to test for the normality in the data set. The hypothesis to be tested are:
H_0: data sets are normally distributed
Vs
H_1: data sets are not normally distributed
The results of this test indicates that the data sets of both exchange rate, Inflation rate, and the stock exchange are normally distributed $p<0.05$.

Trend Analyses of the Data Sets

Time Plots of the Raw Data

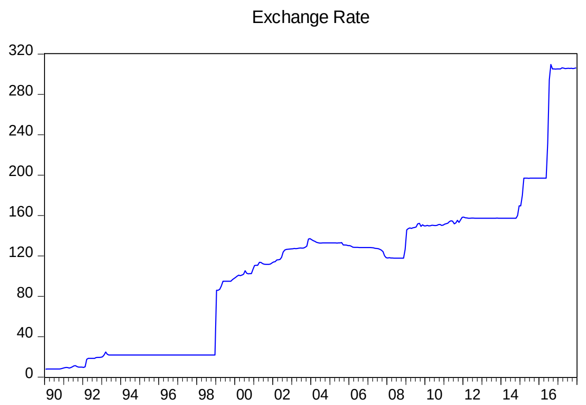

Fig 1 Time series plot of Exchange Rate

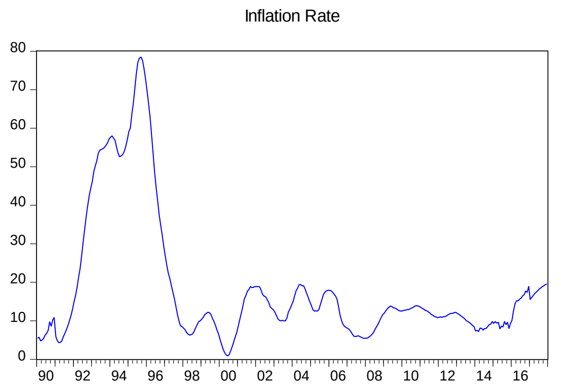

Fig 2 Time series plot of Inflation Rate

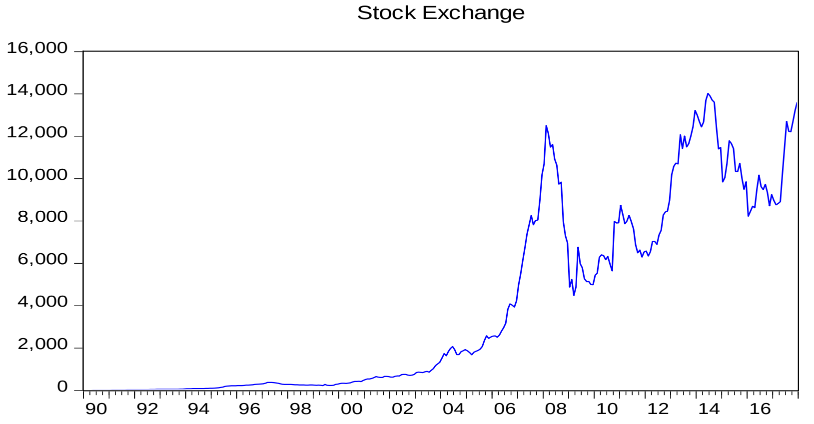

Figure 3 Time series plot of Stock Exchange

Figure 1 display the plot of exchange rate in Nigeria from January 1990 to December 2017, where it was noticed that there was a slight increase towards the end of 1990 to mid-1993 with a stationary movement from early part of 1994 to 1999. There was a rise from that 1999 up to 2005 and the trend

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continued in an up and down movement. This pattern clearly indicates that, non-stationarity is inherent in the data set.

Figure 2 display the time plot of Inflation rate in Nigeria from January 1990 to December 2017, in which it was observed that there was a rapid increase from the beginning of the year 1991 with a break in 1995 and an upward movement up to 1996 then experience a fall in the beginning of 1996 down to 1998 and later maintain a stationary trend down to 2005 and experience a break 2016 followed by slight increase. These patterns also indicate that, the data set is not stationary.

Figure 3 display the time plot of Stock Exchange in Nigeria from January 1990 to December 2017, where the trend was observed to be moving with parallel trend from 1990 to 1993 with a slight increased from 1994 with slow movement to 2002 and a sharp increased from 2004 to 2008 and a down fall trend from that 2008 to 2009 with a break in the early part of 2008 and later experienced a drop in 2013 down to 2016 and finally it increased from 2016 to 2017. The pattern also indicates that the data set is not stationary.

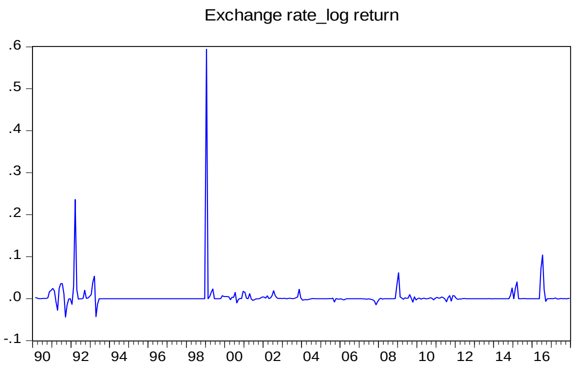
The formal test for stationarity was conducted to augment the graphical analysis. These test, conducted at 5% significance level using the Augmented Dickey-Fuller (ADF) test are displayed in table 2.

Table 2 Unit Roots Test for the Exchange rate, Inflation rate and Stock exchange series of the raw Data

Variable	Test Statistic	p-value
Exchange rate	1.927096	0.9874
Inflation rate	-1.955791	0.4843
Stock exchange	0.679534	0.8621

The ADF test for the three variables are shown in table 2. The test shows the presence of a unit root in the data (p>0.05). these patterns indicates clearly that the series have to be transformed or differenced to stabilize or stationarize the data before their capability are assessed or before improvement are initiated.

Time Plots of the first differenced of the Data



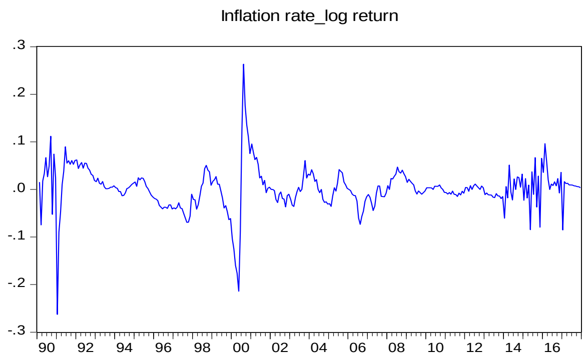


Fig 4 Time plot of the first differenced of Exchange Rate Fig 5 Time plot of the first differenced of Inflation Rate

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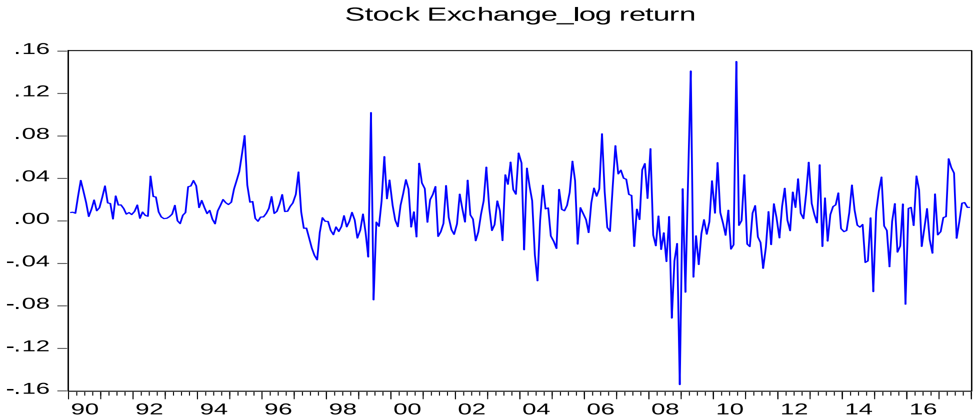

Figure 6 Time plot of the first differenced of Stock exchange

Figures 4-6 shows the first differenced of the data set of the three variables. The patterns of the figures indicates that the mean and variance of the series were stable over time. These patterns confers stationarity of the data at first differenced. The ADF test of stationarity display in table 3 also corroborate the graphical analyses that the series were stationary at first differenced. ($p<0.05$).

Table 3 Unit Roots Test for the Exchange rate, Inflation rate and Stock exchange series of the First differenced

Variable	Test Statistic	p-value
Exchange rate	3.320974	0.0012
Inflation rate	-4.856796	0.0001
Stock exchange	1.779633	0.0042

It was observed from Figure 4, Figure 5, and Figure 6; that the log returns of Exchange rate, Inflation rate and Stock Exchange offer evidence of the well-known volatility clustering effect. It is a tendency for volatility in financial markets to appear in bunches. Large returns (of either sign) are expected to follow large returns, and small returns (of either sign) to follow small returns (Brooks, 2002).

Table 4 comparing the three variables under the GARCH (1, 1) model

S/N	Variables	Log-likelihood	AIC	SIC	HQIC
1	Exchange Rate	550.238	-3.653764	-3.604259	-3.633950
2	Inflation Rate	667.703	-4.439484	-4.389980	-4.419670
3	Stock Exchange	687.528	-4.572092	-4.522588	-4.55227

Source: Author's computation using Ox-metric G@rch package

LogL (Log-Likelihood), Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), Hannan-Quim Information Criteria (HQIC)

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Table 4 presents the model summary of the GARCH (1, 1) in which the Nigeria Stock Exchange has the best performance among the three variables with the highest log-likelihood (LogL) of 687.528 and lowest AIC, SIC and HQIC of -4.572092, -4.522588 and -4.55227 respectively, followed by Inflation rate and then Exchange rate.

Table 5 Parameter estimate of the GARCH (1, 1) model

	Exchange Rate	**Inflation Rate**	**Stock Exchange**
Cst(M) S.e P-value	0.009259 - -	-0.000421 (0.0032312) 0.8965	0.012260 (0.0012555)* 0.0000
Cst(V) S.e P-value	1.490926 - -	0.251305 0.25016 0.3159	0.372242 0.21907 0.0903
Alpha1 S.e P-value	12.842739 - -	0.612739 (0.19383)* 0.0017	0.623656 (0.20439)* 0.0025
Beta1 S.e P-value	0.00000 - -	0.482978 (0.17563)* 0.0063	0.505729 (0.09101)* 0.0000
Normality test Chi^2(2)	1.0916e+006	22.470	29.727
LogL	550.238	667.703	687.528

Source: Author's computation using Ox-metric G@rch package

Notes: Standard errors (S.e) are in parentheses. * indicates significant at the 5% level. LogL and Chi^2(2) are the maximum log-likelihood, and Chi-square value at 2 degree of freedom respectively

From Table 5 above, based on the assumption of 5% level of significant for GARCH (1, 1) model, three out of four parameters under the Stock exchange are significant with a p<0.05, for Exchange rate only the constant (Cst1) and a_1 parameters are significant, for Inflation both Alpha1 and Beta1 are significant. It was also observed from the table 5 that for GARCH (1, 1) model, the best performance was on Stock Exchange with the highest LogL of 687.528 followed immediately by Inflation rate and Exchange rate in that order and all the variables are normally distributed.

Table 6. Comparing the three variables under the EGARCH (1, 1) model

S/N	**Variables**	**Log-likelihood**	**AIC**	**SIC**	**HQIC**
1	Exchange Rate	580.757	-3.844530	-3.770274	-3.814810
2	Inflation Rate	656.135	-4.348730	-4.274474	-4.319009
4	Stock Exchange	680.419	-4.511166	-4.436909	-4.481445

Source: Author's computation using Ox-metric G@rch package
LogL (Log-Likelihood) Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), Hannan-Quim Information Criteria (HQIC)

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Table 6 presents the model summary of the EGARCH (1,1) where it was observed that Nigeria Stock Exchange have the best performance among the three variables with the highest log-likelihood (LogL) of 680.419 and lowest AIC, SIC and HQIC of -4.511166, -4.436909 and -4.481445 respectively followed by Inflation rate and lastly Exchange rate.

Table 7 Parameter estimate of the EGARCH (1, 1) model

	Exchange Rate	Inflation Rate	Stock Exchange
Cst(M)	-	-0.003399	0.010481
S.e	-	(0.0016191)*	(0.0011596)*
P-value	-	0.0366	0.0000
Cst(V)	-	-0.026806	-72904.350138
S.e	-	6.8088	(1828.0)*
P-value	-	0.9969	0.0000
Alpha1	-	-0.420146	0.250669
S.e	-	(0.010012)*	0.20556
P-value	-	0.000	0.2237
Beta1	-	0.999721	0.747421
S.e	-	(0.0044242)*	(0.074431)*
P-value	-	0.0000	0.0000
Theta1	-	-0.240427	-0.163150
S.e	-	(0.086623)*	(0.065123)*
P-value	-	0.0059	0.0128
Theta2	-	1.284623	0.759601
S.e	-	(0.16893)*	(0.15449)*
P-value	-	0.0000	0.0000
Omega	-0.08539997	-	-
S.e	NaN		
Phil	0.96155959	-	-
S.e	6.170518e-05		
Kappa1	2.02621078	-	-
S.e	8.581886e-05		
Kappastar	-0.02578299	-	-
S.e	7.612018e-05		
Normality test Chi^2(2)	-	2.3588	24.737
LogL	580.757	656.135	680.419

Source: Author's computation using Ox-metric G@rch package

Notes: Standard errors (S.e) are in parentheses. * indicates significant at the 5% level. LogL and Chi^2(2) are the maximum log-likelihood and Chi-square value at 2 degree of freedom respectively.

For the exchange rate, E-GARCH (1, 1) model is covariance stationary since ϕ (Phi) of 0.9616 which is the GARCH parameter ($|\phi| < 1$ implies stability), Omega (ω) of -0.08539 the unconditional or long-term log volatility, kappa1 (κ) of 2.02621 indicate the ARCH parameter and Kappa1star (κ^*) which is -0.02578 is the leverage or volatility-asymmetry parameter. Based on the assumption of 5% level of significant for EGARCH (1, 1) model, three out of four model parameters under both Inflation rate and Stock exchange are significant with a p-value less 0.05, for Inflation rate all the parameters Alpha1, Beta1, theta1 and theta2 are significant while in the case of Stock exchange, only Beta1, theta1 and theta2 are significant. It was also observed from the table 7 that for EGARCH (1, 1) model,

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the best performance was on Stock Exchange with the highest LogL of 680.419 followed immediately by Inflation rate and Exchange rate in that order and all the variables are normally distributed.

Table 8.Comparing the three variables under the GJRGARCH (1, 1) model

S/N	Variables	Log-likelihood	AIC	SIC	HQIC
1	Exchange Rate	793.030	-5.271102	-5.209221	-5.246334
2	Inflation Rate	669.157	-4.442524	-4.380644	-4.417757
4	Stock Exchange	689.486	-4.578504	-4.516624	-4.553737

Source: Author's computation using Ox-metric G@rch package

LogL (Log-Likelihood) Akaike Information Criteria (AIC), Schwarz Information Criteria (SIC), Hannan-Quim Information Criteria (HQIC)

Table 8 presents the model summary of the GJR-GARCH (1, 1) it was clearly shown that the Exchange rate have the best performance among the three variables with the highest log-likelihood (LogL) of 793.030 and lowest AIC, SIC and HQIC of -5.271102, -5.271102 and -5.246334 respectively, followed by Inflation rate and lastly Stock exchange.

Table 9 Parameter estimate of the GJR-GARCH (1, 1) model

	Exchange Rate	Inflation Rate	Stock Exchange
Cst(M)	0.0046449	-0.000537	0.011469
S.e	-	(0.0022593)*	(0.0012493)*
P-value	-	0.8122	0.0000
Cst(V)	-0.126834	0.173741	0.446205
S.e	-	0.11978	0.26530
P-value	-	0.1480	0.0937
Alpha1	-0.010029	0.441643	0.405389
S.e	-	0.14805	0.18496
P-value	-	(0.0031)*	(0.0292)*
Beta1	1.002331	0.535059	0.521386
S.e	-	0.099529	0.10019
P-value	-	(0.0000)*	(0.0000)*
Gamma1	0.428728	0.237021	0.323201
S.e	-	0.13512	0.18823
P-value	-	0.0805	0.0870
Normality test Chi^2(2)	56272	26.064	31.526
LogL	793.030	669.157	689.486

Source: Author's computation using Ox-metric G@rch package

Notes: Standard errors (S.e) are in parentheses. * indicates significant at the 5% level. LogL and Chi^2(2) are the maximum log-likelihood and Chi-square value at 2 degree of freedom respectively.

From Table 9, based on the assumption of 5% level of significant for GJR-GARCH (1, 1) model, it was observed that the Alpha1 and Beta1 parameters under the Inflation rate Stock exchange are significant with a p-value less than 0.05, while that of Gamma1 parameter for both Inflation and Stock Exchange are not significant. It was also observed from the table 9 that for GJR-GARCH (1, 1) model, the best performance was on Exchange rate with the highest LogL of 793.030 followed

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immediately by Inflation rate and Exchange rate in that order and all the variables are normally distributed

CONCLUSION

This paper is about modelling volatility of Exchange rate, Inflation rate and Nigeria stock exchange. The return series of the variables shows periods of low and high volatilities, which signify volatility clustering. The parameters of the three variables were estimated and compared using each of univariate GARCH (1, 1) model under consideration i.e. GARCH (1, 1), EGARCH (1, 1) and GJR-GARCH (1, 1) models. It was discovered that Nigeria stock exchange has the best performance, followed by inflation rate and exchange rate in that order. Based on the assumption of 5% level of significant for GARCH (1, 1) model, most of the parameters of the Stock exchange were significant with a p-value less than 0.05, for Exchange rate only the constant (Cst1) and a_1 parameters were significant, for Inflation both Alpha1 and Beta1 were significant. On the case of EGARCH (1, 1), it was observed that Nigeria stock exchange just as GARCH (1, 1) has the best performance, followed by inflation rate and exchange rate in that order. Only Exchange Rate has leverage volatility effect out of the three variables based on the result from E-GARCH model.

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