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Modeling of Volatility in Naira/Pounds Sterling Exchange Rate

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ABSTRACT

The study models exchange rate volatility in Naira/Pounds sterling with a monthly data March, 2003 - May, 2017 extracted from Central Bank of Nigeria using a set of parameters for the error distribution except for the normal errors. From the analysis, the variable was stationary at first differencing with P-value less than 0.05. The presence of ARCH effect was confirmed and volatility estimated using GARCH family models with varying degrees of freedom for student-t error distribution, which controls the tail shape and also varying degrees of shape parameters for the generalized error distribution (GED). The shape parameters for the generalized error distribution (GED) was fixed at r = 1.0, 1.5 and 1.75 while student's–t error distribution, the degrees of freedom was fixed at r = 5, 10 and 15. The optimal model selected using Schwarz Information Criteria (SIC) of -3.816914. Recommendations were made based on the findings of the result.

INTRODUCTION

Exchange rate and its volatility have remained very key issues that influence economic activities in Nigeria. These hold numerous converse of interest from academic, financial economists, traders, investors and decision makers alike, especially ever since the fall of the Breton woods consensus of pegged exchange rates among major business nation (Suliman, 2012). Sequel to the adoption of market determined rates on the basis of demand and supply, there has been consistent greater variability in the prices of many currency indexes. Recently, researchers have introduced various models to clarify and foresee these vulnerabilities designs in instability. Among these models are the autoregressive conditional heteroskedasticity (ARCH) and the Generalized Autoregressive conditional heteroskedasticity (GARCH).

According to Musa e*t al.*, (2014), the ARCH model modeled the heteroskdasticity by relating conditional variance of the disturbance term to the linear contribution of the squared disturbances in the recent past. Whereas the universal autoregressive conditional heteroskedasticity (GARCH) model the constitutional variance as dependant of lagged standards and squared lagged standards of disturbance term (Musa et al, 2014). However, since the development of the two models above, various variance of GARCH model have been developed to model volatility. Some of which include the Exponential GARCH (EGARCH), Threshold GARCH (TGARCH), power ARCH (PARCH) etc. Hence, in view of the above the study model volatility in Naira/pounds stering in attempt to estimate exchange rate volatility as well as unifying model for estimating exchange rate volatility using GARCH family model.

LITERATURE REVIEW

Engle (1982), where it was shown that conditional heteroskedasticity can be modeled using an autoregressive conditional heteroskedasticity (ARCH) model. ARCH model relates the conditional variance of the disturbance term to the linear combination of the squared disturbance in the recent past. Having realized the potentials of ARCH model, several research studies have used it to model financial time series. Determining the optimal lag length is cumbersome, oftentimes engender over parametrization. Rydberg (2000) argued that large lag values are required in ARCH models, thus the need for many parameters, this lead to the introduction of the GARCH model.

However, Bollerslve (1986) and Taylor (1986) independently proposed the extension of ARCH model with an Autoregressive Moving Average (ARMA) formulation, with a view to achieving parsimony. The model is called the Generalized ARCH (GARCH), which models conditional variance as a function of its lagged values as well as squared lagged values of the disturbance term. Although GARCH model has proven useful in capturing symmetric effect of volatility, but it is bedeviled with some limitations. Such as the violation of non-negativity constraints imposed on the parameters to be estimated.

To overcome these constraints, some extensions of the original GARCH model were proposed. This includes asymmetric GARCH family models such as Threshold GARCH (TGARCH) proposed by Zakoian (1994), Exponential GARCH (EGARCH) proposed by Nelson (1991) and Power GARCH (PGARCH) proposed by Ding et al., (1993). The idea of the proponents of these models is based on the understanding that good news (positive shocks) these models is based on the understanding that good news (positive shocks) and bad news (negative shocks of the same magnitude have differential effects on the conditional variance.

The EGARCH which captures asymmetric properties between returns and volatility was proposed to address three major deficiencies of GARCH model. They are (1) parameter restrictions that ensures conditional variance positive; (ii) non-sensitivity to asymmetric response of volatility to shock and (iii) difficulty in measuring persistence in a strongly stationary series. The log of the conditional variance in the EGARCH model signifies that the leverage effects exponential and not quadratic. The specification of volatility in term of its logarithmic transformation implies the non-restrictions on the parameter to guarantee the positivity of the variance (M^{a}Jose, 2010), which is a key advantage of EGARCH model over the symmetric GARCH model.

Zakoian (1994) specified the TGARCH model by allowing the conditional standard deviation to depend on sign of lagged innovation. They specification does not show parameter restrictions to guarantee the positivity of the conditional variance. However, to ensure stationarity of the TGARCH model, the parameters of the model have to be restricted and the choice of error distribution account for the stationarity TGARCH model is closely related to GJR-GARCH model developed by Glosen et al., (1993).

Ding *et al.,* (1993) further generalized the standard deviation GARCH model initially proposed by Taylor (1986) and Schwert (1989) and called it power GARCH (PGARCH). This model relates the conditional standard deviation raised to a power, d (positive exponent) to a function of the lagged conditional standard deviations and the lagged absolute innovations raised to the same power. This expression becomes a standard GARCH model when the positive exponent is set at two. The provision for the switching of the power increases the flexibility of the model.

Researchers in different field of study including econometrics and statistics has carried out research on modeling exchange rate in Naira/Pounds sterling, some of the studies are similar but different analysis technique, duration of the used etc. hence, this study used the below studies to served as review of related empirical studies since no research will be completed without review of what others had done to show similarities and difference in their approach and methods. However, in one of the noticeable empirical studies conducted could be raced to Vergil, (2002). He investigated the impact of real exchange rate volatility on the export flows of Turkey to the United States and its three major trading partners in the European Union for the period between 1990 – 2000. The standard deviation of the percentage change in the real exchange rate was used to measure the exchange rate volatility.

Also, Asemota and Bala (2013) examine exchange – rate volatility with GARCH models using monthly exchange-rate return series from 1985 – 2011 for Naira/US dollar returns rates with exogenously determined break points. Result reveal present of volatility in the three currencies and equally indicate that most of the asymmetric models rejected the existence of a leverage effect except for models with volatility break. Evaluating the models through standard information criteria, volatility persistence and log likelihood statistic indicated that the results improved with estimation of volatility models with breaks as against those of GARCH models without volatility breaks and that the introduction of volatility breaks the level of persistence in most of the models.

Jayasuriya (2002) examines the effect of stock market liberalization on stock return volatility using Nigeria and fourteen other emerging market data, from December 1984 to March 2000 to estimate asymmetric GARCH model. The study inferred that positive (negative) changes in prices have been followed by negative (positive) changes. The Nigeria session of the result tilted more to business cycle of behaviour of return series than volatility clustering. Ogum et al, (2005) apply the Nigeria and Kenya stock data on EGARCH model to capture the emerging market volatility. The result of the study differed from Jayasuriya (2002). Though volatility persistence is evidenced in both market; volatility responds more to negative shocks in the Nigeria market and the reverse is the case for Kenya market.

Gulumbe, Dikko, Hassain and David (2016) investigated the exchange rate between the Naira and other currencies. The impact of exogenous rambles in modeling volatility was considered while using both the GARCH (1,1) and its asymmetric variants. Three of the four return series reveal heteroscedastility. The results of the fitted models indicated that the majority of the parameters are significant and that volatility is quite persistent. Hence, the results of the asymmetric model indicate different impacts for both negative and positive shocks and evidence of superior forecasting performance to the asymmetric GARCH.

MATERIALS AND METHODS

The data for this research work is the monthly Naira/Pound sterling exchange rates from 2003 to 2017 published under the Data and statistics heading of the Central Bank of Nigeria website www.cenbank.org.

Model Specifications

The idea of model specification needs to do with measurement to digest or gauge some genuine part of swapping scale unpredictability. In this examination, there are three instability models we should consider. They include: GARCH (p,q) as an expanded structure of ARCH (q) as proposed by Bollersele v (1986) in which the plags of past protected difference were included. The GARCH (p,q) is refined as:

$$\sigma_t^2 = \beta_0 + \sum_{i=1}^{q} \beta_i \, \varepsilon_{t-i}^2 + \sum_{j=1}^{p} B_j \, \sigma_{t-j}^2 \qquad (1)$$

Where p is the order of the GARCH terms, σ^2 and q is the order of the ARCH terms, ε^2. β_o is constant term, $\beta_o > 0$; $\beta_i \geq$; 0, i = 1,…, q – 1; j = 1,…., p – 1 and $\beta_p, \beta_q > 0$. σ_t^2 is the conditional variance and ε_t^2, disturbance term. The reduced form of equation 1 is the GARCH (1,1) represented as;

$$\sigma_t^2 = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \beta_2 \sigma_{t-1}^2 \qquad (2)$$

Also, the second model for the study is the EGARCH simply refers to as **Exponential Generalized Autoregressive conditional Heteroskedasticity.** This model was proposed by Nelson (1991) and the conditional variance was specified generally as

$$\log\left(\sigma_t^2\right) = B_o + \sum_{t=1}^{q} \left\{ \alpha_t \left| \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right| + Y_t \left(\frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right) \right\} + \sum_{j=1}^{p} B_j \log\left(\sigma_{t-i}^2\right) \qquad (3)$$

$\varepsilon_{t-i} > 0$ and $\varepsilon_{t-i} < 0$ implies good and bad news and their total effects are $a(1-Y_1)|\varepsilon_{t-1}|$ and $(1-Y_1)|\varepsilon_{t-1}|$ respectively. When $Y_t < 0$, expectation is that bad news would have higher impact on volatility. However, this achieves variance stationary when $\sum_{j=1}^{p} B_j < 1$. Hence, we shall constraint the study to modeling of conditional variance using EGARCH (1,1), which is defined as

$$\log\left(\sigma_t^2\right) = B_o + \alpha_1 \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + Y_1 \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + B_1 \log\left(\sigma_{t-1}^2\right) \qquad (4)$$

Here, we shall consider the total effect of both bad and good news for EGARCH (1,1) as given in $(1+Y_1)|\varepsilon_{t-1}|$ and $(1-Y_1)|\varepsilon_{t-1}|$ accordingly. In an attempt to accept the Null Hypothesis that $Y_1 = 0$ shows the presence of Leverage effect, that is bad news have stronger effect than good news on the volatility of exchange rate return and the third model for the study is the Threshold GARCH (TGARCH) model. The threshold GARCH (TGARCH) model was proposed by Zakolam (1994). The generalized specification for the conditional variance using TGARCH (p,q) is refined as

$$\sigma_t^2 = B_o + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{i=1}^{q} Y_i \, l_{t=i} \, \varepsilon_{t-1}^2 + \sum_{j=1}^{p} B_j \, \sigma_{t-j}^2 \qquad (5)$$

Where $l_{t-j} = 1$ if $\varepsilon_{t-1}^2 < O$ otherwise.

In this model, good news implies $\varepsilon_{t-1}^2 > O$ and bad news implies that $\varepsilon_{t-1}^2 < O$ and these two shocks of equal size have variations in their effects on the conditional variance. However, the first order representations of TGARCH (1,1), defined as

$$\sigma_t^2 = B_o + a_1 \, \varepsilon_{t-1}^2 + Y_1 \, l_{t-1} \, \varepsilon_{t-1}^2 + B_1 \, \sigma_{t-1}^2 \qquad (6)$$

Then good news has an impact of α_1 and bad news has an impact of $\alpha_1 + y_1$

Error Distributions

These three models specified above were analyzed in specific error distributions to show that return series is inefficient with the Gaussian process. The series were estimated with the following error distribution models; they are normal distribution, generalized error distribution and t-distribution otherwise called the student's t –distribution.

The normal distribution done by maximizing the likelihood function as follows:

$$L(\theta_t) = -{}^1\!/_2 \sum_{t-1}^{T} \left(In2\pi + In\sigma_t^2 + \frac{\varepsilon_t^2}{\sigma_t^2} \right) \quad (7)$$

Where δ_t^2 is the given GARCH models

Likewise, the suspicion that GARCH models take after GED as it's tends to represent kurtosis in returns which are not enough evaluated with normal assumption, at that point we consider the utilized of the Generalized Error Distribution. This is finished by augmenting the probability work beneath

.

$$L(\theta_t) = -{}^1\!/_2 \log \left(\frac{\Gamma\, r/v^2}{\Gamma\left(3/v\right)\left(v/2\right)^2} \right) - {}^1\!/_2 \log \sigma_t^2 - \left(\frac{\Gamma\left(3/v\right)\left(y_t - X_t^1\theta\right)^2}{\sigma_t^2 \Gamma\, 1/v} \right)^{v/2} \quad (8)$$

Where v is the shape parameter which represent the skewness of the profits and v > 0.

The higher the estimation of v, the more noteworthy the heaviness of the tail probability, GED is viewed as normal distribution when v = 0.

The volatility models evaluated is focused to augment the probability capacity of student's t distribution.

As per Atoi (2014) this is refined as:

$$L(\theta_t) = -{}^1\!/_2 \log \left(\frac{\pi(r)\Gamma\, r/v^2}{\Gamma\left(r+1\, v/2\right)^2 \left(v/2\right)^2} \right) - {}^1\!/_2 \log \sigma_t^2 - \frac{(r+1)}{2} \log\left(1 + \frac{\left(Y_t - X_t^2\theta\right)^2}{\sigma_t^2 (r-2)} \right) \quad (9)$$

Hence, r represent the degree of freedom and controls the tail behavior. r >2.

RESULTS

Trend Analysis

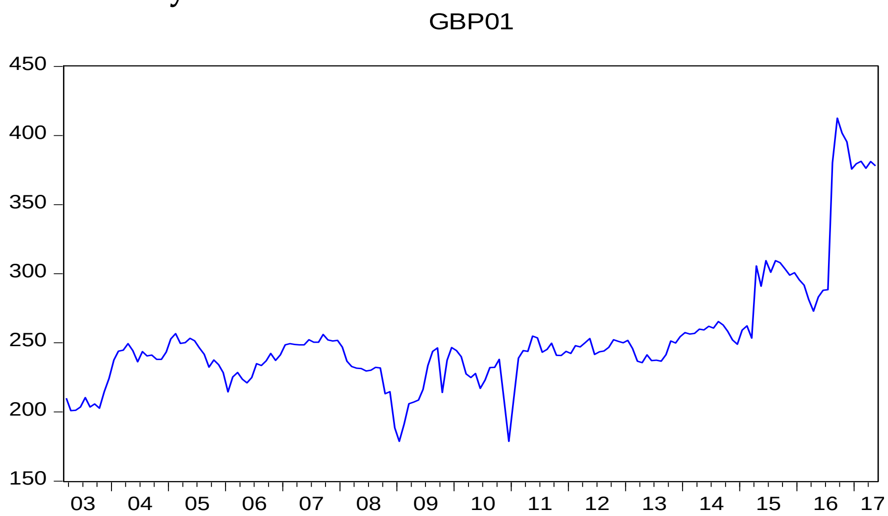

Figure 4.1: Trends in Monthly Exchange Rate Returns (March, 2003- May, 2017)

The Great Britain Pounds Sterling (GBP) time series graph demonstrates confirmation of volatility however not in here and there movement. The conversion scale month to month return display sharp increments with comparing diminishes. This demonstrates Pounds Sterling swapping scale inside this period under the examination will be volatile.

Differencing of the Variable

The differencing of the variable were done to enhance stationarity using Augmented Dickey Fuller and the outcomes are as show underneath;

Table 4.1: Augmented Dickey Fuller Test for Unit Root

Variable	Order of Differencing	ADFT	1%	5%	10%
Exchange Rate	1(0)	-0.813337	-3.468980	-2.878413	-2.575844
	1(1)	-11.89054	-3.469214	-2.878515	-2.575899

Source: Researcher's Computation

From the table 4.1 above the variable is stationary at the first difference (1(1)). The estimations of the information tried at stationary was utilized to gauge a relapse condition whose lingering generally called the arrival arrangement of the gauge where utilized as a part of plotting the beneath diagram.

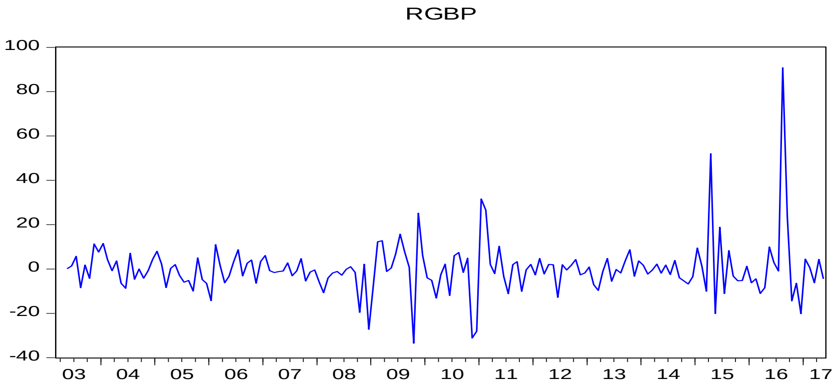

Figure 4.2: Graph of the Exchange Rate Return Series

Table 4.2: Descriptive Statistics of the Return Series

Variable	**Mean**	**Median**	**Max**	**Min**	**Std. Dev**	**Skewness**
Exchange Rate	-1.13e-18	-0.0021	0.2723	-0.1484	0.04619	1.3484
	Kurtosis		Jarque-Bera		Probability	
	12.7261		**717.4310**		**0.000**	

Source: Research Computation

Henceforth, from the table Jargue-Bera statistics value is 717.3410 genuine it is significant at 0.05% level of significance. This demonstrates that the Jarque–Bera demonstrates that trade return arrangement for this investigation is not typically conveyed. What's more, the skewness is not close to zero (it is 1.348423) and the Kurtosis is more noteworthy than 3. The alterative inferential measurements, for example, student – t test, normal distribution and generalized error distribution (GED), and so forth will be consolidated in the ARCH and GARCH models and the use of model selection becomes necessary.

Table 4.3: Test for ARCH Effect

Heteroskedasticity Test: ARCH	Lag 5
F-statistic	1.016721
Pro. F(5,158)	0.4097
Obs * R-squared	5.112171
Prob. Chi-square (5)	0.4023

Source: Researcher Calculation using Views Software Version 9.1

The consequence of the ARCH test was led in accordance with the ARCH LM test, propounded by Engle (1982),. The f-test measurement and Obs*R-squared in the table (4.3) demonstrates proof of ARCH impact in the development rate of Pounds Sterling utilized as the variable for the investigation, despite the fact that, it is not measurably huge at any level of centrality. Correspondingly, the test for different lags is ignored on the grounds that the lags tested here is sufficiently adequate for unpredictability demonstrating (Abdukareen *et al.,* 2016). Additionally, having affirmed that the variable displayed conduct which can be evaluated utilizing GARCH. We might in this way, appraise the information of the arrival arrangement utilizing GARCH family models with fixed and non-fixed parameter in the dispersion presumptions. Beneath table (4.4) demonstrates an estimated result of first order GARCH family models (Non-fixed parameters).

Table 4.4: Estimation Results of First Order GARCH Family Models (with Non - Fixed Parameters)

			Student's-t Distribution		Normal Distribution		Generalized Error Distributions		Min SIC Across Error Distribution
Models	**Equations**	**Model Parameter**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**	
	Mean	Intercept	0.01199	0.5191	0.002429	0.4943	0.001118	0.3175	
		AR	0.035940	0.6335	0.031051	0.7548	-0.095960	0.0041	
GARCH (1,1)		SIC	**-3.816914**		**-3.274599**		**-3.759037**		-3.816914
	Variance	Intercept	0.000746	0.2192	0.001387	0.0024	0.000511	0.1068	
		ARCH	0.763267	0.2927	0.207160	0.0410	0.538701	0.2150	
		GARCH	0.352004	0.0713	0.128680	0.6190	0.363283	0.1774	
	Mean	Intercept	0.000912	0.6235	-0.000233	0.9504	-0.001223	0.2791	
EGARCH(1,1)		AR	0.045309	0.5314	-0.109254	0.2119	-0.097767	0.0406	
		SIC	**-3.805415**		**-3.334743**		**-3.750098**		-3.805415
		Intercept	-1.980878	0.0230	-0.577314	0.0033	-1.531752	0.0809	
	Variance	ARCH	0.680222	0.0308	0.394670	0.0000	0.566168	0.0091	
		Asymmetric	-0.263597	0.1317	-0.316477	0.0004	-0.236966	0.1262	
		GARCH	0.744874	0.0000	0.943787	0.0000	0.816604	0.000	
	Mean	Intercept	0.000746	0.6970	0.000522	0.8904	-0.000929	0.3435	
		AR	0.058440	0.4231	0.078994	0.4215	-0.10435	0.0240	
		SIC	**-3.803403**		**-3.279762**		**-3.738617**		-3.803403
TGARCG(1,1)		Intercept	0.000672	0.1654	0.001170	0.0009	0.000435	0.1424	
		ARCH	0.256841	0.5405	0.018378	0.8561	0.231338	0.4706	
	Variance	Asymmetric	0.898530	0.3298	0.462746	0.0740	0.591354	0.3359	
		GARCH	0.383764	0.0780	0.233122	0.2810	0.446083	0.0839	

Source: Researcher's Computation using Eview Software Version

The above outcomes in table (4.4) are estimation results, of the first order GARCH (1,1) family show with non-fixed parameter. In the model, the ARCH co-efficient parameters are for the most part not huge at 5% level of hugeness aside from the block whose coefficients are importance at 1%, 5% and 10% separately level of significances. While GARCH (1,1) with student's t distribution have the base Schwartz information criterion of (- 3.816914) and it's instability at 111.5271%.

So also, the EGARCH (1,1) have all the coefficient of noteworthy at 5% level of huge. In spite of the fact that, the EGARCH (1,1) with typical and General Error circulation has negative coefficient of their catch and ARCH segment. This demonstrates the estimator has mean returning qualities, showing that instability stun is changeless. Additionally, the whole fluctuation condition segment is not measurably centrality at 1%, 5% or 10% level criticalness. Be that as it may, EGARCH (1,1) with student's t distribution having (-3.805415) minimum Schwartz data model and it's unpredictability effect is 142.1%.

Likewise, TGARCH (1,1) has every one of it's coefficients of the capture in the mean condition to positive aside from TGARCH (1,1) with Generalize error distribution whose intercept is negative (-0.000929) and the ARCH (-0.10435). In spite of the fact that, they are measurably huge at 5% level of noteworthiness separately. This uncover displaying trade utilizing TGARCH (1,1) with summed up mistake dispersion, negative part is in a mean returning circumstances demonstrating that unpredictability stun is lasting. Though in the difference condition parts, every one of the coefficients of the model parameters are altogether positive. Despite the fact that they are not all noteworthy at their different level of hugeness. Be that as it may, TGARCH (1,1) with the understudies-t distribution with the Schwartz information criterion (-3.8034303) was chosen the best fit.

Table 4.5: Estimation Results of First Order GARCH Family Models ((with Fixed Parameters at r = 5, 10 and 15)

			Student's-t Distribution (r = 5)		**Student's-t Distribution (r = 10)**		**Student's-t Distributions (r = 15)**		**Min SIC Across Error Distribution**
Models	**Equations**	**Model Parameter**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**	**Coefficient**	**P-Value**	
	Mean	Intercept	0.000842	0.6907	0.000369	0.8742	0.000118	0.9612	
		AR	0.040340	0.6184	0.031288	0.7187	-0.021031	0.8173	
GARCH (1,1)		SIC	-3.797139		-3.682786		-3.605530		-3.797139
	Variance	Intercept	0.000350	0.0125	0.000351	0.0046	0.000384	0.0030	
		ARCH	0.347671	0.0380	0.316714	0.0182	0.313877	0.0137	
		GARCH	0.355703	0.0359	0.367752	0.0183	0.375511	0.0137	
	Mean	Intercept	5.87E-05	0.9776	-0.000611	0.7920	-0.000847	0.7304	
EGARCH(1,1)		AR	0.049482	0.5126	0.018948	0.8098	-0.004860	0.9499	
		SIC	**-3.793734**		**-1.536875**		**-3.614281**		-3.793734
		Intercept	1.830289	0.0189	-1.536875	0.0117	-1.186570	0.0047	
	Variance	ARCH	0.461124	0.0008	0.414930	0.0000	0.385058	0.0000	
		Asymmetric	-0.195447	0.0308	-0.189412	0.0079	-0.201245	0.0015	
		GARCH	0.785418	0.0000	0.822883	0.0000	0.866921	0.000	
	Mean	Intercept	0.000319	0.8842	0.000170	0.9465	-0.000404	0.8835	
		AR	0.077118	0.3247	0.095404	0.2593	0.098352	0.2649	
		SIC	**-3.787979**		**-3.676887**		**-3.602120**		-3.787979
TGARCG(1,1)		Intercept	0.000352	0.0222	0.000468	0.0015	0.000560	0.0001	
		ARCH	0.100956	0.4934	0.065381	0.5666	0.052314	0.6145	
	Variance	Asymmetric	0.434819	0.1080	0.479472	0.0519	0.522689	0.0357	
		GARCH	0.398970	0.0469	0.301301	0.1031	0.262264	0.01168	

Source: Researcher's Computation using Eviews Software Version (9.1)

In table (4.5) over, the coefficients of the conditions display parameter's for the models are not factually noteworthy at the 5% level of criticalness. Every one of the coefficients in the mean conditions have positive sign demonstrating that swapping scale stun instability is transiently. This could be credited to changeability in the arrangement return. Additionally, in the difference condition parts of the ARCH coefficients for GARCH (1,1) with fixed parameter at r = 5, 10, is individually are for the most part positive and measurably noteworthy at the 5% level of centrality.

The outcomes that GARCH (1,1) with fixed parameter is mean returning (summing the ARCH and GARCH coefficient is less than one). In any case, the level of impact in GARCH (1,1) is assessed at 70.3374%, 68.4464% and 68.9388% individually. This demonstrates instability ingenuity was better than expected inside the period under this investigation. GARCH (1,1) with fixed parameter r = 5 with the Schwarz information criterion (-3.797139) was consider best fitted at this level, and this was supported by Olowe, (2009) findings.

Also, EGARCH (1,1) fixed parameter r = 15 demonstrates negative mean in the mean condition yet they are not all measurably huge at 5%. In this way, this confirmation that negative stuns increment swapping scale instability of the Pounds sterling. Likewise, the difference condition segment all have positive catch aside from EGARCH with fixed parameter (r = 10, 15) with the capture (-1.536875) and (- 1.186570) separately. This mean increment in swapping scale prompts relating increment in instability. Albeit, every one of the coefficients of the captures are noteworthy at 5% level of centrality. The ARCH part all have positive sign and are noteworthy at 5% level of critical while the Asymmetric segments all have negative noteworthiness at 5% level of hugeness. The negative sign show that the fluctuation of the arrangement recommended that the positive stuns infer a higher next period restrictive difference as against the negative sign.

Additionally, the EGARCH (1,1) parts all have positive and it is critical at 5% level of hugeness. Be that as it may, the level of effect is evaluated at 124.6542%, 123.7813% and 125.1979% utilizing EGARCH with fixed parameter r = 5, 10, 15 individually while EGARCH with fixed parameter r = 5 is chosen as the best fitted model with the esteem (- 3.793734). Furthermore, TGARCH (1,1) with fixed parameter r = 5, 10 and 15 was additionally considered of the block and shows they are not measurably critical at 5% level of centrality where as in the fluctuation condition every one of the captures positive coefficient with under 5% level of hugeness. Additionally, ARCH all have positive coefficient however they are measurably critical at 5% level of importance.

Model Selection (Best Fitted)

From the eighteen (18) models evaluated utilizing the request GARCH family demonstrate with fixed and non-fixed parameter in it's three mistake dissemination suppositions, three models were chosen on the premise of the Schwarz information criterion (SIC). The consequences of the three models chose are displayed in the table underneath.

Table 4.6: Results of the Estimated Model Selection (Best Fitted)

First Order GARCH Family Model	Error Distributions Assumptions	Set/Non-Set Parameters	SIC
GARCH (1,1)	Student's-t	Non-set parameters	-3.81914
GARCH (1,1)	Student's-t	Set Parameters at r = 5	-3.797139

Source: Researcher's Computation

Table 4.6 demonstrates that the model with the minimum Schwarz information criterion was considered for choice, in any case, GARCH (1,1) for non-fixed parameter in student's-t distribution have the slightest SIC, followed by GARCH (1,1) with fixed parameter at r = 5 in student's-t distribution.

DISCUSSION

The monthly exchange rate data for this study spans from 03/2003 – 05/2017 with the total data points of 169, conditional variance models were fitted to continually, compound monthly exchange rate. Eighteen (18) models was estimated using the order GARCH family model with set of parameters in its three error distribution assumptions.

In the estimation of the models, certain conditions where taken into contemplations and this incorporate the pattern showed by the variable, the ARCH impact, and the level of the primary request, GARCH family models. Be that as it may, the pattern displayed swings in a here and there development which is in accordance with Abdulkareem *et al.*, (2016) and this demonstrates a flimsy example of the arrangement. The level of determination of the primary request GARCH family display were additionally inspected, using percentage distribution.

The results obtained were reflected in the discussions on the respective tables. Also, the models were selected base on their fitness using the SIC. However, GARCH (1,1) in student's-t error distribution for non-fixed parameter with the minimum SIC of -3.816914 and its volatility impact 111.5271 was considered best fitted, followed by GARCH (1,1) in student's-t with fixed parameter at r = 5, SIC -3.797139 and volatility impact 70.3374. All these supported and confirmed the findings of Olowe, (2009).

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DATA ON NAIRA/ POUNDS STERLING EXCHANGE RATE FROM MARCH 2003-MAY 2017

032003	2004	2005	2006	2007	2008	2009	2010
209.9955	224.3431	243.3399	228.3847	241.2363	251.8566	188.5753	246.5881
200.9329	237.6349	252.7643	214.575	248.5644	246.9395	178.8018	244.3407
201.2191	244.0107	256.7061	225.329	249.3899	236.7878	191.205	240.0033
203.573	244.7712	249.6398	228.6525	248.8474	232.9075	205.9846	227.507
210.4556	249.4665	250.2402	223.68	248.5526	231.7032	207.107	224.8673
203.5847	244.4235	253.258	220.9951	248.5526	231.4289	208.6278	227.8043
205.773	236.2476	251.5389	224.8917	252.2849	229.5722	216.3113	217.0849
202.714	243.5963	246.3994	234.8945	250.5031	230.2052	233.6344	223.151
214.6949	240.5165	241.7703	233.6113	250.5031	232.257	243.7518	232.0686
	241.1878	232.3839	237.061	256.1253	231.8276	246.3388	232.2505
	238.0579	237.5499	242.3669	252.1554	213.1882	214.0415	238.1117
	237.988	234.1988	237.3376	251.3745	214.6686	237.4209	208.4568

2011	2012	2013	2014	2015	2016	052017
178.8018	243.7811	250.0883	254.3998	249.01	300.7008	375.71
208.8615	242.3366	251.8645	257.4811	259.15	295.5985	379.49
238.9212	247.9191	245.9135	256.39	262.25	291.7176	381.39
244.4643	247.1015	236.6621	256.79	253.4616	281.2963	376.32
243.7957	250.0216	235.6186	259.96	305.6922	272.9632	381.17
254.9788	253.1215	241.2412	259.34	290.969	283.1678	378.13
253.5003	241.5683	237.1297	262.06	309.5069	287.9746	
243.1828	243.4535	237.5188	260.72	300.9766	288.4277	
245.2799	244.1701	236.7085	265.41	309.5069	380.2105	
249.7226	246.8339	241.3813	262.84	308.0292	412.4714	
240.9441	252.2546	251.4272	258.25	303.5376	401.778	
240.7907	251.0062	249.9499	252.05	298.9307	395.4209	

Source: Central Bank of Nigeria (www.cbn.gov.ng)