NAIRA OPTIONS PRICING AND EXCHANGE RATE VOLATILITY IN NIGERIA

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Abstract: *Volatility is the key ingredient for the pricing of assets and derivative securities. This study pursues this reasoning for the exchange rate conditions in Nigeria based on the Black and Sholes option pricing model. The effect of naira option pricing on the volatility of the naira exchange rate is investigated in the study. The implications of different pricing strategy of the naira across the official, interbank and Bureau de Change (BDC) markets are examined. In the empirical analysis, the role of risk-free rate, and the differentials in different market pricing of the naira were shown to have strong and significant impacts on exchange rate volatility in Nigeria. While risk-free rate was shown to be stabilizing in the market, the differentials between official and other market rates of the naira had strong exacerbating effects on the volatility of exchange rate. Thus, the study demonstrates that when there are diverse pricing options for the naira, the exchange rate tends to be highly unstable in Nigeria.*

Keywords: *Naira Options Pricing, Exchange Rate Volatility, ARCH, EGARCH, Unit Root*

1. Introduction

An analysis of exchange rate movements is important because there is a growing body of evidence that highlights the significant role they play in macro-economic stability and economic growth. Exchange rate is a very important macro-economic variable and getting it right in a developing country has turned out to be one of the main challenges faced in macro-economic policy design in recent times. In this direction, stability of the real effective Exchange rate (REER) is a significant factor in in driving foreign trade and international capital inflows. Thus, Edwards (1994) has noted that real exchange rate behaviour occupies a central role in policy evaluation and design especially in the less developed countries. Moreover, since the real exchange rate is the price of foreign goods in terms of domestic goods (see Blanchard, 2006), the real exchange rate plays a crucial role in guiding the broad allocation of resources in the domestic economy between foreign and domestic goods.

Given the above, it is of utmost importance for the monetary authorities to monitor and facilitate the pricing of a country's currency, especially when it is a small-open economy. However, the pricing options of the naira has not always been done in well-articulated systems. Many factors have led to different pricing regimes of the naira over time. In the early 1980s, for instance, the declining economic fortune of many sub-Saharan African countries including Nigeria was attributed to over-valued exchange rates. Given that currency over-valuation leads to a reduction in profits in the tradable goods sector, declining investment and adverse trade balance which may lead to currency crisis (Xiaopu, 2002), the economic position of the country I the 1980s was weak.

These potential weaknesses of currency over-valuation informed the adoption of the Structural Adjustment Programme(SAP) in 1986 in Nigeria. As Sanusi (2007) noted, one of the main objectives of

SAP was to put in place a realistic and stable exchange rate for the Naira. The new policy did not quite achieve the target of exchange rate stability. Rather, the Naira exchange rate depreciated and also fluctuated throughout the post SAP era. Following the adoption of SAP, the monthly nominal exchange rate of the Naira to the Dollar depreciated from N3.18 in December 1986 to N8.7 by December 1990. This began the era of large naira exchange rate swings that has continued till date in Nigeria. Indeed, the real effective exchange rate has since appreciated to N80.61 in December 2012 from N90.38 in December 2008 and has reached N86.16 in December 2016 (CBN, 2017).

Several factors may be responsible for the instability in the Naira exchange market. Obadan (2006) highlighted factors including, inadequate foreign capital inflow, unguided trade liberalization policy, weak export base, expansionary monetary and fiscal policies, import dependent production structures, fluctuations in crude oil prices and earnings and demand-supply foreign exchange gaps. To address the problem of frequent fluctuations in the naira exchange rate, the CBN deregulated the rate in the early 1990sand included a parallel market for the foreign exchange in Nigeria. There were therefore three tiers of markets in the foreign exchange market in Nigeria, namely, the first tier, the second tier and the third tier (made up of the parallel market participants). The aim was to ensure easy flow of foreign exchange in the economy. The proliferation of markets has however led to different pricing strategies of the naira at the different markets. These phenomena have further increased susceptibility of the naira exchange rate to deep fluctuations (Obadan, 2006). For instance, Sanusi (2004) noted the "fraudulent activities of some commercial banks that engage in ''round-tripping'', a situation in which banks buy foreign exchange from the CBN at official rates and sell to parallel market operators outside stipulated official prices" (p.14).

From the foregoing, there are strategic issues with option pricing in the naira exchange market in Nigeria which requires further analysis of its implication for the stability of the naira. On the one hand, the pricing mechanism by banks and other importers has a strong effect on the behaviour of the exchange rate over time. On the other hand, parallel market pricing strategies may portend risks for exchange rate stability at any given time. As Manzur, Hoque and Poitras (2010) noted, volatility is the key ingredient for the pricing of assets and derivative securities. It has direct implications for risk-return tradeoff driving portfolio decision-making and financial risk management (see Andersen, Bollerslev, Diebold& Labys, 2003).

Following the seminal work of Black and Scholes (1973) and Merton (1973), volatility modeling has progressed significantly. However, its applications, particularly in currency options pricing, remain patchy.In this study therefore, the effect of naira option pricing on the volatility of the naira exchange rate is examined. The goal is to investigate how different pricing strategy of the naira differ across the official, interbank and Bureau de Change (BDC) markets. The study also considers the relative roles that currency markets returns and the risk-free rate play in explaining exchange rate fluctuations in Nigeria.

2. Overview of Nigeria and Foreign Exchange Market

Nigeria is an oil producing country which depends on its oil income for most of its federal revenue. The share reached 80 percent in 2008 (Central Bank of Nigeria, 2011). Following the SAP implementation in 1986, Nigeria shifted to a managed float regime, but this was a de facto dual market system consisting of an official rate and a market rate while pursuing integration. The black market flourished rate and the market rate widened. Suffering from radical economic adjustment and economic stagnation as a result of cuts in public expenditures, domestic criticism of the SAP peaked, forcing the government to retreat from the SAP and re-introduce a fixed exchange rate regime in 1994. The next year, Nigeria again shifted to a managed float regime and established an Autonomous Foreign Exchange Market to boost the integration of exchange rate.In 2002, the Central Bank introduced a Dutch Auction System, and since then, the auction system has been modified and extended several times in response to economic conditions.

3. Currency Options: Patterns and Directions

Currency options have gained acceptance as invaluable tools in managing foreign exchange risks and volatility in many countries. They are extensively used to bring a much wider range of hedging alternatives as a result of their unique nature. Options are fundamentally different from forward contracts, as whereas the parties are committed or 'locked-in' to a future transaction in a forward contract, the buyer (holder) of an option contract has the right, but not the obligation to complete the transaction at some time in the future. Options are attractive financial instruments to portfolio managers and corporate treasuries because of this flexibility. Options contracts Simply stated, an option contract is a choice. The holder of the option has the right but not the obligation to buy or sell a fixed amount of currency at a fixed rate of exchange at a predetermined date in the future. It is entirely up to that buyer whether or not to exercise that right (that is take up the right of the option), only the seller of the option is obligated to perform (Manzur et al, 2010).

The option holder (buyer) can therefore choose the better price – either from the prevailing market price at the time, or the price specified in the option. An option can be regarded as a form of insurance; if the market moves against you, you will be protected and can still take advantage of better prices should the market move in your favour. Two types may be bought and sold: Call options give the buyer the right to buy the underlying currency. The holder of a call option has the right to buy the underlying currency, while the seller of the call option has the obligation to sell the underlying currency if and when the holder thereof takes up the right. Put options give the buyer the right to sell the underlying currency. As noted by Kemme and Roy (2006), the holder of a put option has the right to sell the underlying currency, while the seller of the put option has the obligation to buy the underlying currency if and when the holder thereof takes up the right. In a foreign exchange transaction, one currency is bought, while another is simultaneously sold.

As Andersen, Bollerslev, Diebold& Labys(2001) noted, an option to buy US dollars against the naira (USD Call) is an option to sell naira against the US dollar (naira Put). In every foreign exchange transaction, one currency is purchased and another currency is sold. Consequently, every currency option is both a call and a put. Importers: Buy call If either option is exercised, Client buys currency Sell put Exporters: Buy call If either option is exercised, Client buys currency Sell put Currency options may be quoted in one of two ways: American terms, in which a currency is quoted in terms of the US dollar per unit of foreign currency; and European terms, in which the US dollar is quoted in terms of units of foreign currency per US dollar. A European style option may be exercised on the expiration date of the option only, while American style options may be exercised at any time up to and including the expiration date (Andersen et al., 2003).

4. Methodology

The analytical research design is used in the empirical investigation in this study.This essentially involves estimation of econometric coefficients regarding the implications of different pricing options in the different market for the naira in Nigeria. From this, inferences are made concerning the nature of the sampled data and the relationships hypothesized for the study. The study employs monthly time series data covering the period 2004 and 2016. This is the period within which the naira exchanged rates stabilized a bit (following the debt forgiveness deal in 2005) and when the naira experienced one of the most emphatic fluctuations (in 2007-2009, and in 2016). Emphasis is based on the real effective exchange rate (REER) in Nigeria. The goal is to explain how various pricing of the naira currency has affected the volatility of the naira over the period.

4.1 Model Specification

The objective of this study is to examine the main relationships the pricing strategy of the naira and exchange rate volatility in Nigeria. This pattern of investigation indicates that a function that relates real effective exchange rate with the pricing of the naira in different exchange markets in Nigeria. In selecting the model for pricing currency options techniques, we modify the strategy by Manzur, Hoque

and Poitras (2010). Since the return to holding a foreign security is equivalent to a continuously paid dividend on a stock, the Merton (1973) version of the Black-Scholes (BS) model can be applied to foreign security. To value currency options, various prices in the domestic foreign exchange markets are substituted for exchange rates in the country.

Thus, it is argued in this study that the way the naira is priced in different markets tends to affect the pattern of movement of the naira exchange rate to the US dollars. The various markets from which the naira exchange rate can be determined include the official market, the inter-bank market and the Bureau de Change (BDC) market. Thus, the differences between the naira exchange rates in these markets and that of the official rate cab explain the volatility of the naira exchange rate for the period of the study. The model specified therefore indicates that exchange rate volatility (*reerv*) depends on difference between the interbank exchange rate and the official rate (*intbdiff*) and the difference between the BDC rate and the official exchange rate (*bdcdiff*). Since gains from holding the naira is a form of capital gain for the participants in the market the rates of the naira exchange present certain risks to the market participants. We therefore show in this study that a comparison between the risk-free rate (*rfr*) and the exchange rate also determines volatility of the naira-dollar rate. The model specified is therefore based on a modified Black and Scholes (1973) model as modified by Manzur et al (2010). The model is specified in functional form as:

$$reerv = f(reerv_{t-1}, intdiff, dbcdiff, rfr) \quad (1)$$

In the equation, a lagged exchange rate variable is included on the right-hand side since we intend to determine the extent to which volatility in the exchange rate is persistent over time.

4.2 Method of Data Analysis

Real effective exchange rate volatility is a short term factor that requires dynamic modeling. Due to the nature and objectives of the study, a dynamic framework is devised for the empirical analysis. In the same vein, a major aspect of the study is to investigate whether pricing options of the naira are transmitted into exchange rate volatility.Based on this structure within the study,the estimation of effective exchange rate volatility is performed by means of the autoregressive conditional heteroskedasticity (ARCH) technique. Particularly, the impact of pricing on exchange rate volatility is estimated using the Exponential Generalised autoregressive conditional heteroskedasticity (EGARCH) technique. This method was developed by Bollerslev, Chou and Kroner (1992) and it measures the conditional variation in the dependent variable based on changes in the explanatory variables. In this regard, the EGARCH model better captures the essence of this purported relationship between exchange rate volatility and naira pricing in the market. In developing an ARCH model, two distinct specifications are considered - one for the conditional mean and one for the conditional variance. Moreover, a model with a first-order EGARCH term and a first-order ARCH term (i.e., EGARCH [1,1]) is specified because of its simplicity. The EGARCH model is specified as:

$$reer_t = \lambda_0 + \lambda_1 reer_{t-1} + \varepsilon_t \quad (2)$$

$$\log(\sigma_t^2) = \omega + \beta \log(\sigma_{t-1}^2) + \alpha \left(\left| \frac{\epsilon_{t-1}}{\sigma_{t-1}} \right| - \sqrt{\frac{2}{\pi}} \right) + \gamma \frac{\epsilon_{t-1}}{\sigma_{t-1}} \quad (3)$$

Equation (2) is the mean equation and (3) is the variance equation.The mean equation is written as a function of exogenous variables (in this case, the lag of reer) with an error term. σ_{t-1}^2 is the conditional variance because it is the one-period ahead forecast variance based on past information. The conditional variance equation specified in (3) is a function of four terms:

- The mean: ω
- News about volatility from the previous period (the ARCH term which has α as coefficient).
- Last period's forecast variance: σ_{t-1}^2 (the GARCH term).
- The leverage effect (with coefficient of γ) which measures the level of asymmetry in the model.

In this model the focus is on the conditional variance equation in the EGARCH. It is hypothesized that

the differentials in the pricing options for each of the markets for the naira set up volatility in exchange rate in Nigeria. Thus, the conditional variances or volatility over time in exchange rate depends on interbank exchange rate and the official rate (*intbdiff*) and the difference between the BDC rate and the official exchange rate (*bdcdiff*) and risk free rate (*rfr)*. Therefore, the conditional variance equation is re-specified as:

$$\text{Log}(\sigma_t^2) = \omega + \beta \log(\sigma_{t-1}^2) + \alpha\left(\left|\frac{\epsilon_{t-1}}{\sigma_{t-1}}\right| - \sqrt{\frac{2}{\pi}}\right) + \gamma\frac{\epsilon_{t-1}}{\sigma_{t-1}} + \varphi_1 intbdiff + \varphi_2 bdcdiff + \varphi_3 rfr \quad (4)$$

Based on the results from the estimation of this EGARCH model, the volatility of exchange rate would be explained based on changes in the foreign capital variables.

5. Data Analysis

The descriptive statistics for the variables in the study are shown in Table 1 below. All the various patterns of exchange rate pricing in Nigeria are presented in the Table along with the returns to the official, inter-bank, and BDC naira exchange rate markets. The risk-free rate (measured as the Treasury Bill rate - *rfr*) is also included. The Table shows that of the exchange rates in the the different markets (official – *neer* and *reer*, interbank – *interbank*, and BDC – *bdc*) in the Table, the BDC rates have the highest average value (as expected) with 171.77 rate over the period, while the real effective exchange rate has the least average value of 136.88. This shows that there is general tendency for the unofficial exchange rate market to over price the naira at any given period. In terms of returns to exchange rate pricing in each of the markets, that of BDC is also highest, with 78 percent (0.78) while that of official rate is lowest, and actually negative at (-0.02). This implies that gains from participation in the exchange rate market for the BDC is the highest in Nigeria. This could spur more volatility in the real exchange rate market for Nigeria since activities of arbitragers could be intensified with large differences in the pricing mechanisms of the different markets. This case is strengthened when the maximum and minimum values of the returns in all of the markets is considered. From the Table, it can be seen that while returns to exchange rate pricing in the official market has a minimum value of -6.05, that of BDC has a high minimum value of -10.1. The Table also shows that, apart from the returns to pricing in the BDC market, the risk-free rate is higher than returns to currency markets using the more official rates.

Table 1: Descriptive Statistics

	Mean	Max.	Min.	Std. Dev.	Skewness	Kurtosis	J-B	Prob.
reer	136.88	162.81	98.64	17.03	-0.36	1.86	11.74	0
neer	154.76	309.73	117.72	37.21	2.55	10.61	546.50	0
interbank	156.17	309.73	116.79	37.34	2.43	10.10	481.22	0
bdc	171.77	462.03	118.70	65.23	2.75	10.55	568.06	0
rofficial	-0.02	30.01	-6.05	3.65	4.19	32.55	6131.75	0
rinterbank	0.55	27.10	-3.22	3.13	5.72	42.26	10870.75	0
rbdc	0.78	15.58	-10.10	3.59	1.26	7.12	151.61	0
inbdiff	1.41	14.74	-1.13	2.49	2.70	11.50	658.60	0
bdcdiff	17.01	156.82	0.34	31.70	3.03	11.35	691.43	0
rfr	9.07	15.48	1.04	3.71	-0.17	2.20	4.94	0.08

Unit Root and Cointegration Analysis

Generally, unit root tests involve the test of stationarity for variables used in regression analysis. The importance of stationarity of time series used in regression borders on the fact that a non-stationary time series is not possible to generalize to other time periods apart from the present. This makes forecasting based on such time series to be of little practical value. Moreover, regression of a non-stationary time series on another non-stationary time series may produce spurious result.The Augmented dickey Fuller (ADF) test is employed in order to analyze unit roots. The results are presented in levels and first difference. Table 2 presents results of ADF test in levels without taking into consideration the trend in variables. The reason for this is that an explicit test of the trending pattern of the time series has not been carried out. In the result, the ADF test statistic for each of the variables is shown in the second column, while the 95 percent critical ADF value is shown in the third column. The result indicates that all the variables,have ADF values that are less than the 95 percent critical ADF value of -2.9467. The implication of this is that the time series are non-stationary in their levels.

Table 2 Unit Root Test for Variables in Levels

Variable	ADF Test Statistic	95% Critical ADF Value	Remark
reer	-2.642	-2.991	Stationary
Δntbdiff	-1.759	-2.991	Non-stationary
bdcdiff	-1.545	-2.991	Stationary
rfr	-1.129	-2.991	Non-stationary

Box and Henkins (1978) have argued that non-stationary time series in levels may be made stationary by taking their first differences. The result of the unit root test on these variables in first differences is reported in table 3 below. From the result, it is seen thatthe ADF test statistic for each of the variables is greater than the 95 percent critical ADF values (in absolute values). With these result, these variables are adjudged to be stationary. This implies that the three variables that were initially non-stationary are actually difference-stationary, attaining stationarity after the first differences of the variables. Thus, we would accept the hypothesis that the variables possess unit roots. Indeed, the variables are integrated of order one (i.e. I[1]).

Table 3 Unit Root Test for Variables in First Difference

Variable	ADF Test Statistic	95% Critical ADF Value	Remark
Δreer	-4.333	-2.991	Stationary
Δintbdiff	-3.687	-2.991	“
Δbdcdiff	-5.899	-2.991	“
Δrfr	-4.148	-2.991	“

We also perform a cointegration test to determine the long run properties of the data for the exchange rate market. Having established that the series in the analysis are all I(1) variables, possessing unit roots, we move on to determine if they are cointegrated. The Engle and Granger two stage cointegration method is used. from the stationarity test for the residuals reported in Table 4, it can be seen that the residuals are stationary levels. Thus, the null hypothesis that the residuals have a unit root

is rejected. The implication of this is that a long run relationship exists among the variables.

Table 4: Cointegration Test Result

Null Hypothesis: residuals has a unit root

Exogenous: Constant

Lag Length: 4 (Automatic - based on SIC, maxlag=5)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.664921	0.0016
Test critical values:	1% level	-3.808546	
	5% level	-3.020686	
	10% level	-2.650413	

*MacKinnon (1996) one-sided p-values.

The Empirical Analysis: EGARCH Results

The results of estimating the EGARCH model as stated in Chapter three is presented in Table 5. The mean equation shows that the impact of lagged exchange ratevolatility is significant at 1% level of significance confirming the correctness of adding the variable to correct for autocorrelation in the stock return series. The result also shows that, with a coefficient above one, there seems to be a very long delay for the naira exchange rate to return to its long run position after any shock. Thus, exchange rateshocks are seen to be persistent over time. Any volatile movement in exchange ratetakes time to be restored. The diagnostic statistics of the results are quite impressive. The adjusted R squared value of 0.908 reveals that over 90 percent of the systematic variations in exchange rateis determined by the two explanatory variables in the mean equation. This demonstrates the predictive ability of past exchange ratein the stock price equation. The F-value of 56.3 is very high and easily passes the significance test at the 1 percent level, implying that we cannot reject the hypothesis of a significant relationship between exchange rateand the independent variables in the mean equation.

Table 5: The EGARCH Results

Variable	**Co-efficient**	**z-Statistic**	
Mean Equation			
Constant	-1.193	-0.653	0.51
reer(-1)	1.006	77.53	0
Variance Equation			
ω	0.693	1.724	0.08
α	0.539	2.808	0.01
γ	-0.032	-0.342	0.73
β	0.667	5.270	0.00

Risk free rate	-0.062	-2.969	0.00
BDC option	0.012	3.579	0.00
Interbank option	0.074	3.246	0.00
Adj.R^2 = 0.908		F = 56.3	DW = 1.64

The equation of interest is that of the conditional variance which measures the effects of each of the variables on exchange rate volatility. The results of the conditional variance equation are presented in the second section in table 5. In particular, the coefficients of each of the factors hypothesized to explain exchange rate volatility are significant. From the results, it is seen that the coefficient of risk-free rate is negative and passes the test at the 1 percent level. This implies that the rate tends to reduce volatility in the exchange rate in Nigeria. The higher the risk-free rate, the less the volatility in the exchange rate market. This result is plausible since exchange rate returns has a trade-off relationship with risk free rate. When the rates are high, investors would prefer to involve in this market than in the holding highly risky naira-dollar currency.

On the other hand, the coefficients of differentials between the official exchange rate and the other rates from the market are significant and positive. This shows that these differentials have significant positive impacts on exchange rate volatility in Nigeria. The higher the differentials, the higher the volatility of the exchange rate. Surprisingly, the coefficient of interbank options differences is higher than that of the BDC differentials, suggesting that interbank pricing of the naira exchange rate has stronger distabilising impact on the exchange rate than that of BDC. In general, the proliferation of exchange rate market and pricing techniques in Nigeria is shown to have significant volatility impacts on the naira exchange rate.

The mean term in the result (ω) is positive but fails the significance test at the 5 percent level. This shows that generally, the position of exchange rate market at any given period has weak effect on its pattern of volatility. This implies that the market is inherently stable; only external factors tend to cause volatility in the naira exchange rate market. The leverage effect (γ) in the output however fails the significance test at the 5 percent level (considering the p-value of 0.73) and it has a negative sign. Based on this result, there appears to be no asymmetric effect in the naira exchange rate. Indeed, negative information in the market does not appear to be destabilising since γfails the test. This underscores the initial finding of internal stability of the naira exchange rate.

The α parameter represents a magnitude effect or the symmetric effect of the model, the "GARCH" effect. The coefficient of this term passes the significance test at the 5percent level. This shows that there is actually a strong tendency of the naira real exchange rate to gain an upward movement at any given shock. The parameter β measures the persistence in conditional volatility irrespective of anything happening in the market (see Alexander, 2004). The coefficient is large at 0.66 and passes the test at the 1 percent level. This shows that for the Nigerian currency market, any disequilibrium in the market will persist for a long period and would require external forces to bring it bank to long run stability. This was demonstrated in the exchange rate crisis that resulted from the 2016 recession in the economy. It took intervention of the CBN in order to restore stability over time.

Diagnostic Results for EGARCH Results

The diagnostic tests for the EGARCH model are considered in order to ascertain the appropriateness of the use of GARCH in this study. The Ljung-Box Q-statistics and their p-values are shown in table 6 below. The Q-statistic at lag k is a test statistic for the null hypothesis that there is no autocorrelation up to order k (the lag order of 12 is selected in this study). In the test above, all the lags have Q-statistics whose probabilities are higher than the 5 percent level. Hence, they all fail the significance test at the 5 percent level. This implies that we cannot reject the null hypothesis that the series are not serially correlated for the lag period of 12months. The presence of long term

autocorrelation in the naira-dollar exchange rate emphasizes the ability of disequilibrium to be self-re-enforcing in the market. Indeed, in the absence of external stabilization force, the exchange rate disequilibrium can last for up to 12 months (or one year) in Nigeria, especially when different pricing options are available.

Table 6: Ljung-Box Q-statistics

Lag (months)	Q-Stat	Prob
1	0.1834	0.668
2	1.5352	0.464
3	1.5372	0.674
4	1.6081	0.807
5	1.6981	0.889
6	2.5397	0.864
7	4.3179	0.743
8	5.9421	0.654
9	8.5861	0.476
10	9.9736	0.443
11	11.776	0.381
12	14.866	0.249

Source: Author's computations

The ARCH test, which is presented in Table 7 shows that the F-value and the R-squared values both fail the 5 percent significance F-test and Chi-square test respectively. We would therefore conclude that the EGARCH model effectively and satisfactorily eliminates any serial correlation in the series.

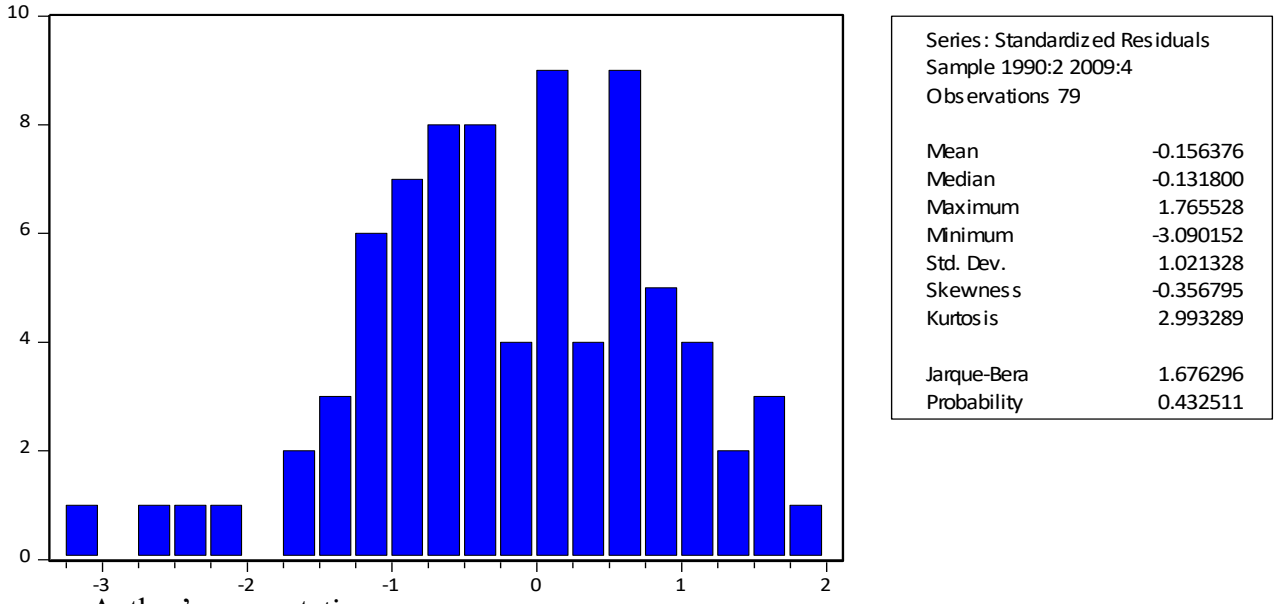
Table 7: ARCH Test

F-statistic	0.621526	Probability	0.648665
Obs*R-squared	2.572324	Probability	0.631734

Source: Author's computations

In figure 2 below, the ARCH test is also presented in the Histogram format. The result shows sufficient signs of normality in the chart for the EGARCH residual estimates (since the histogram I generally bell-shaped). This confirms the absence of serial correlation in the model, as seen in the Jarque-Bera statistic value in the chart description.

Fig. 1 : Histogram Test ARCH Test



Source: Author's computations

6. Conclusion

Volatility is a key parameter in currency option pricing. This is the main goal of this study where the effect of naira option pricing on the volatility of the naira exchange rate is examined. Generally, the Manzur et al (2010) analysis is extended and modified for the Nigerian case in this study using monthly data for the naira-dollar exchange ratein Nigeria. Indeed, it is noted that different pricing strategy of the naira differ across the markets in Nigeria, including official, interbank and Bureau de Change (BDC) markets. The study also considers the relative roles that currency markets returns and the risk-free rate play in explaining exchange rate fluctuations in Nigeria. After a brief review of the trends in exchange rate in Nigeria, the empirical analysis was performed.

In the empirical analysis, the role of risk-free rate, and the differentials in market pricing of naira exchange rate were shown to have strong and significant impacts on exchange rate volatility in Nigeria. While risk-free rate was shown to be stabilizing in the market, the differentials between official and other market rates of the naira had strong exacerbating effects on the exchange rate. Thus, the study demonstrates that when there are diverse pricing options for the naira exchange rate, the rate tends to be highly unstable in Nigeria.An interesting direction for future research is to explicitly account for non-linear features in the realized volatility and determine if this improves the volatility forecasts for currency options.

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