

Impact of Some Key Macro-Economic Variables on Stock Prices in Nigeria

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ABSTRACT: This work examines the impact of macroeconomic variables on stock market prices in Nigeria: 1987 – 2018. The study was carried out using secondary data obtained from the Central Bank of Nigeria Statistical Bulletin, Nigerian Stock Exchange Reports, and Annual Statistical Bulletin Reports of the National Bureau of Statistics. The main findings of the study reveal that stock prices in Nigeria are volatile in nature; rising and falling rapidly in successions. The GARCH model indicated a significant ARCH term in the analysis, suggesting that news or information in the market causes fluctuation in the prices. Also, the previous quarter volatility of all share indexes in the market also has a great effect and influence on present quarter stock price volatility in Nigeria. In this study, it has been shown that only interest rate, among the monetary and real sector variables, exerts pressure on the stock prices in Nigeria. The analyses demonstrate that the Nigerian stock market is actually an emerging one where a strong competition is beginning to develop between the stock market and the other financial sector in terms of their instruments.

KEYWORDS: GARCH, ARCH, Volatility Clustering, Financial Crisis

I. INTRODUCTION

The Nigerian economy has experienced mixed macro-economic performance over the years as the economy is tied to international crude oil price which is largely unstable. Between mid-70s and early 80s, the economy experienced boom due to rise in the price of oil while between 1983 and 1990, the Nigerian economy was in crises arising from fall in the price of oil, and this necessitated economic reform and adoption of the structural adjustment program (SAP). In 1986, this reform contributed to the development of the financial market in Nigeria as there was deregulation. Again, there was another boom between 2001 and 2006 but this was however truncated by the global financial crises of 2008 which affected the stock market negatively and indeed the overall performance of the economy. A study identifies high inflation, interest rates and degree of volatility in exchange rates, to be significant in Nigeria, as a result of large structural fiscal deficits, erratic monetary and exchange rates policies[1]. These conditions affect the stability of business environment and increase return variability of operating firms. These have implications on stock prices. Generally, there is consensus among macroeconomists that stock market prices are driven by macroeconomic variables. Moreover it is also agreed that the linkage is two ways, that is, feed-back exists between the stock market and the real activity. In Nigeria, the influence of some macroeconomic variables is not fully reflecting in the activities of the Nigerian stock exchange especially since the 2008 global economic meltdown that affected stock markets all around the globe. The Monetary authority has tried to peg all the monetary variables (MPR rates, exchange rate and Money supply) so as to influence the financial markets but there has been no significant effect on the stock exchange market. This adversely affected the growth of ASI in the stock market and returns. Thereafter the rate stabilizes in 2010, from N 150.30 per US Dollar, a depreciation of 0.9 per cent compared to the level in 2009 [2]. However this does not fully reflect in the movement of ASI due to the eroded confidence of investors since the global financial crisis in 2008.

II. RELATED WORK

A number of studies have been conducted to investigate the impact of macroeconomic variables on the stock market in Nigeria using GARCH method [3, 4, 5, 6,]. The findings revealed conflicting results on the effect of interest rate, exchange rate, and inflation rate on the stock market prices. Given that economic activities in Nigeria have been changing and that macro-economic variables have taken different values over the years alongside stock prices, the main aim of this study, therefore, is to examine the impact of some key macro-economic variables such as gross domestic products, exchange rates, interest rates and inflation rates volatility on stock prices and to determine the magnitude and direction of their influence on stock prices in Nigeria. Also, this work estimated if a long run relationship exists between the macroeconomic variables and the stock market prices in Nigeria.

Muhammad et al. [7] conducted a study on the relationship between stock prices and exchange rate in four South Asian countries; Pakistan, India, Bangladesh and Sri-lanka for the period 1994 to 2000. The study employed co-integration, vector error correction modeling techniques and standard Granger causality tests to examine the long run and short run association between stock prices and exchange rates. The result of the study showed no short run association between the variables for all the four countries. There was no long run relationship between stock prices and exchange rates for Pakistan and India as well.

Courage et al. [8] investigated the effects of exchange rate volatility on the stock market in South Africa, using GARCH model for the period 2000 to 2010. The study used market capitalization as proxy to stock market prices. The result found very weak relationship between currency volatility and the stock market

Demirhan et al. [9] investigate the causal relationship between stock prices and exchange rate, using data from 23rd February 2001 to 11th January 2008 about turkey. The reason for using this period is that exchange rate regime is determined as floating in this period. The result of empirical study indicates that there is bi-directional causal relationship between exchange rate and all stock market indices.

Serkan [10] investigates the role of macroeconomic factors in explaining Turkish stock returns. He employs macroeconomic factor model for the period July 1997 to June 2005. The macroeconomic variables considered are growth rate of industrial production index, change in consumer price index, growth rate of narrowly defined money supply, change in exchange rate, interest rate and growth rate of international crude oil prices. He finds that exchange rate and interest rate seems to affect all the portfolio returns, while inflation rate is significant for only three out of the twelve portfolios. Also, industrial production, money supply and oil prices do not appear to have significant effect on stock returns in Turkey.

Vuyyuri [11] investigates the co-integrating relationship and the real sectors of the Indian economy using monthly observations from 1992 to December 2002. The financial variables used were interest rates, inflation rates, exchange rates, stock return, and real sector was proxy by industrial productivity. Johansen's (1988) multivariate co-integration test supports the long-run equilibrium relationship between the financial sector and the real sector, and the Granger test shows unidirectional Granger causality between the financial sector and real sector of the economy.

Kandir [12] investigates the role of macroeconomic factors in explaining Turkish stock returns from July 1997 to June 2005. Macroeconomic variables used were growth rate of industrial production index, changes in consumer price index, growth rate of narrowly defined money supply, change in exchange rate, interest rate, growth rate of international crude oil price and return on the Morgan Stanley capital International (MSCI) world Equity Index. The analysis was based on stock portfolios rather than single stocks. He finds that exchange rate, interest rate, and world market return seem to affect all of the portfolio returns, while inflation rate is significant for only three of the twelve portfolios. On the other hand, industrial production, money supply and oil prices have no significant effect on stock returns.

III. DATA

Nigerian Stock Exchange (NSE) All Share Index (ASI) was used to measure the stock market trends and performance. The sample period spans from 1987 to 2018, consisting of 123 quarterly data for each variable. This period is important because it marks the times Nigerian government embarked on Structural Adjustment programme (SAP) which made Nigerian Stock Market became more accessible to the international community around this period. This is an important consideration since the exchange rate is one of the four macroeconomic variables. This will enable the investigation of the extent to which the economy has achieved the cardinal objective of exchange rate stability. The time series data set was sourced from various issues of the Central Bank of Nigeria Statistical Bulletin and Bullion, Security and Exchange Commission and NSE fact book and annual reports. The data series were subjected to the appropriate time series tests using EVIEWS 9 econometric software which is time series friendly.

IV. METHOD

The study carried out some diagnostic tests to determine the properties of the time series data that was used in the course of the study. Augmented Dickey-Fuller test was conducted to determine the stationarity of the time series variables. Also, the GARCH model (1.1) was conducted to investigate the impact and relationship between macroeconomic variables and the stock market price. Two null hypotheses were tested to answer the research questions.

1. Augmented Dickey-Fuller Test of Stationarity

Empirical works on time series data assumed that the underlying time series are stationary. Therefore, it has become important to investigate the stationarity status of a data before estimation in order to avoid the problem of spurious regression.



The Augmented Dickey-Fuller (ADF) test (1979, 1981) is carried out to test for the existence of a unit root in the time series. It is an extension of the standard Dickey-Fuller (DF) test [13]. Usually, the unit root is conducted on individual variables and stated in three possible forms as shown below:

$$\Delta\mu_i = \gamma_0 + \gamma_1t + \gamma\mu_{i-1} + \beta\sum_{i=1}^3 \Delta u_{i-1} + e_{3i} \dots\dots\dots (1)$$

$$\Delta\mu_i = \beta_0 + \beta_1\mu_{i-1} + \beta\sum_{i=1}^3 \Delta u_{i-1} + e_{2i} \dots\dots\dots (2)$$

$$\Delta\mu_i = \beta\mu_{i-1} + \beta\sum_{i=1}^3 \Delta u_{i-1} + e_{1i} \dots\dots\dots (3)$$

Where;

μ_i = (GDP, INT, EXCH & INF) represents the variables used for the unit root test. The equation (3) represents the model without intercept and no trend; equation (2) represents the model with intercept but no trend tile equation (1) represents the model with intercept and trend. One of the standard conditions required for the implementation of the ADF unit root test is that both the null and alternative hypotheses must be stated and tested. Therefore, we state the hypothesis as follows:

H_0 : $\beta = 1$, the presence of a unit root using either equation (1), (2) or (3).

H_1 : $\beta \neq 1$, the absence of unit root using either of equation (1), (2) or (3).

2. Co-integration test

After handling the varying lag length recommendations, Johansen test of co-integration through Unrestricted Co-integration Rank Test (Maximum Eigenvalue) [14] and trace statistics for the lags chosen was conducted to discover if there is long run equilibrium between the stock market index (all share index) and the four macroeconomic variables (GDP, exchange rate, inflation and interest rates).

$$Y_t = A_t Y_{t-1} + \dots + A_p Y_{t-p} + B_y + e_t \dots\dots\dots (4)$$

Where; Y_t represents the dimensional vector of non-stationary I(1) variable, $y = y$ - dimensional vector of deterministic variable and e_t stochastic error residual. Therefore, the hypothesis for Johansen co-integration test is:

H_0 : there is no co-integration between the variables

H_1 : there is co-integration between the variables

If the variables statistical value is greater than the critical value, the null hypothesis should be rejected. This means there is co-integration between series moving together in the long run. This study used Johansen (1991) approach, which allows it to estimate and test for the presence or multiple co-integration relationship in a single step procedure. The co-integration test represents the long run relationship among the variables.

3. Model Specification

The purpose of this study is to investigate whether changes in stock market volatility through time can be attributed to time-varying volatility of a set of macroeconomic variables. Theoretical motivation for such a link can be found through a Capital Asset Pricing Model (CAPM). CAPM has its basis in the construction of an efficient market portfolio that maximizes return, given a level of risk. The expected return of an individual security is a function of its risk covariance with the market. The model speculates that the expected return on a stock is determined by the risk free interest rate and a risk premium which is a function of the stock responsiveness to the overall movement in the market that is its beta coefficient.

The study adapted the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model (1.1) developed by [15] and advanced by, [16, 17].

The study first developed an ARCH model with two distinct specifications considered – the first being the conditional mean specified as follows.

$$ASI_t = \lambda_0 + \lambda_1 ASI_{t-1} + \epsilon_t \dots\dots\dots (5)$$

The second step in the specification process is the conditional variance. A model with a first-order GARCH term and a first-order ARCH term (GARCH [1, 1]) is specified because of its simplicity as advanced by [18]. Therefore, following [18], conditional volatility estimates is obtained using the GARCH model developed by [9] and advanced by [16, 17].

We therefore specify the following GARCH (1, 1) model:

$$h_t = \alpha_0 + \alpha_1 \delta^2_{t-1} + \alpha_2 h_{t-1} + \alpha_i M_{i=t} + \mu_t \dots\dots\dots (6)$$

Where:

h_t = the conditional variance or volatility in stock prices (dependent variable)

α_0 = the constant variance (mean)

α_1 = first order ARCH effect

δ^2_{t-1} = one period lagged value of the squared errors (ARCH term)

α_2 = first order GARCH effect

h_{t-1} = one period lagged value of the conditional variance or last periods forecast (GARCH term)

α_i = coefficients of the macroeconomic variables (gross domestic product (GDP), exchange rate (EXCH), inflation rate (INF) and interest rates (INT)).



M_i = vector of macroeconomic variables (gross domestic product (GDP), exchange rate (EXCH), inflation rate (INF) and interest rates (INT)).

μ_t = error term

t = time subscript

From the foregoing, equation (4) is the conditional mean return expression, while Equation (5) gives an expression for the volatility of returns. It is a function of the mean of yesterday's forecast α_0 ; the lag of the squared residual obtained from the mean equation δ^2 or the ARCH term (the ARCH terms represent the news (information) about volatility of previous period that has an impact on the current volatility); the GARCH term, h_{t-1} , measuring the impact of last period's forecast variance; and the selected macroeconomic variables. α_1 and α_2 help in confirming the presence of ARCH and GARCH effects, as in equation(5). The size of the parameters α_1 and α_2 determines the short-run dynamics of the volatility of the data, and the sum of the estimated α_1 and α_2 reveals the persistence of volatility to a particular shock. A large positive value of α_1 shows that strong volatility clustering is present in the time series in question. A large value of α_2 reveals that the impact of the shocks to the conditional variance lasts for a long time before dying out, so volatility is persistent [19]. The GARCH (1, 1) model is covariance stationary if and only if α_1 and $\alpha_2 < 1$ [20], while if α_1 and $\alpha_2 > 1$, this implies that the GARCH model is non-stationary; the volatility will eventually explode to infinity as time goes to infinity and, if α_1 and $\alpha_2 = 1$, it shows a case of a restricted version of the standard GARCH model which is well known in the literature as the Integrated Generalized Autoregressive Conditional Heteroskedasticity or IGARCH model [19, 21].

4. Pre Diagnostic tests

We can run a GARCH model only if we can fulfill the following conditions:

- a. Clustering volatility in the residual: this test is conducted to determine whether periods of high volatility are followed by periods of high volatility, and periods of low volatility are followed by low volatility for a prolonged period. If this condition is satisfied, it suggests that the residual (error term) is conditionally heteroscedasticity and it can be represented by ARCH and GARCH model.
- b. ARCH effect: the ARCH effect is the second (2nd) condition for determining whether GARCH model is appropriate. To carry out this test, we specify the null and alternative hypothesis. The H_0 is that no ARCH effect, while the H_1 is that there is ARCH effect. If the probability value of the chi-square is less than (<) 5% then we reject H_0 and accept H_1 , meaning that the GARCH model is appropriate.

5. Apriori Expectation

Table 3.1: A priori expectations of the signs of coefficient

S/N	Variable	A priori coefficient
1.	GDP	Positive (+ve)
2.	Inflation rate	Negative (-ve)
3.	Exchange rate	Negative (-ve)
4.	Interest rate	Negative (-ve)

Source: Authors' computation.

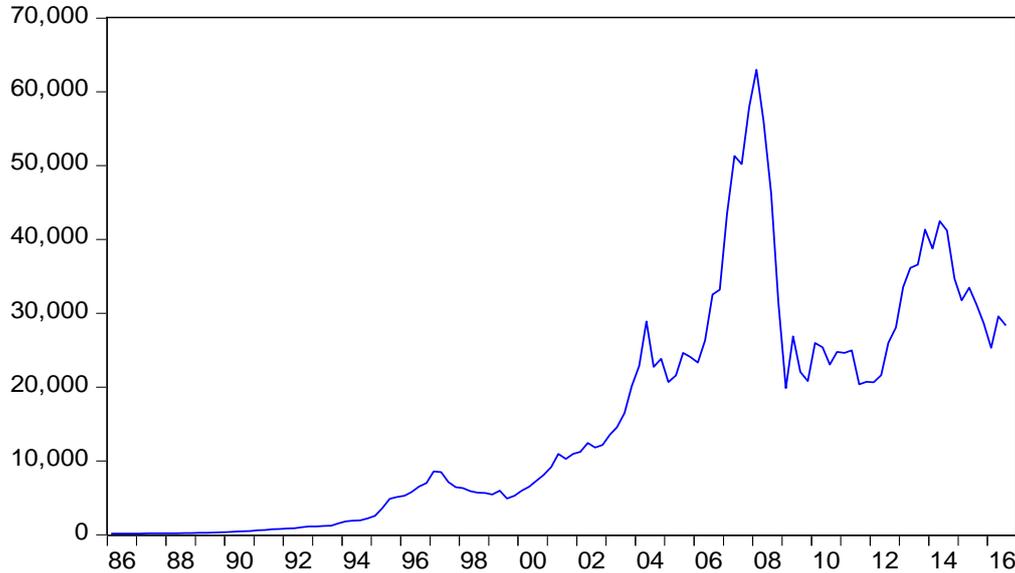
However, if the estimate of the parameters turns up with signs not conforming to the apriori expectations, they should be rejected unless there is sufficient empirical reason to justify the abnormality.

V. STATISTICAL DATA ANALYSIS AND DISCUSSION

In this section, the results of the study are presented, analyzed and discussed. The section is divided into five broad sub-sections with this introduction as the first section. The second provides empirical analysis of the data captured. It contains the unit root tests, the Johansen co-integration test, and the results of the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model (1.1) the section further provide the pre and post-estimation diagnostic tests. In the last sub-section, discussion of the results in relation to those reviewed in the literature and the policy implications of findings are presented.



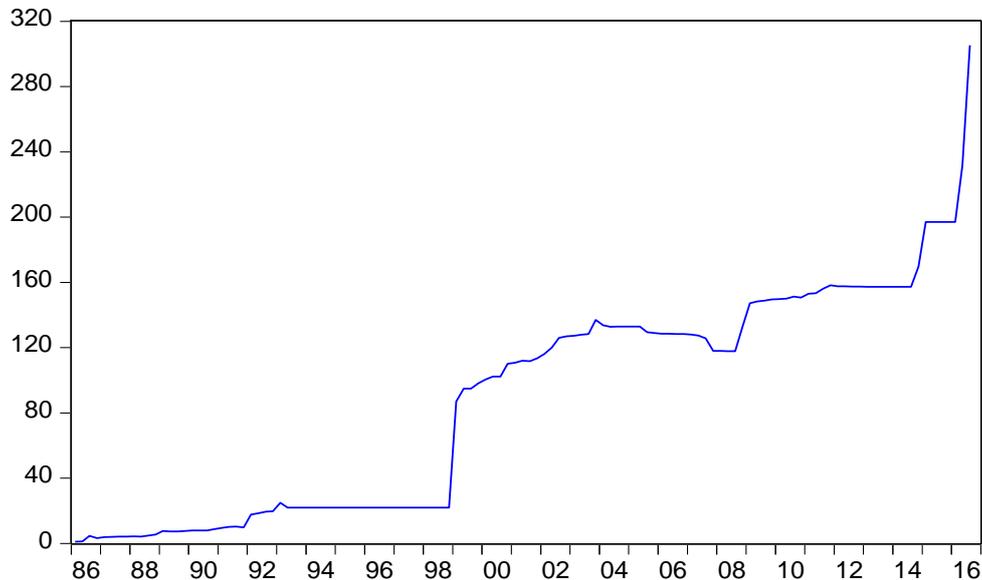
Figure 1: Trend on all share index in Nigeria (1987-2018)
ASI



Source: CBN Bulletin (2018)

Figure 1 presents the trends analysis of the quarterly data on all share index during the period of 1987 to 2018. Its NSE-all share index started in January 1984, the introduction of second tier security market in 1985 during first quarter of 1985 to 1995 NSE-all share index was relatively stable and its rose slightly between the first quarter 1996 to 1997 and declined slightly in third quarter 1997 but relative share fell in second quarter of 1999.

Figure 2: Trend on Naira/US dollar exchange rate in Nigeria (1987-2018)
EXC

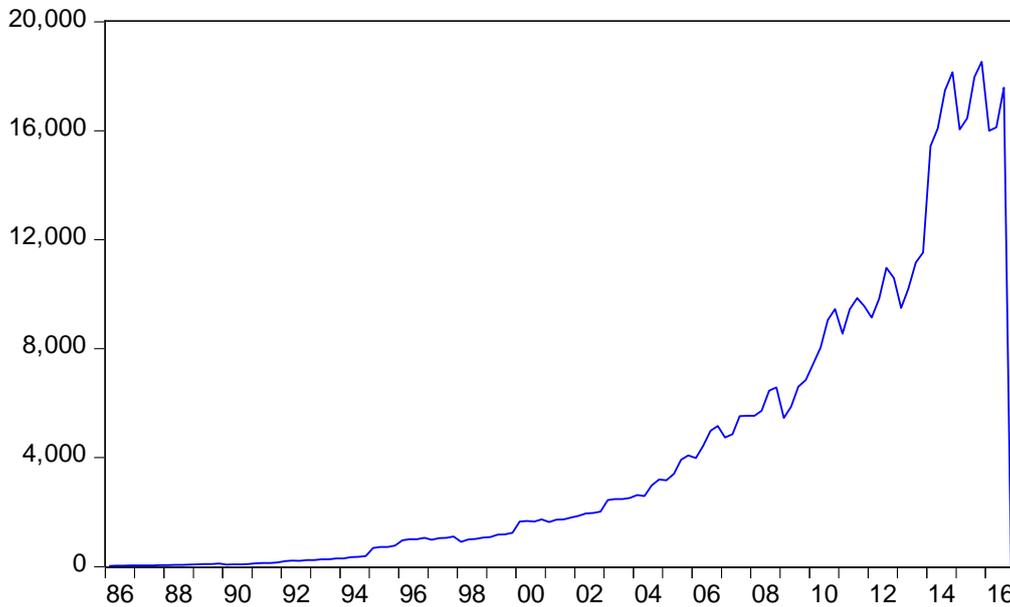


Source: CBN Bulletin (2018)

Figure 2 presents the trend analysis of quarterly data on official exchange rate of the Naira/US dollar in Nigeria during the period of 1987 to 2018. Its shows the relative values of naira per dollar continued to increase steadily at the interbank and bureau De Change(BDC) throughout the period of study. During the SAP era (1986) the average real exchange rate growth of the naira per US dollar maintained relatively stability at official and other segment of the market from 1987 to 1991, due to CBN policy intervention and capital flow. While from the period 1992 to 1998 represents depreciation of the value of naira against US dollar.



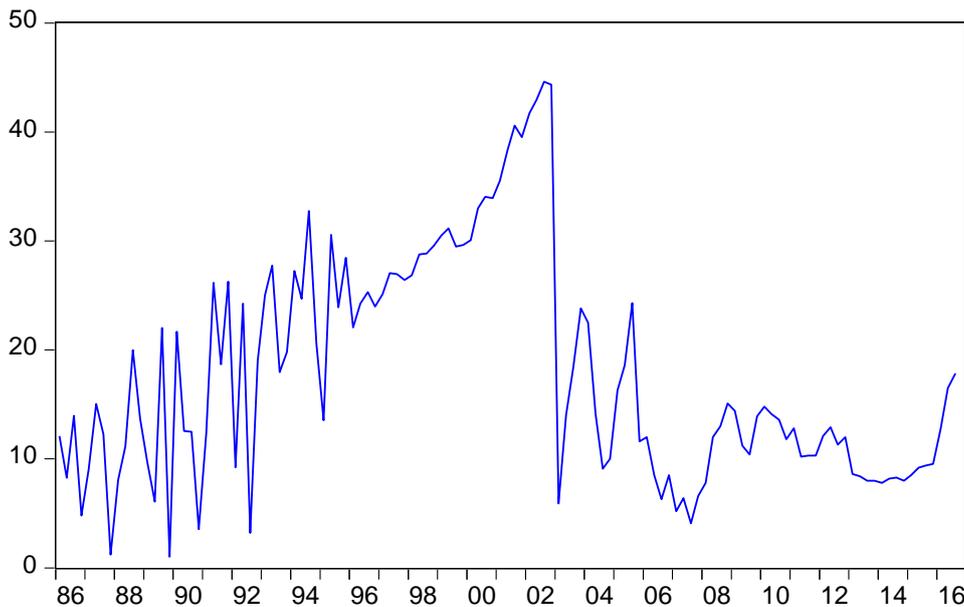
Figure 3 Trend of Gross Domestic Product in Nigeria (1987-2018)
GDP



Source: CBN Bulletin (2018)

Figure 3 illustrates the dynamics of real GDP and its returns. The behavior of the real GDP and its return follows a steady pattern and the returns of real GDP suggest evidence of volatility clustering. However, GDP in Nigeria was worth 486.80 billion US dollars in 2015. The GDP value of Nigeria represents 0.79 percent of the world economy. GDP in Nigeria average 86.50 USD billion from 1960 until 2015, reaching an all-time high of 546.70 USD billion in 2014 and a record low of 4.20 USD billion in 1960.

Figure 4 Trend of inflation rate in Nigeria (1987-2018)
INF



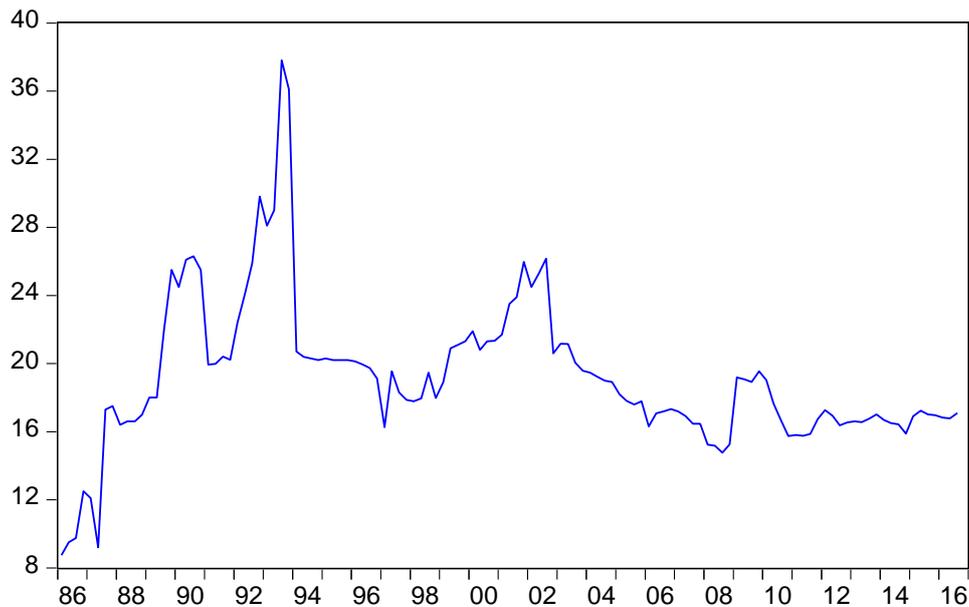
Source: CBN Bulletin (2018)

Figure 4 illustrates the steady fluctuations in Nigeria inflation rate from the period of 1987 to 2018. This period marked a period of up and down swings in consumer price index (CPI) in Nigeria. It shows that Nigeria inflation rate fluctuates



at a very high and low degree in the year 1986 to 1996. This fluctuation does not correspond with the increase in return of investment. The high fluctuation in inflation rate can be traced to ineffective and unstable monetary policy variables used to combat inflation in Nigeria. However, a significant level of fluctuation was observed especially in the 2001 to 2006.

Figure 5 Trend of interest rate in Nigeria (1986-2017)
INT



Source: CBN Bulletin (2018)

Figure 5 shows a trend for interest rate with clear evidence of volatility in the return series. The trend of the interest rate has been unsteady over the year. The Monetary Policy Committee (MPC) increased the Monetary Policy Rate (MPR) from 12.00 to 14.00 per cent at its first meeting in the third quarter to moderate inflation, ensures positive real returns on investment and attracts investors. The restrictive monetary policy stance of the Bank brought about liquidity squeeze in the system due to the increase in market interest rates. Available data showed an upward movement in all banks’ deposit and lending rates in the third quarter of 2017. Similarly, the average term deposit rate rose by 0.75 percentage point above the level in the preceding quarter to 6.16 per cent at end-September 2017. The average prime and maximum lending rates increased by 0.58 and 0.4 percentage points to 17.14 per cent and 27.25 per cent, respectively. Consequently, the spread between the weighted average term deposit and maximum lending rates narrowed by 0.34 percentage point to 21.09 percentage points, at the end of the third quarter of 2017.

Table 1: Descriptive Statistics for Quarterly Data on Stock Prices (All Share Index)

Variable	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
LASI	8.68621	9.23739	1.81851	-0.73582	2.20830	14.3115	0.000780
LEXC	3.86954	4.71492	1.35842	-0.78121	2.45405	14.0386	0.000894
LGDP	7.18586	7.45604	1.86149	-0.44698	2.04685	8.75169	0.012578
LINF	2.68499	2.63905	0.67559	-0.90371	4.86749	34.6160	0.000000
LINT	2.93071	2.907447	0.223190	-0.29519	5.723265	39.79421	0.000000

Source: SPSS output

Table 1 shows that all the macroeconomic variables have positive mean return values, the average all share index (ASI), exchange rate, GDP, inflation rate and interest rate are 8.686219, 3.869542, 7.185864, 2.684993, and 2.930714 values points respectively for the 123 Observations, which is relatively normal. The standard deviation of all share index, exchange rates, GDP, inflation and interest rate are 1.818510, 1.358425, 1.861496, 0.675593 and 0.223190 respectively. They are much lower than their mean values, thereby indicating that their prices have been expressly unstable over the years. All share index, exchange rate and GDP all have values below three (3) which implies a platykurtic kurtosis, while inflation and interest rate has value higher than three (3) and this indicate a leptokurtic.



1. Unit Root Test Results

As a precondition for the analysis of time series variables, the need to ensure that the variables are stationary requires unit root tests of each of the variables in the model. The outcome of our unit root tests using the Augmented Dickey Fuller (ADF) test revealed that all the variables are stationary, some at level I(0), and some at first difference I(1). The results are presented in the

Table 2: Unit Root Tests Results

Variables	ADF levels	1%	5%	10%	Prob.	Status
ASI	-2.759924	-3.484653	-2.885249	-2.579491	0.0672	I(0)
EXC	1.550336	-2.584055	-1.943471	-1.614984	0.9699	I(0)
GDP	-2.285175	-3.484653	-2.885249	-2.579491	0.1784	I(0)
INF	-1.302260	-2.584055	-1.943471	-1.614984	0.1773	I(0)
INT	0.282771	-2.584055	-1.943471	-1.614984	0.7663	I(0)
Variables	ADF Difference	1%	5%	10%	Prob.	Status
ASI	-8.614243	-3.485115	-2.885450	-2.579598	0.0000	I(1)
EXC	-12.00080	-3.485115	-2.885450	-2.579598	0.0000	I(1)
GDP	-12.32323	-3.485115	-2.885450	-2.579598	0.0000	I(1)
INF	-19.76118	-2.584214	-1.943494	-1.614970	0.0000	I(1)
INT	-12.06039	-2.584214	-1.943494	-1.614970	0.0000	I(1)

Source: E-views 9.0 Output

As a first step in the analysis, unit roots test was conducted to know the stationarity properties so as to avoid spurious regression. The result revealed that all the variables were stationary at levels at 10% only, except GDP. Given their probability values that is greater than 5%, and this necessitates testing at first difference. With the first difference level of the variables, the result revealed that, all the variables were stationary at first difference which means that they were all integrated of order one{ I(1)}.

Table 3: Johansen Co-integration Test Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-373.2043	NA	0.000495	6.577466	6.696811	6.625908
1	293.1706	1263.215*	7.08e-09*	-4.576880*	-3.860810*	-4.286231*
2	310.4101	31.18102	8.12e-09	-4.441914	-3.129121	-3.909058
3	322.9918	21.66246	1.01e-08	-4.225945	-2.316427	-3.450881
4	338.5929	25.50436	1.21e-08	-4.062485	-1.556243	-3.045214
5	357.9605	29.97775	1.36e-08	-3.964531	-0.861564	-2.705052
6	372.9475	21.89393	1.66e-08	-3.790390	-0.090699	-2.288704
7	392.9776	27.51964	1.89e-08	-3.703958	0.592458	-1.960064
8	406.6270	17.56628	2.43e-08	-3.506557	1.386583	-1.520456

* indicates lag order selected by the criterion
 LR: sequential modified LR test statistic (each test at 5% level)
 FPE: Final prediction error
 AIC: Akaike information criterion
 SC: Schwarz information criterion
 HQ: Hannan-Quinn information criterion

Source: E-views 9.0 Output

Table 3 present the results of the optimal length of lag selection for the co-integration, based on the five information criteria. The Schwarz (SC) and Hannan-Quinn (HQ) information criterion, which are most widely used, suggested that a lag length of one is optimal for the test. Therefore, this study used a lag length of one for the test of co-integration ranks and for the subsequent diagnostics test for data analysis.



Table 4: Johansen Co-integration Test Results

Hypothesized No. of CE(s)	Trace Statistic	5%Critical Value	Probability	Max. Eigen value	5%Critical Value	Probability
None*	106.6122	88.80380	0.0015	51.99409	38.33101	0.0008
At most 1	54.61816	63.87610	0.2343	25.51076	32.11832	0.2576
At most 2	29.10739	42.91525	0.5555	13.44334	25.82321	0.7688
At most 3	15.66405	25.87211	0.5197	9.218156	19.38704	0.7018
At most 4	6.445894	12.51798	0.4059	6.445894	12.51798	0.4059

Trace test indicates 1 co-integration at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: E-views 9.0

A test for co integration is a test to avoid spurious regression situation but based on the result of the co integration test, we do not accept the null hypothesis because there is existence of a long run relationship among variables. It reveals that there is existence of one co-integrating equation in the system with its maximum Eigen value and trace statistics greater than the critical values at 5 per cent. Therefore, the null hypothesis of no co-integration is rejected in favour of the alternative hypothesis of the presence of co-integration among the variables. Based on the result, we concluded that a long run relationship is present among the actual variables as shown by the Max- Eigen value and the trace statistics (none*), as both values are higher than the 5% value as presented in the above table.

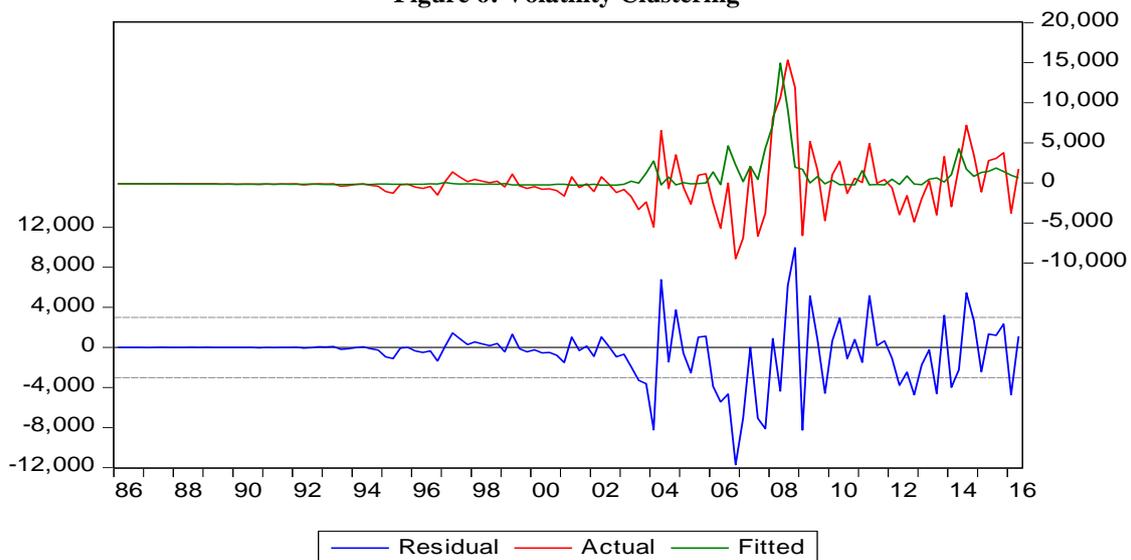
2. Pre-Diagnostic Tests for GARCH Model

As a precondition for estimation of GARCH model, a test for its suitability in the analysis was conducted by estimating whether there is clustering volatility in the residual, and testing for the ARCH effect.

a. Test for Clustering Volatility

Clustering volatility means when the periods of low volatility are followed by periods of low volatility, and periods of high volatility are followed by periods of high volatility for a prolonged period. This is shown in figure 6 below:

Figure 6: Volatility Clustering



Source: E-views 9.0 Output

From figure 6, the periods between 1987 and 2003 shows a prolong periods of low volatility followed by periods of low volatility. While the periods between 2004 and 2018 indicates that periods of high volatility are followed by



periods of high volatility. It suggests that the residuals or error term is conditionally heteroscedastic and it can be represented by ARCH and GARCH model.

b. Test for ARCH Effect

The second pre-test for the application of GARCH model is the ARCH effect. Here, the study tests the null hypothesis (H_0) that there is no ARCH effect against the alternative hypothesis that there is ARCH effect (H_1). This test is presented in Table 5.

Table 5: Heteroskedasticity (ARCH Effect) Test

F-statistic	105.2833	Prob. F(1,119)	0.0000
Obs*R-squared	56.79993	Prob. Chi-Square(1)	0.0000

Source: E-views 9.0 Output

From Table 5, the chi-square probability is less than 5% which shows that there is ARCH effect. From the foregoing, there is clustering volatility in the residual and ARCH effect which implies that chosen GARCH (1.1) model is suitable for the analysis. The study therefore, proceeded to estimate the GARCH model as follows.

3. Estimated Results of the Mean Equation

The estimated results of the mean equation are presented in Table 6.

Table 6: Results of the Mean Equation

Variables	Coefficient	Standard error	Z-statistics	Prob
Constant	99.68991	420.8161	0.236897	0.8131
ASI(1)	0.978933	0.019229	50.90819	0.0000

Source: E-views 9.0 Output

The mean equation as presented in Table 6 reveals that the impact of lagged stock prices is significant at 5% level of significance. This implies that previous quarter value of stock prices can influence the current quarter values of the variable. The coefficient is 0.978933. This implies that there seems to be a very long delay for share prices to return to its long run position after any shock. Thus, stock price shocks are seen to be persistent over time.

4. Results of the Conditional Variance Equation in the GARCH (1.1) Model

The estimated results of the conditional variance equation in the GARCH (1.1) model are presented in Table 7.

Table 7: Results of the Conditional Variance Equation in the GARCH (1.1) Model

Variable	Coefficient	Std. Error	Z-Statistic	Prob.
EXC	-1.345726	0.817197	-1.646759	0.0996
GDP	0.064599	0.050622	1.276094	0.2019
INF	-1.576149	0.654552	-2.407982	0.0160
INT	-5.05098	0.454447	-11.11457	0.0000
Variance Equation				
C	-39.61787	112.5702	-0.351939	0.7249
RESID(-1)^2	0.915777	0.151519	6.043994	0.0000
GARCH(-1)	0.54182	0.047457	11.41717	0.0000
R-squared	0.022958			
Adjusted R-squared	-0.001673			

Source: E-views 9.0 Output

The equation of interest in the GARCH (1.1) model is that of the conditional variance equation which measures the effects of the macroeconomic variables on stock price volatility. The results are shown in Table 7. They reveal that the ARCH term (δ^2_{t-1}) coefficient is 0.915777 and its P-value is 0.0000 which is less than 5%. This implies that previous quarters of all share index (ASI) information can exert or influence the volatility of present quarter of ASI in Nigeria. While the GARCH term (h_{t-1}) coefficient is 0.54182 and its P-value 0.0000 is less than 5% which also indicates that the past quarters volatility of ASI can affect present quarter volatility of ASI. A large positive value of ARCH (α_1) shows that strong volatility clustering is present in the time series in question. And a large value of GARCH (α_2) reveals that the impact of the shocks to the conditional variance lasts for a long time before dying out, so volatility is persistent following a crisis in the Nigerian market.

VI. DISCUSSION OF FINDINGS AND CONCLUSION

This research work has empirically examined the impact of macroeconomic variables (exchange rate, GDP, inflation and interest rate) on stock prices in Nigeria using quarterly time series data analysis ranging from 1987: 1 to 2018: 3. Firstly, ADF test was carried out in testing for the stationarity of the variables, and the outcome of our unit root tests revealed a mixture of integration order, I(0) and I(1) among our variables. The discussion of the outcome examines how the results of this research, earlier explained are in line with or different from similar studies previously conducted. To start with, the result on exchange rate revealed that it has negative relationship but statistically significant on stock price volatility. So we therefore, reject H_{01} that exchange rate has no significant impact on stock prices in Nigeria. On the relationship between GDP and stock prices, the study revealed that it has positive impact but has no statistically significant effect on stock prices. For the third independent variable (inflation rate), the hypothesis H_{01} postulated that; increasing rate of inflation has no significant impact on stock prices in Nigeria. While the result indicated that ASI return volatility is negatively influenced by changes in inflation rate and thus, the null hypothesis is rejected. The result on interest rate revealed negative relationship but shows statistically significant effect on stock price volatility. So we reject H_{01} and accept alternate hypothesis that there is a negative significant relationship between interest rate and stock prices in Nigeria. The interest rate result depicted a high interest rate in Nigeria. Monetary policy decision made by the monetary authorities in their attempt to stabilize the economy is usually responsible for this. It could make access to credit difficult and thus make shares price less attractive.

It has become obvious that the factors behind changes in stock prices may be potent enough to create necessary directions in overall stock market performance in Nigeria. In this study, it has been shown that only interest rate, among the monetary and real sector variables, exerts pressure on the stock prices in Nigeria. The analyses demonstrate that the Nigerian stock market is actually an emerging one where a strong competition is beginning to develop between the stock market and the other financial sector in terms of their instruments. However, this pace of development should be handled with care because any false movements in the stock market may have resounding impact in the whole financial sector and even the entire economy. Findings of this paper suggest that the government should be cautious with how interest rates and inflation rate are managed since they have ramifications for the budding stock price. In the years to come, it is likely that Central banks will be required to include financial stability among their macroeconomic responsibilities more directly and explicitly.

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