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Stock Market Volatility and Macroeconomic Variables Volatility in Nigeria: An Exponential GARCH Approach

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Abstract

This study employed AR (k)-EGARCH (p, q) technique to examine the volatility in stock market and macroeconomic variables, and used LA-VAR Granger Causality test to analyze the nexus between stock market volatility and macroeconomic variables volatility in Nigeria for the periods 1986 to 2010 using time-series data. The results of the findings revealed that there exists a bi-causal relationship between stock market volatility and real GDP volatility; and there is no causal relationship between stock market volatility and the volatility in interest rate and inflation rate. The study recommended that in order to less the stock market volatile, government should take pro-active role in building a stable market through tapping the growing interest of general people in the market by increasing supply of shares.

Keywords: Stock market, Macroeconomic variables, Volatility, EGARCH, LA-VAR

1. Introduction

The role of macroeconomic policies in determining the growth of stock market activities in Nigeria has been a subject of debate among the economists. However, stock market has been viewed as a market where most elements that gear the development of a nation's economic are operating with one another. In Nigeria, investors have a great interest in discovering variables that may help forecast stock prices. They can more appropriately manage their positions and portfolios (increase returns and/or lower risk) if they can use macroeconomic news releases as reliable indicators for where the stock market is headed.

Meanwhile, policymakers pay attention to the situation of the stock market that can be regarded as a leading indicator of future macroeconomic activity. They can better control the direction, magnitude and stability of the economy by adjusting macroeconomic variables if the relationship between stock returns and economic activity has predictive power to stimulate the growth of the economy.

The relationship between the stock market and macroeconomic variables has been subjected to serious economic research. Historically, the stock market played a prominent role in shaping a country's economic and political development. The collapse of the stock market always tends to trigger a financial crisis and push the economy into recession. Most of the major stock markets in the world were greatly affected by this global financial crisis. In Nigeria, the recent problem encountered by the stock market (financial crisis)

made many industrialized economies suffered a significant decline in economic activity, and one can safely say that the volatility of stock markets is the most important factor in the economic growth in not only developed economies but also developing economies like Nigeria.

Theoretically, the evidence of such a relationship can be found through a simple discount model, which spells that the fundamental value of a corporate stock equals the present value of expected future dividends. The future dividend ultimately reflects real economic activity. Currently, if all available information is taken into account, there would be a close relationship between stock prices and expected future economic activity. To this extent, stock prices might react quickly to macroeconomic information; which would be a leading indicator of real economic activity. There is substantial evidence that stock prices have been a leading indicator of real economic activity for some developed countries and other developing nations with high income level. Similarly, the volatility of stock prices depends on the volatility of expected future cash flows and future discount rates. If discount rates are constant over time, the volatility of stock prices is proportional to that of expected future cash flows. Since the value of corporate equity at the aggregate level might depend on the state of the economy, it is plausible that a change in the level of uncertainty about future macroeconomic conditions would produce a change in stock return volatility. Would this be possible in the Nigerian Case, this study intends to fill this gap by covering the periods of global financial crisis.

This study therefore examines the asymmetric relationship cum the nexus between stock market volatility and macroeconomic volatility in Nigeria. It also analyses the theoretical relationship that exist between stock market volatility and macroeconomic variables volatility in Nigeria for twenty-five years ranging from 1986 to 2010.

This paper is organized as follows. Section 2 entails the selected review of literatures. Section 3 outlines the methodology employed in achieving the asymmetric relationship between the stock market volatility and macroeconomic variable volatility of Nigeria as well as the nexus. In section 4, we reveal the estimated results of the analysis. Finally, in section 5, we present the conclusions and policy recommendations.

2. Review of Selected Literatures

There is no gainsaying in the fact that a large body of literature is centered to the study of the stock market and its effects on macroeconomic variables.

Lee (1992) analysed the causal relationships and dynamic interactions among asset returns, real economic activity, and inflation in the postwar US using a VAR approach and found that stock returns assist to explain the real economic activity; however, stock returns elucidate little about the variation in inflation. Dropsy and Nazarian-Ibrahimi (1994) examined the influence of underlying macroeconomic policies on stock returns using monthly data from 1970 to 1990 for 11 industrialized countries, concluding that predictable macroeconomic policies failed to predict stock returns.

Park and Ratti (2000) analysed the dynamic interdependencies among real economic activity, inflation, stock returns, and monetary policy, using a VAR model. They used monthly U.S. data from 1955 to 1998

and concluded that shocks due to monetary tightening generated statistically significant movements in inflation and expected real stock returns, and that these movements are not found in opposite directions.

Wongbangpo and Sharma (2002) examined the relationship between the stock returns for the ASEAN-5 countries and five macroeconomic variables and found that in the long term all five stock price indexes were positively related to growth in output and had negative relationship with the aggregate price level. Mukhopadhyay and Sarkar (2003) ran a systematic analysis of Indian stock market returns prior to and after market liberalization and the influence of macroeconomic factors on returns. The result suggests for the post-liberalization period (since 1995), real economic activity, inflation, money supply growth, foreign direct investment, and the NASDAQ index were significant in explaining variations in Indian stock returns.

More so, the determinants of stock market capitalization have been analyzed for specific groups of countries in some studies. Fabozzi et al (2004), examine the determinants of stock market development for OECD and some emerging markets, studying 27 countries in total. They find, apart from macro stability and legal rights, that the size of the institutional investor bases positively affects stock market development, and report evidence of a causal times series relation between institutional investors and stock market development. Caporale, Howells and Soliman (2004), investigate the development of stock markets in a panel of transition economies and highlight the role of privatization for stock market development in this sample of countries.

The nature and economic significance of the relationship between stock market development and growth vary according to a country's level of economic development with a larger impact in less developed economies (Abugri, Benjamin A. (2008). The proponents of positive relationships between stock market development and economic growth hinged their argument on the fact that the stock market aids economic growth and development through the mobilization and allocation of savings, risk diversification, liquidity creating ability and corporate governance improvement among others.

Raju and Ghosh (2004) in attempting to calculate the volatility of stock prices for a number of countries came into conclusion that both in Indian and Chinese stock market volatility is higher compared to other emerging economies. Döpke et. al. (2005) using monthly data of Germany concluded that volatility in the stock market can be explained by the performance of major macroeconomic indicators which have influence on business cycles.

Also, in attempting to investigate the role of regulators in shaping the stock market of Bangladesh, Ahmed (2005) concluded that the regulations are not competent enough to promote the market. She also suggested major structural changes in the regulatory mechanism of this market for its future development. In an attempt to find the prime factors that are responsible for the relative price fluctuation in the Dhaka Stock Exchange (DSE), Rahman and Rahman (2007) concluded that the relative variability in a stock price and the general level of that price are related with variables like earning variability, price-earnings ratio and turnover of the stocks.

Uppal and Mangla (2006) empirically concluded that although the Indian regulatory agencies managed to control excessive market volatility to a large extent, the Karachi Stock Exchange demonstrated little success. They argued that market behaviour due to regulatory responses depends both on the structure of industry and effectiveness of the regulations. In an attempt to find the determinants of stock volatility, Verma and Verma (2007) concluded that investors' irrational sentiments contribute more strongly to increase the stock volatility than to reduce it.

Ahmed and Samad (2008) using different descriptive statistics for DSE tried to find whether the general non-systematic behaviour of stock price holds at sectoral level and concluded that rumour and non-declaration of any dividends also affect share price. Finally, they suggested that the regulatory decisions should be taken well ahead to reduce the unintended shocks in the market. While trying to find out the factors which determine the price of stocks in DSE, Uddin (2009) concluded that the prices of stocks rarely reflects the development in macro economy rather corresponds closely with the micro information such as net asset value, dividend percentage, earnings per share. Alam and Uddin (2009) using monthly data for fifteen developed and developing countries found strong relationship between share price and interest rate-one very important macroeconomic variable or change in share price and change in interest rate.

Chinzara anad Aziakpono (2009) find that stock returns and volatility in South Africa are linked to major world stock markets with Australia, China and the U.S. having the most impacts and that volatility exhibits asymmetry and stability over time, and that there is lack of evidence of the risk premium hypothesis.

Mahmood and Dinniah (2009) used the Engle-Granger test and Johansen and Juselius maximum likelihood procedure to test relationship between stock price and three macroeconomics variables which consist of inflation, output and exchange rates of six countries in Asian-Pacific region. The study provides evidence of long-run relationship between these variables in all countries, thus support the cointegration hypothesis with exception of Malaysia. Analysis rejected existence of short-run relationship between all variables in all selected countries except between foreign exchange rates and stock price in Hong Kong and between real output and stock price in Thailand.

Alagidede and Panagiotidis (2010) investigate the relationship between the stock price and inflation for selected African stock markets. For South Africa, they reveal that the elasticity of the stock price with respect to the consumer price is 2.264 and that the stock price shows a transitory negative response to the consumer price in the short run and a positive response in the long run. Hence, stocks are a hedge against inflation in the long run.

Arjoon, Botes, Chesang and Gupta (2010) analyze the relationship between stock prices and inflation for South Africa. They find that real stock prices are not affected by a permanent change in the inflation rate in the long run and that any deviation in real stock prices in the short run will be adjusted toward real stock prices in the long run.

Xiufang Wang (2010) investigates the time-series relationship between stock market volatility and macroeconomic variable volatility for China using exponential generalized autoregressive conditional heteroskedasticity (EGARCH) and lag-augmented VAR (LA-VAR) models and found evidence that there is a bilateral relationship between inflation and stock prices, while a unidirectional relationship exists between the interest rate and stock prices, with the direction from stock prices to the interest rate. However, a significant relationship between stock prices and real GDP was not found. Our study however is a prototype of this study but the structure of Nigerian economy is quite different from theirs. Even China today is known to be one of the fast growing countries in terms of economic activities and also classifies as an emerging country in the world whereas Nigeria is still a developing nation.

Gupta and Modise (2011) estimate the predictive power of selected macroeconomic variables for South Africa. They report that for in-sample forecasts, interest rates, the money supply and world oil production growth have some predictive power in the short run, that for out-of-sample forecasts, interest rates and the money supply exhibit short-run predictability, and that the inflation rate shows a strong out-of-sample predictive power.

Chinzara (2011) studies macroeconomic uncertainty and stock market volatility for South Africa. He indicates that stock market volatility is significantly affected by macroeconomic uncertainty, that financial crises raise stock market volatility, and that volatilities in exchange rates and short-term interest rates are the most influential variables in affecting stock market volatility whereas volatilities in oil prices, gold prices and inflation play minor roles in affecting stock market volatility.

In summary, the relationships between stock markets and macroeconomic variables have been examined in several developed and developing countries. In this study, we focus on whether these causal relationships exist in Nigeria. We examine the asymmetric relationships between stock market volatility and macroeconomic variable volatility based on Nigerian data for the periods 1986 to 2010. Furthermore, we used AR (k)-EGARCH (p, q) model to estimate the volatility of the stock market and of macroeconomic variables. Moreover, the LA-VAR Granger Causality approach with block exogeneity Wald test is applied to investigate the nexus between stock market volatility and macroeconomic variable volatility.

3. Methodology

Theoretically, the heterosecdasticity is often associated with cross-sectional data, while time series are usually employed when studies are concerned with homoscedastic processes. However, in analysing macroeconomic data, Engle (1982) found evidence that the disturbance variances in time-series models were less stable than usually assumed for some kinds of data. Such instance is the changes over time in the uncertainty of stock market returns, which are measured using variance and covariance. Hence, more attention is paid on the heteroskedasticity when performing the time series analysis. It is necessary to specify the variance dynamics (volatility) for this problem. Engle (1982) suggested that the ARCH (autoregressive conditional heteroskedasticity) model as an alternative to the standard time series treatments is well known that a period of high volatility continues for a while after a period of increased volatility, a phenomenon known as volatility clustering.

The ARCH model takes the high persistence of volatility into consideration and so has become one of the most common tools for characterizing changing variance and volatility. This observation led Bollerslev (1986) to extend the ARCH model into the generalized ARCH (GARCH) model. The plus of this approach is that a GARCH model with a small number of terms seems to perform better than an ARCH model with many terms. It is commonly assumed that volatility is likely to rise during periods of falling growth and likely to fall during periods of intensifying growth. However, neither the ARCH nor the GARCH model can capture this asymmetry or lopsidedness. The exponential GARCH (EGARCH) model developed by Nelson (1991) can demonstrate the existence of asymmetry in volatility with respect to the direction of real growth. The EGARCH (*p*, *q*) model is given by

$$\log \sigma_t^2 = \psi + \sum_{i=1}^{p} (\lambda_i |z_{t-i}| + \varphi_i z_{t-i}) + \sum_{i-1}^{q} \beta_i \log \sigma_{t-i}^2 \quad 1$$

where $z_t = \varepsilon_t / \sigma_t$ and ε_t is the error term. The left-hand of equation 1 is the logarithm of the conditional variance. The logarithmic form of the EGARCH (p, q) model certifies the non-negativity of the conditional variance without the need to constrain the model's coefficients. The asymmetric effect of positive and negative shocks is represented by inclusion of the term z_{t-i}.If $\varphi_i > 0$ (< 0) volatility tends to rise (fall) when the lagged standardized shock, $z_{t-i} = \varepsilon_{t-i} / \sigma_{t-i}$ is positive (negative). The persistence of shocks to the conditional variance is given by $\sum_{i=1}^{q} \beta_i$. As a special case, the EGARCH (1, 1) model is given as follows:

$$\log \sigma_t^2 = \psi + \lambda |z_{t-i}| + \varphi_i z_{t-i} + \beta_1 \log \sigma_{t-1}^2 \quad 2$$

For a positive shock ($z_{t-1}>0$), equation (2) becomes:

$$\log \sigma_t^2 = \psi + (\lambda + \varphi_i) z_{t-i} + \beta_1 \log \sigma_{t-1}^2 \quad 3$$

and for a negative shock ($z_{t-1}<0$), equation (2) becomes

$$\log \sigma_t^2 = \psi + (\lambda - \varphi_i) z_{t-i} + \beta_1 \log \sigma_{t-1}^2 \quad 4$$

Thus, the presence of a leverage effect can be tested by the hypothesis that $\varphi = 0$. The impact is asymmetric if $\varphi_i \neq 0$. Furthermore, the parameter β governs the persistence of volatility shocks for the EGARCH (1, 1) model. There are several benefits to using the EGARCH model. First, since the log value of volatility is used as an explained variable, there is no need to impose nonnegative constraint on the

parameters of variance dynamics. Second, the EGARCH model can take into consideration the asymmetric effect of the volatility. Third, only the coefficients of the GARCH term govern the persistence of volatility shocks. Considering its dole, it is useful to estimate the volatility of the stock market and of macroeconomic variables by applying the EGARCH approach. Thus, this analysis will provide empirical evidence regarding the asymmetric relationships between the volatility in the stock market and macroeconomic variables.

Furthermore, in estimating the nexus between the stock market and macroeconomic variables in Nigeria, the study employed the lag-augmented VAR (LA-VAR) model developed by Toda and Yamamoto (1995). The LA-VAR approach is applicable to the Granger-causality test in the VAR framework. The most paramount benefit to the using of LA-VAR model is to avoid the biasness by paying little attention to the integration and cointegration properties of the data-generating process. Whereas, the standard VAR or VECM (vector error correction model) relied on the prior test of integration or cointegration order, which subjects coefficient restrictions test based on the VAR or VECM to pre-test biases if there were flaws in these conclusions. The LA-VAR method avoids these biases by sumptuous the Granger causality test and other tests of coefficient restriction. Therefore, using the LA-VAR technique, we can cope with pre-test biases that give rise to problems in statistical inference and execute the Granger-causality test in a level VAR model when the variables are of unknown integration or cointegration order.

The LA-VAR method process can be written in n-dimensional vector which constituting the levels of the variables in the study as follows:

Let $\{x_t\}$ represents the n-dimensional vector of the stock market and macroeconomic variables, then the generated equation becomes:

$$x_t = \alpha_0 + \alpha_1 t + g_1 x_{t-1} + g_2 x_{t-2} + ... + g_k x_{t-k} + \varepsilon_t \quad 5$$

where t is the time trend, k is the lag length, ε_t is an i.i.d. sequence of n-dimensional random vectors with zero mean and variance covariance matrix $\sum_{\varepsilon}$; and $\alpha_0, \alpha_1, g_1, ... g_k$ are the vectors or matrices of coefficients.

The null hypothesis that the gth variable does not Granger-cause the ith variable is formulated as:

$$H_0 : g_{ij}(1) = g_{ij}(2) = ... g_{ij}(k) = 0 \quad 6$$

where $g_{ij}(h)$ is the (i, j) element of the matrix $g_h (h = 1, 2, 3, ..., k)$. In order to empirically test this hypothesis, we estimate a VAR formulated in levels by using conventional Ordinary Least Squares (OLS) technique as follows:

$$x_t = \hat{\alpha}_0 + \alpha_1 t + \hat{g}_1 x_{t-1} + g_2 x_{t-2} + ... + \hat{g}_p x_{t-p} + \hat{\varepsilon}_t \quad 7$$

where an angstrom (^) signifies an estimation of OLS and $p = k + d_{\max}$ stands for the true lag length k amplified by a suspected maximum integration order $d_{\max}(k \geq d_{\max})$. $\hat{\alpha}_0, \alpha_1, \hat{g}_1, \ldots, g_p$ are vectors (matrices) of parameter estimates. Bearing in mind that the true values of $d_{\max}$ are zero, those parameters are not included in restriction (6). Toda and Yamomoto (1995) established that the Wald statistic asymptotically has a chi-square distribution with degrees of freedom equal to the number of excluded lagged variables regardless the order of integration of the process or the existence of a cointegrating relationship.

Therefore, the study employed a secondary data obtained for the periods of 1986 to 2010. Annual time series data on stock price index, real gross domestic product and consumer price index as measure of economic activities and inflation rate, short-term interest rate which also influence the economic activity and stock market for the periods 1986 to 2010.

Based on the data described above, we performed a two-step procedure to examine theoretically the relationship between stock market volatility and macroeconomic variable volatility in Nigeria. The first step was to estimate the volatility of each variable using the AR-EGARCH model. In the second step, the nexus between the volatility of the stock market and that of selected macroeconomic variables were analyzed using a LA-VAR. In this analysis, all variables employed were taken in logarithmic form.

4. Results and Discussion

4.1 Empirical Analysis of EGARCH result

The Exponential GARCH (EGARCH) Model estimated is given below:

$$\log(\sigma^2) = \omega + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) + \sum_{t=1}^{p} \alpha_i \left| \frac{\epsilon_{t-i}}{\sigma_{t-i}} - E\left(\frac{\epsilon_{t-i}}{\sigma_{t-i}} \right) \right| + \sum_{k=1}^{r} \gamma_k \frac{\epsilon_{t-k}}{\sigma_{t-k}} \qquad 8$$

the equation above is in line with Nelson's specification for the restricted log conditional variance and is used to examine the asymmetric relationship between stock market volatility and macroeconomic volatility in Nigeria while the conditional mean is specified in an autoregressive process of order as follows:

$$y_t = \chi_0 + \sum_{i=1}^{k} \chi_i y_{t-i} + \varepsilon, \qquad E_t(\varepsilon_t) = 0, \qquad E_{t-1}(\varepsilon_t^2) = \sigma_t^2, \qquad 9$$

Thus, the study estimates a series of univariate time-series model to allow for time variation in both the conditional mean and conditional variance. We used AR(k)-EGARCH(p, q) to model the dynamic in the real GDP growth, inflation rate, interest rate and stock returns in Nigeria. The study therefore estimates the volatility of real growth rates of GDP, inflation rate, interest rate and stock returns in Nigeria using maximum likelihood method. Hence, Schwarz Baysian Information criterion was used for the selection of the best regression results with reference to smaller SBIC values. In addition, ARCH Lagrange Multiplier

Test was used to test for the presence of serial correlation in residual. However, using the SBIC and residual diagnostics, the following models are selected: the AR (1)-EGARCH (1,1) for real GDP growth model (GDP), the AR(2)-EGARCH(2,1) for the inflation rate (infl), the AR(1)-EGARCH(1,2) model for the interest rate (IR) and the AR(4)-EGARCH(2,2) model for stock returns (SP). The results of the stated models are presented in table 1.

The result reveals the parameter estimates and their corresponding standard error, indicating that the coefficient of the GARCH term (β) is estimated to be -0.11 for the GDP, -0.59 and -0.05 for the interest rates, 0.03 and -0.01 for the stock returns, and -0.02 and 0.11 for the inflation rates. The results of interest rate are statistically significant at 1% level and one of the results of both stock returns and inflation rate is significant at 5% and 1% levels respectively. The coefficient of the ARCH term (α) is estimated to be -0.31 and 0.06 for the GDP, 0.26 and
-0.83 for the interest rates, 0.03, -0.04, -0.06 and 0.03 for the stock returns, and 0.35 and -0.29 for the inflation rate. One is significant at 1% level for the GDP and interest rate, three are significant at 1% and 5% levels for the stock returns and the two coefficients are significant fro the inflation rate. The asymmetric parameter (γ) is estimated to be 2.02 for the GDP, -1.77 for the interest rate, -0.56 for the stock returns and 0.76 for the inflation rate. All are statistically significant at 1% level. Also, the table reveals that the null hypotheses of no autocorrelation for the standardized residuals is accepted for all variables except for interest rate whose $O*R^2$ is statistically significant at 5% level. In addition, LM, the Lagrange Multiplier test statistic for ARCH in residual, is distributed as chi-square. It is clear from the table that the null hypothesis of no further ARCH effect in the residuals is accepted for each variables except for interest rate. These results claim that the selected model specification of the AR-EGARCH model explains the data well.

As regards the parameters estimated based on the AR-EGARCH model in table 1, the volatility of Nigeria's GDP inflation rate, interest rate and stock returns can be calculated. Thus, table 2 shows the descriptive statistics for the volatility of each variable.

From the table 2, it can be observed that the mean and standard deviation of the stock returns volatility is fairly high compared to other variables. The table also shows that the volatility for either stock returns or the macroeconomic variables demonstrate scrawny negative skewness and relative high levels of kurtosis. Furthermore, the Jarque-Bera statistics and the corresponding p-values discarded the null hypothesis of normal distribution at 1% significant level for all the variables. These results strongly designate that Nigeria's stock prices are much more impulsive than the major macroeconomic variables.

More so, in order to estimate the nexus between stock market volatility and macroeconomic variables volatility, the study employed Lag Augmented Vector Autoregressive Granger Causality test (LA-VAR GCT). For the empirical analysis, volatility of the real growth rate (GDP), inflation rate (INFL), interest rate (IR) and stock returns (SP) are used and estimated. The results of the test are shown in table 3.

The table 3 reveals that there is bi-causality between GDP volatility and Stock Market Volatility in Nigeria but no causality between stock market volatility and inflation rate as well as interest rate. This result

indicate that fluctuation in stock market is as a result of flux in the growth of the economy equally the shakiness in the growth of the economy is allied to the unprompted changes in stock price in Nigeria. The results therefore suggest that steadiness in productivity level in Nigeria will provide valuable information to Nigerian stock market likewise the stock market.

4.2 Discussion

All over the world, it is known that higher stock prices heighten household wealth and this encourages consumers to spend more. Hence, a rise in stock prices makes it cheaper for firms to raise funds and thus invest more. Meanwhile, the rise in the value of collateral, such as real estate, increases banks' enthusiasm to lend. All these factors can swell domestic demand and help increase real GDP growth.

Thus, if stocks prices are truthfully reflect the basic fundamentals, then the stock prices should be used as principal indicators of future economic activity. Similarly, since the value of corporate equity at the aggregated level should depend on the state of the economy, it is plausible that a change in the level of uncertainty about future economic growth would produce a change in the stock market. However, the result of our empirical analysis suggests that there exists a bi- causal relationship between volatility of Nigeria's stock market and that of its real GDP.

This result reveals that small investors are more interested in short-term gains and ignore long-term investment opportunities. This makes Nigeria's stocks more volatile than those in mature markets like developed nations and less correlated to longer-term company performance and economic growth. Therefore, the stock market performance of the listed companies in Nigeria can hardly reflect their real economic competence. In fact, the Nigerian stock market is somewhat separated from the real economy, and the stock indexes do not reflect the actual situation of the economy.

5.0 Conclusion

This study examined the relationship between the stock market volatility and volatility in macroeconomic variables such as the real GDP, inflation, and interest rate. The study employed secondary data and analysed the data using AR (k)-EGARCH (p, q) to estimate the volatility in each of the variable employed and also used LA-VAR Granger Causality test to determine the nexus between stock market volatility and macroeconomic variables volatility in Nigeria context. The result of the analysis suggests that there was a bi-causal relationship between stock market volatility and real GDP volatility, confirming the existence of a feedback phenomenon between Nigeria's real GDP and stock prices. Conversely, the study found no causal relationship between inflation volatility and stock market volatility. This finding implies that the stock prices were not significant in explaining the inflation rate and interest rate, and vice versa.

5.1 Policy Recommendations

In order to make the stock market less volatile, Securities and Exchange Commission (SEC) itself should be strengthen both in terms of number of manpower and quality of the professionals involved with special focus on independent research, monitoring mechanism and prompt decision making. However, the following steps might be considered from the regulators position for the sound development of the market so that the interests of all parties in the market are addressed properly.

- The decisions taken by the regulatory authority should be made as much as predictable with providing adequate explanation for the investors. Again, before taking any major regulatory decisions a broad-based consultation among widely representative advisory committees,

deliberations with the stock exchanges and intermediary associations, chambers of commerce and investor associations and the public which helped drive market consensus for the reforms could be considered by the SEC.

- Making relevant information available, relating to specific securities SEC should monitor strongly the quality of audited reports, which requires transparency and accountability of audit firms in topmost.
- SEC along with the government should take steps to increase the number of mutual fund to stabilize the market in the long run, which can be done by enforcing a level playing regulatory measure for public and private mutual funds.
- To bring more companies which have good track record in terms of financial performance tax gap between listed and non-listed companies could be made in such a way that they are encouraged to enlist in the market. For this purpose, for different sectors different margins can be considered as well.
- Government can also take pro-active role in building a stable market through tapping the growing interest of general people in the market by increasing supply of shares.

Thus, this study shows that Nigerian Stock market is not responsive to changes in macroeconomic factors in spite of the sizable proportion of stock market capitalization as a share of the country's GDP. Hence, predicting stock prices and returns via changes in macroeconomic performance becomes precarious and this affects economic forecast, planning and growth. It thus becomes obvious that Nigerian Stock market might be very sensitive to global macroeconomic factors or other salient issues in the Nigerian environment which of course warrants further investigation.

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Table 1: Empirical results of AR-EGARCH model

	GDP	**IR**	**SP**	**INFL**
Model	AR(1)-EGARCH(1,1)	AR(1)-EGARCH(1,2)	AR(4)-EGARCH(2,2)	AR(2)-EGARCH(2,1)
Mean Equation				
GARCH	2.98(1.13)*	-2.75(0.47)*	-17.04(4.77)*	1.07(0.22)*
χ_0	-0.23(0.12)**	0.57(0.09)*	1.90(0.29)*	-0.94(0.07)*
χ_1	0.17(0.08)**	-0.26(0.07)*	-0.27(0.13)**	0.45(0.03)*
χ_2			0.12(0.02)*	0.01(0.14)

χ_3			0.06(0.03)**	
Variance Equation				
Ω	-2.84(0.77)*	-2.53(0.26)*	-2.44(0.09)*	-0.62(0.18)*
α_1	-0.31(0.12)*	0.26(0.17)	0.03(0.01)*	0.35(0.06)*
α_2	0.06(0.13)	-0.83(0.04)*	-0.04(0.01)*	-0.29(0.10)*
α_3			-0.06(0.03)**	
α_4			0.03(0.02)	
β_1	-0.11(0.07)	-0.59(0.05)*	0.03(0.01)**	-0.02(0.03)
β_2		-0.05(0.01)*	-0.01(0.01)	0.11(0.03)*
γ	2.02(0.66)*	-1.77(0.29)*	-0.56(0.09)*	0.76(0.04)*
Diagnostic				
GED	0.30(0.13)**	0.31(0.15)**	0.25(0.04)*	0.20(0.04)*
O*R^2	0.996	5.495**	0.069	0.064
LM	0.949	6.659**	0.063	0.058
SBIC	-1.55	-1.29	-2.37	-0.67

Note: 1. The numbers in parentheses are the standard errors.

2. *(**) indicates the statistical significance at the 1% (5%) level.

3. GED is the generalized error distribution parameter.

Table 2:Descriptive Statistics of Volatility

	GDP	**INFL**	**IR**	**SP**
Mean	0.176	0.024	0.014	0.208
Std. Deviation	0.227	0.752	0.269	0.313
Skewness	-0.193	-0.194	-0.190	-0.747
Kurtosis	5.084	3.940	2.902	3.842
Jarque-Bera	24.643	23.899	24.685	15.211
p-value	0.001	0.008	0.001	0.011

Table 3:Granger Causality Results of LA-VAR model

Null Hypothesis	**Wald Statistics**	**p-value**
GDP volatility does not Granger Cause Stock Market Volatility	13.68*	0.0011
Stock Market volatility does not Granger Cause GDP Volatility	20.95*	0.0000
Inflation rate volatility does not Granger Cause Stock Market Volatility	0.35	0.8457
Stock Market volatility does not Granger Cause Inflation rate Volatility	0.34	0.8420
Interest rate volatility does not Granger Cause Stock Market Volatility	0.89	0.6399
Stock Market volatility does not Granger Cause GDP Volatility	0.20	0.9030

Note: * indicates the statistical significance at the 1% level