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The Nexus between Stock Market Volatility and Economic Growth in Nigeria

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Abstract: *The study examines the Nexus between stock market volatility and economic growth in Nigeria. An evaluation of literature on the transmission between stock market volatility and economic growth was conducted resulting into specification of an empirical model. The researchers adapted Generalized Autoregressive Conditional Herteroskedascity (GARCH) and Bivariate GARCH (BGARCH) specifications to account for the relationship between the variables. The study employed quarterly data for the period of 1985 to 2015. The data frequency selected ensured an adequate number of observations. The maximum likelihood estimation technique was adopted to estimate the model. The estimated result reveals that both the stock market return and GDP growth rate have Autoregressive Conditional Herteroskedascity (ARCH) and GARCH effects. This is an indication that there are presence of shocks and evidence of uncertainty in the Nigerian stock market as well as the economic sector. The study concludes that innovation passes through from stock market to the economic sector while on the contrary volatility disconnects and appears un-transmittable from the stock market to the economic sector. Finally, it recommends that government or her representative agent should reposition the economy and make it stable so that it could yield positive innovation that could enhance the expansion of the stock market.*

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I. Introduction

The nexus between finance and growth has been a controversial issue in finance literature. Different schools of thought have emerged with varying positions. The foremost of these schools was led by Schumpeter (1912). Schumpeter provided strong evidence in support of positive trade-off between financial market development and economic growth. Schumpeter's view was overwhelmingly celebrated for decades without stringent opposition.

Pagano (1993) has convincingly demonstrated in his seminal work that the capital markets of less developed countries have succeeded in mobilizing domestic savings and efficiently allocating them to enhance economic growth. Similarly, Spears (1991) affirmed that the early stages of financial markets are synonymous with positive growth. Likewise, Smith and Imrohoroglu (1997) concluded that stock markets are agents capable of decreasing the cost of mobilization and thereby facilitating investment in most productive manners.

It is very overt that these aforementioned authors unanimously agreed on the monotonic link existing between stock market and economic growth. However, this compromise has been questioned, debated and revalidated by various researchers both in the developed and developing economies

Hence, the treatment of stock market and economic growth has taken a new empirical dimension. Responding to this issue quantitatively is empirically demanding and it is the driving force behind this study. In view of this, the researcher is inspired with the quest of providing a thorough empirical investigation on the spilling of volatility between stock market and economic sector during the periods from 1985 to 2015 which is considered as the aggregate period, before 2007 financial crisis and after the crisis.

Objectives of the study:

The specific objectives of the study are to;

- Examine whether stock market and economic growth rate volatility are predictable within the context of Nigerian capital market
- To investigate whether volatility spills from stock market to economic sector

Hypothesis

The null hypotheses formulated for this study are:

- Stock market and economic growth volatility are not predictable in Nigeria.
- Volatility does not spills from stock market to economic growth in Nigeria

II. Literature Review

Theoretical Issues

The "finance-led growth" hypothesis postulates the "supply-leading" relationship between financial and economic developments. It is argued that the existence of financial sector, as well-functioning financial intermediations in channeling the limited resources from surplus units to deficit units, would provide efficient allocation of resources, thereby leading the other economic sectors in their growth process. Indeed, a number of studies have argued that the development of financial sector has significantly promoted economic development (Schumpeter, 1912; Levine, 1997).

In contrast, the "growth-led finance" hypothesis states that a high economic growth may create demand for certain financial instruments and arrangements and the financial markets are effectively responding to these demands and changes. In other words, this hypothesis suggests a "demand following" relationship between financial and economic developments. The impact of economic growth on the financial development has been documented in Robinson (1952) and Romer (1990), among others.

Also, there is the "feedback" hypothesis which suggests a two-way causal relationship between financial development and economic performance. In this hypothesis, it is asserted that a country with a well-developed financial system could promote high economic expansion through technological changes, product and services innovation (Schumpeter, 1912). This in turn, will create high demand on the financial arrangements and services (Levine, 1997). As the banking institutions effectively response to these demands, then these changes will stimulate a higher economic performance. Therefore, both financial development and economic growth are positively interdependent and their relationship could lead to feedback causality. The work of Luintel and Khan (1999), among others, is supportive of this view

The endogenous growth theory tries to explain the link between financial development and economic growth. Levine (1997, 2005) reviews the theoretical literature on the finance-growth relationship. Levine (1997) argues that costs of information gathering and transactions are the incentives for the emergence of financial markets and institutions. Financial systems may affect economic growth by providing such functions as facilitating the trading, hedging, diversifying and pooling of risk. These functions affect growth by influencing the rate of capital formation. Project holders use outside funding as a source for investments, and banks are the cheapest and fastest mobilization of savings for these project holders. Levine (2005: 86) argues that financial systems influence growth by easing information and transactions costs and thereby improving the acquisition of information about corporate governance, risk management, resource mobilization, and financial exchanges. Functions provided by financial systems are classified by Levine (2005) as follows. In particular, financial systems produce information about possible investments and allocate capital accordingly; monitor investments and exert corporate governance; facilitate trading, diversification, and management of risk; mobilize and pool savings; and ease the exchange of goods and services. McKinnon (1973) and Shaw (1973) show that countries with high economic growth also have developed financial markets, and, in those countries, developed financial markets lead to higher economic growth by increasing the size of savings and improving the efficiency of investments. According to the endogenous growth model of Pagano (1993), growth rate depends positively on the percentage of savings diverted to investment. Pagano (1993) discusses that better screening of fund seekers and monitoring of recipients leads to more efficient resource allocations; financial services can encourage the mobilization of otherwise idle resources; and improvements in risk sharing and reductions in origination costs can enhance savings rates and promote the start of innovative, high-quality projects.

Empirical Evidence

Onakoya (2013) conducted an empirical investigation on the trade-off between stock market volatility and economic growth in Nigeria over the period 1980-2013 using Exponential Generalized Autoregressive Conditionally Heteroskedastic (EGARCH) technique. It was documented that there is tendency for volatility to be persistent thereby distorting growth on the long run.

Poterba (2000) revealed that the unpredictability of either return or return distorts the smooth functioning of the financial system and adversely influences economic performance; while Wang (2010) stressed that a declining in stock market produced a corresponding falling in economic growth.

Ahmed and Samad (2008) including Levine and Zervos (1998) positioned that stock market volatility is significantly and positively correlated to economic growth. In the same token, some researchers persuasively showed that stock market volatility had an adverse effect on the economy (Adjasi & Biekpe, 2006). Campbell et al. (2001) stated that stock market volatility could be employed in predicting real GDP growth.

Conversely, Guo (2002) demonstrated that the relationship between stock market volatility and economic performance is not essentially empirical to attract model formulations.

Gupta and Modise (2011) conducted an empirical investigation on the predictive power of selected macroeconomic variables for South Africa. They reported that interest rates, the money supply and world oil production growth have some predictive power in the short run, for in-sample forecasts. However, they claimed that for out-of-sample forecasts, interest rates and the money supply exhibited short-run predictability and that the inflation rate showed a strong out-of-sample predictive power. Chinzara (2011) investigated macroeconomic uncertainty and stock market volatility for South Africa and concluded that stock market volatility is significantly affected by macroeconomic uncertainty and that financial crises raised stock market volatility.

Augustine and Pius (2010) employed ordinary least square technique to examine the impact of stock market development on long-run economic growth in Nigeria using time-series data for the period of 1986 to 2006. In their studies, GDP per capita growth was adopted as the dependent variable, while the independent variables include total market capitalization, total value of shares traded and turnover ratio. Other variables that may introduce bias in the results were controlled. They found that stock market size and turnover ratios maintained positive association with economic growth, but on the contrary, stock market liquidity had negative influence on the Nigerian long-run growth.

Guglielmo and Nicola (2011) adopted bivariate VAR-GARCH(1,1) model to examine linkages between stock market and economic growth in three countries- Czech Republic, Hungary and Poland. Their empirical findings suggested that there was unidirectional causality running from stock markets to growth in the levels, this linkage becoming stronger following the EU accession, which appeared to be attractive, presumably as a catalyst for institutional building and development. The same holds in most cases for volatility spillovers as well.

The study of Kar and Pentecost (2000) in Turkey revealed that the direction of causality between the financial markets development and economic growth was based on the sensitivity of the financial markets development chosen by the agents. However, their results indicated that the degree of causality from financial development to economic growth was much weaker than degree of causality from economic growth to financial development. In the same token, Stem (1989) and Romer (1990) discovered that economic growth could cause the financial markets development.

Levine and Zervos (1998) provided a detailed study of 48 countries over the period from1973 to1993. They found that volatility, international integration and stock market size were not robustly associated with economic growth. Also, the findings reveals a positive impact of stock market liquidity on economic growth. Campbell et al. (2001) persuaded that stock market volatility could be used to predicting GDP growth.

Aggarwal et al. (1999) documented that country specific factors like corporate earnings, political, and government decisions tend to be associated with high volatility. Engle et al. (2008) conveniently showed that at a daily level, inflation rate and industrial production growth accounted for between 10% and 35% of the one-day a-head volatility prediction. In view of this, a wide range of variables such as money supply, prices of goods, political risks, real activity, exchange rate, oil prices, original stock market indexes and trade sector may be relevant in explaining the stock market volatility.

Mala and Reddy (2007) investigated 16 firms of Fiji's stock market using time series data for 2001-2005 periods and revealed that interest rates changes had a significant effect on stock market volatility. Beaulieu et al. (2005) confirmed that political news played an important role in the stock return volatility. Kumar (2007) singularly demonstrated that short-term and long term volatilities declined in the Indian stock market when volatility was at the highest level. The author concluded that investors are largely receptive to economic fundamentals.

III. Research and Methodology

Model specification

The model adopted and modified for the study is consistent with the volatility model rooted in the Wold (1954) decomposition theorem.

The GARCH model for market index specified as follows:

$$h_{\varepsilon int} = f(\varepsilon^2_{t-1}, h_{\varepsilon\ int-1}) \quad (1)$$

Where: $h_{\varepsilon int}$ is the conditional variance of the return on market index,

ε^2_{t-1} is the ARCH term and $h_{\varepsilon\ int-1}$ is the GARCH term

While the GARCH model for GDP is specified as follows

$$h_{\varepsilon gdpt} = f(\varepsilon^2_{t-1}, h_{\varepsilon\ gdpt-1}) \quad (2)$$

Where: $h_{\varepsilon gdpt}$ is the conditional variance of the GDP

ε^2_{t-1} is the ARCH term and $h_{\varepsilon\ gdpt-1}$ is the GARCH term

The Bivariate GARCH Model accounts for the transmission of volatility or information between stock market and economy and it is specified as:

$$\begin{pmatrix} h_{int} \\ h_{ingdpt} \\ h_{gdpt} \end{pmatrix} = \begin{pmatrix} c_{int} \\ c_{ingdpt} \\ c_{gdpt} \end{pmatrix} + \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{bmatrix} \varepsilon_{int-1} \\ \varepsilon_{int-1}\varepsilon_{gdpt-1} \\ \varepsilon_{gdpt-1} \end{bmatrix} + \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix} \begin{bmatrix} h_{int-1} \\ h_{ingdpt-1} \\ h_{gdpt-1} \end{bmatrix} \quad (3)$$

Where: h_{int} is the own variance of market index, h_{gdpt} is the own variance of GDP, h_{ingdpt} is the co-volatility of market index and GDP, $\varepsilon_{int-1}\varepsilon_{gdpt-1}$ is the covariance between the innovations or shocks of market index and GDP, $h_{ingdpt-1}$ is the lag of the co-volatility of market index and GDP

Data Sources

The study utilizes time series quarterly data over the period from1985 to 2015. The raw (real) GDP data were sourced from the CBN annual statistical bulletin; while those on the market index were sourced from the Nigerian Stock Exchange Daily Official List. The raw data of both variables are logarithmic transformed to first differenced data series. Consequently, the volatility of the series were obtained such that the final data are GDP volatility and market index volatility.

Estimation Test Results

The central thrust of this study is to test two prepositions:

- Predictability of the stock market and economic growth volatility.
- To test volatility transmission from stock market to economic sector.

To conduct these tests, the researcher estimated the GARCH-model and bivariate GARCH-model respectively for the first and second prepositions. The estimation outcome or results in respect of each of these models are presented and discussed below.

Prediction of Quarterly Stock Market and GDP Growth Rate Volatility

The tests on whether the stock market and GDP growth rate volatility are predictable are carried out to achieve the first objective of this study. The researchers conducted these tests by estimating GARCH (11) models which are quoted in terms of market return and GDP growth rate volatility. The test results are reported in tables 4.1 and 4.2 respectively.

Table4.1 Showing the Test Results on the Predictability of GDP Growth Rate Volatility

Regressor	**Coefficient**	**Std-error**	**T-stat**	**P-value**
Con	-0.667161	0.22752	-2.932	0.0040
ARCH (1)	(0.241417)*	0.078549	3.073	0.0026
GARCH (1)	(0.841679)*	0.047307	17.79	0.0000 ARCH (1) + GARCH (1) 1.083896

*Note that * denotes significant at 1%*

Source: Authors' Computation using E-View Window 9

Table 4.1 reveals that the coefficients of the ARCH and GARCH terms are 0.241417 and 0.841679 respectively while their corresponding p values are 0.00 in each case. This means the condition of non-negativity has been fulfilled since the coefficient of either the ARCH term or GARCH term is positive. Again, the p values are less than the alpha value at 1 percent. This is an indication that the null hypothesis of no ARCH and GARCH effects is rejected for the alternative hypothesis. Thus, the test result reveals that there are effects of volatility in the Nigerian economic growth. But whether, the volatility can be predicted or not is revealed by the sum of the coefficients of ARCH and GARCH terms which is pegged at approximately 1.08 percent. Since this value is

close to unity (1), it means that volatility clusters or pools over time with possibly occasional outliers; large shocks of opposite signs follow large shocks of the same signs while small shocks of opposite signs follow small shocks of the same signs. In view of this, the quarterly volatility of GDP growth rate can be predicted in Nigeria.

Table4.2 Showing the Test Results on the Predictability of Stock Market Return Volatility

Regressor	Coefficient	Std-error	T-stat	P-value
Con	0.014554	0.0027848	5.226	0.0000
ARCH (1)	(0.607570)*	0.21889	2.776	0.0064
GARCH (1)	(0.698336)*	0.065576	10.65	0.0000
ARCH (1)+ GARCH (1)	1.305906			

*Note that * denotes significant at 1%*
Source: Authors' Computation using E-View Window 9

The results in table4.2 are quite similar to those in table 4.1. The ARCH and GARCH terms are positive, about 0.61 and 0.70 respectively. Looking at the associated p values in each case, it is certain that they are individually less than 1 percent alpha value. This shows that there are presences of surprise and volatility in the Nigerian stock market. The sum of the coefficients of ARCH and GARCH terms is about 0.3 more than one. Since this value is very small or infinitesimal, It can be said that the sum of the coefficients is close to one thereby negating the assumption of efficiency. Therefore, the findings suggest that stock market volatility clusters and as such appears predictable in Nigerian stock market.

Volatility Spilling from Stock Market to Economic Sector

The second objective of this study is to examine whether volatility transmits from the stock market to economic sector or vice versa. To achieve this, the researchers estimated a bivariate GARCH model using BEKK (11) scheme. The estimated results are reported in table 4.3.

Table 4.3 Results of Volatility Transmission from Stock Market to Economic Growth

Regressor	Coefficient	Std-error	T-stat	P-value
C_11	0.016865	0.0031221	5.402	0.0000
C_12	-13.263504	13.102	-1.012	0.3135
C_22	260.623601	128.17	2.033	0.0444
b_1	0.000007	1.1190e-005	0.5913	0.5555
a_1	(0.999995)*	0.34783	2.875	0.0048

*Note C_11, C_12 & C_22 are the constant terms, b_1 is the parameter of the conditional co-volatility matrix, a_1 is the parameter of the conditional co-innovation matrix and * means significant at 1%*
Source: Authors' Computation using E-View Window 9

The results of the bivariate GARCH model are reported in table 4.8. From the table, the coefficient of the parameter (a_1) is 0.999995 and the corresponding p value is 0.0048. Since this observed p value is less than the alpha value at 1 percent, it means that the surprises, shocks or changes induced by stock market innovations transmit to economic sector and vice versa. However, the parameter (b_1) 0.000007 and it has a corresponding p value of 0.56 approximately. Thus, in comparison with the alpha value at 5 percent or even at 10 percent, the coefficient is insignificant. This means that stock market volatility does not significantly impact GDP growth rate volatility and vice versa, and therefore there is no significant transmission of volatility from stock market to economic sector in Nigeria.

IV. Conclusion

The investigation has yielded two major findings to buttress the position in the literature. Thus, the conclusions of this study are drafted as follows:

- Obviously there are contentious evidences that both stock market and economic growth volatilities cluster with erratic outliers. This makes the researcher to conclude that Nigerian stock market and economic sector are chaotic with evidence of colored noise property. Without equivocation, the researchers conclude that market volatility as well as growth rate volatility in Nigeria follows a non-random walk pattern that makes prediction of volatility possible
- In view of the verity that co-innovation parameter is significant while co-volatility parameter is insignificant, the study finally concludes that innovation passes through from stock market to economic

sector while on the contrary volatility disconnects and appears un-transmittable from the stock market to economic sector.

V. Recommendations

Based on the findings of the research work, the authors make pertinent recommendations that could be handy when formulating policies;

- The Nigerian stock market and economic sector generate volatility series that exhibit clustering pattern. Thus, in view of this the authors recommend that financial market institutions, governments and their statutory agents, as well as all quoted companies should ensure free flow of information either published or unpublished at a zero cost. Moreover, un-intermittent or uninterrupted flows of information among these institutions should be established and sustained in the long run by the statutory regulatory organs through appropriate framework.
- The authors of this study recognize that large or small changes transmit from the economic sector to the stock market. In view of this recommend that Nigerian government should reposition the economy and make it stable so that it could yield positive innovation that could enhance the expansion of the stock market

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