European Journal of Academic Essays 2(11): 1-12, 2015
ISSN (online): 2183-1904
ISSN (print): 2183-3818
www.euroessays.org

An Empirical Investigation of the Relationship between Stock Market Prices Volatility and Macroeconomic Variables' Volatility in Nigeria

ADENIJI Sesan Oluseyi
Department of Economics, University of Abuja, Nigeria
Email: adeniji.sesan@yahoo.com
Tel: +2348073730454

Abstract: This study was an inquiry into the link between stock market prices volatility and macroeconomic variables' volatility in Nigeria. This was motivated due to irrefutable conclusion as inferred from previous work on the subject matter. The research work made use of monthly data for a period of January 1990 – December 2014 and employed GARCH(1,1) models, and the relationship between stock market prices volatility and macroeconomic volatilities was examined using bi-variate and multivariate VAR Granger causality tests as well as through regression analysis. However, the stance of the study was not far from the view of previous studies as only three out of the five macroeconomic variables studied have a relationship with stock market prices volatility based on the result from GARCH (1,1) model, the volatility in GDP, inflation and money supply were not found to Granger-cause and not significantly related to stock market prices volatility but only volatility in interest rate and exchange rate does Granger -cause stock market prices volatility; while from the regression analysis, only interest rate volatility and exchange rate are significantly related to stock market prices volatility. This finding is admissible in the case of developing countries with the supremacy of non-institutional investors and the existence of information asymmetry problem among investors which could account for the weak relationship between stock market prices volatility and macroeconomic variables' volatility.

Keyword: Stock prices volatility, macroeconomic volatility, GARCH, VAR-Granger Causality.

1. Introduction

Developed and developing countries' believe in stock market as a catalyst for economic growth and development cannot be contended. A deep-seated stock market is always providing the opportunity for savings and investments and its key objective is to facilitate the savers and the borrowers, as it collects the savings from different pools (surplus entities) and provide the platform to convert them into fruitful investment (deficit entities). A stock market is also helpful for reallocation of funds in different sectors of the economy. It acts as a means where many factors jointly work together to drive the wheel of the economy of any country.

The prominent role stock market play in a country's macroeconomic development springs up the interest in examining the relationship between the stock market and real economic activities.

[1] asserted that, following the theoretical view, stock market should be closely related with the macroeconomic variables of the country, simply because stock prices are the discounted present value of expected future cash flows. Based on a simple discount model, the fundamental value of a corporate stock is equal to the present value of expected future dividends, thus the future dividend must eventually reflect the real economy activity. Hence, the volatility of stock prices should also depend on the volatility of expected future cash flows and future discount rates. Since the value of corporate equity at the aggregate level depend on the state of economic activity, it is likely that any changes in the level of uncertainty of future macroeconomic conditions would cause a change in

stock return volatility. In other words, stock markets may be volatile simply because real economic activities fluctuate.

In recent years, inquiry into the link between nominal stock market prices and their volatility has produced a number of stylized facts in the literature. For instance, alluding to the fact that the stock market performance depends on not only the overall fitness of the financial markets and external market, but macroeconomic stability as well, mushrooming evidences suggest volatility clustering, that is, large (small) shocks tend to follow similar large (small) shocks. Volatility may impair the smooth functioning of the financial system and adversely affect economic performance [2], [3].

Volatility measures variability, or dispersion about a central tendency. It is simply a measure of the degree of price movement in a stock, futures contract or any other market. It measures dispersion around the mean or average return of a security and the range of an asset price about its mean level over a fixed amount of time [4]. It follows that volatility is linked to the variance of an asset price. If a stock is labeled as volatile then the price will vary greatly over time. Conversely, a less volatile stock will have a price that will deviate relatively little over time. Volatility is calculated as the standard deviation from a certain continuously compounded return over a given period of time. It is an important measure of quantifying risk, for example, a security with a volatility of 50% is considered very high risky because it has the potential to increase or decrease up to half its value. Volatility is a measure of risk based on the standard deviation of the asset return. It is a variable that appears in option pricing formulas, where it denotes the clustering of the underlying asset return from now to the expiration of the option [5], [6].

One of the major problems associated with price volatility is the lack of evidence of their origins. The literature follows two main streams: the first stream in the literature claims that price volatility primarily originate in news announcements. This stream is represented by [7], where the authors claim that the main source of price volatility is corporate statements or macro-economic news announcements, for example. In addition, many authors, e.g., [8], claim that news announcements cannot be perceived absolutely, but rather only relatively with respect to market expectations. The second stream, on the other hand, states that the main source of price volatility is the lack of liquidity on either the bid or the ask side. [9] and [10], two representative works, study the so-called excess liquidity and its impact on the formation of price volatility. In addition, this stream opposes the explanation that the primary source of price volatility is revealed news. Hence, the need to study and empirically analyze the stock market prices volatility in line with the first stream by examining the relationship between stock market volatility and macroeconomics news announcements.

Understanding the origin of stock market volatility and its links with macroeconomic volatility is imperative for the investors, policy makers and market practitioners. It helps the investors in discovering how macroeconomic variables' volatility could help them to correctly forecast stock prices movements which is believe can help them in managing their investment portfolios if it can be used reliably as indicators for the stock market volatility [1]. Also, Policy makers would want to know the main determinants of stock market volatility and its spill-over effects to the real economy [11]. Such knowledge would be worthwhile if policymakers hope to formulate policies that ensure financial and macroeconomic stability. In the same vein, Market practitioners, particularly investment bankers and fund managers, would find this knowledge to be of interest since stock market volatility affects asset pricing and risk. This knowledge would enable them to formulate hedging strategies using plain vanilla options and exotic derivatives [11]. On the other hand, if stock market volatility does not lead macroeconomic volatility, it is not wise for a policy maker to focus on stock market volatility in order to reduce macroeconomic volatility. Hence, it is worthwhile to determine whether macroeconomic volatility can explain stock market volatility, or vice versa.

Therefore, this study pursues analysis of the relationship between stock market prices volatility and volatility of macroeconomic variables in a developing country like Nigeria. The rest of this paper is ordered as follows: section 2 reviews numerous previous studies on the relationship between stock market volatility and macroeconomic variable volatility; section 3 provides methodology, description of the data and estimation strategy used in this study; in Section 4, the empirical results are presented; and followed by the conclusion in Section 5.

2. Literature Review

Analysis of the stock market volatility and macroeconomic variables' volatility cannot be done in isolation of the previous work that had established relationship between stock market prices volatility and some economic variables. Such facts established in the past which is of great impact to the present are reviewed and presented below:
The foremost work on stock market volatility and macroeconomic variables provides a good insight on the study. Such works are; [12] analyzed 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. [13] 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. Ibrahim [14], investigated the dynamic interactions between seven macroeconomic variables and the stock prices in Malaysia by using cointegration and Granger causality tests. He found that the stock prices are Granger-caused by changes in the official reserves and exchange rates in the short run.

[15] analyzed 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. [16] 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. [17] 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.

In the same vein, [18], 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. [19] 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 [20]. [21] 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. The proponents of positive relationships between stock market development and economic growth based 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. [22] investigated the relationship between the volatility of macroeconomic variables and the stock returns in Bangladesh. By using VAR models, they found that macroeconomic volatility significantly cause stock market volatility. [23] using monthly data of Germany concluded that volatility in the stock market be explained by the performance of major macroeconomic indicators which have influence on business cycles. Also, [24] 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. [25] 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. [26] explored the interaction between selected macroeconomic variables and stock prices for the case of Malaysia in a VAR/VECM framework. They found that changes in Malaysia stock market index do perform a cointegrating relationship with changes in money supply, interest rate, exchange rate, reserves and industrial production index.

[27] 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. [28] 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. [29] 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.

In the recent time, [30] 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. [31] 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. [32] investigates the time-series relationship between stock market volatility and macroeconomic variable volatility for China using E-GARCH and lag-augmented VAR models. He found evidence on the existence of a bilateral relationship between inflation and stock prices, and a unidirectional relationship between the interest rate and stock prices. His study also found that the relationship between stock prices and real GDP is not significant.

In the context of Nigeria economy, works on the relationship between stock market volatility and macroeconomic variables was not found wanting, such works includes; [33] employed multiple regressions to estimate the functional relationship between money supply, inflation, interest rate, exchange rate and stock prices. Their study revealed that the relationship between stock prices and the macroeconomic variables are consistent with theoretical postulation and empirical findings in some countries. Though, they found that the relationship between stock prices and inflation does not agree with some other works done outside Nigeria. [34], attempts to establish a long-run relationship between the stock market and some of macroeconomic indicators. His result shows that only industrial production and level of interest rates, as represented by the 3-month commercial bank deposit rate have a long-run relationship with the stock market. He also found that the Nigeria market responds more to its past prices than changes in the macroeconomic variables in the short run. [35] used the same methodology as [33], investigated the relationship between stock market volatility and macroeconomic variables volatility in Nigeria. They found a bi-causal relationship between market volatility and real GDP. However, they did not find evidences on the causal relationship between stock market volatility and the volatility in interest rate and inflation rate.

In conclusion, many authors in developed and developing countries have examined the relationship between stock market volatility and macroeconomic variables and considering an emerging economy like Nigeria, scholars have also dealt with the topic but with little variation expect that of [35], which looked into the relationship between stock market prices volatility and macroeconomic variables' volatility. This study focuses on this curse but differs in its approach by converting the monthly raw data covering the periods of 1990 – 2014 to their volatility form or nature and use the volatility data in furtherance of our analysis.

3. Methodology

3.1 Theoretical Framework

There are five schools of thought on stock price behaviour. These are the fundamentalist schools, the technical school, the random walk hypothesis school, the Behavioural School of finance and macro-economic hypothesis school. They are explained below as thus:

Fundamentalist Schools: The fundamentalist believe that the value of a corporation's stock is determined by expectations regarding future earnings and by the rate at which those earnings are discounted. The fundamentalists apply present value principles to the valuation of corporate stock, using dividends, earnings, assets and interest rate to establish the price of stock.

The Technical School: the technical school opposes the fundamentalists' arguments, and claims that stock price behaviour can be predicted by the use of financial or economic data. They submit that stock prices tend to follow definite pattern and each price is influenced by preceding prices, and that successive prices depend on each other. According to [36], technical analysts engage themselves in studying changes in market prices, the volume of trading and investors' attitude.

The Random Walk Hypothesis School: Both the "technical" and "fundamental" analyses have been challenged by scholars who subscribe to the random-walk hypothesis, which sees stock price movements in terms of a probability distribution of different possible outcome. The random-walk hypothesis is based on efficient market assumption that investors adjust security rapidly to reflect the effect of new information. Believers in the efficient capital market hypothesis argue that stock prices are essentially random and therefore, there is no chance for profitable speculation in the stock market. An interesting feature of random walk is the persistence of random shocks.

The Behavioural School: Behavioural school of finance holds that market might fail to reflect economic fundamentals under three conditions. When all three apply, the theory predicts that pricing biases in financial markets can be both significant and persistent. The first behavioural condition is irrational behavior; it holds that investors behave irrationally when they don't correctly process all the available information while forming their expectations of a company's future performance. The second is systematic patterns of behaviour, which hold that even if individual investors decided to buy or sell without consulting economic fundamentals, the impact on share prices would be limited. Lastly, limits to arbitrage in financial markets ascertain that when investors assume that a company's recent strong performance alone is an indication of future performance; they may start bidding for shares and drive up the price. Some investors might expect a company that surprises the market in one quarter to go on exceeding expectations [37].

Macro-Economic Hypothesis School: The macroeconomic approach attempts to examine the sensitivity of stock prices to changes in macroeconomic variables. The approach posits that stock prices are influenced by changes in money supply, interest rate, inflation and other macroeconomic indicators. It employs a general equilibrium approach, stressing the interrelations between sectors as central to the understanding of the persistence and co-movement of macroeconomic time series, based on the economic logic, which suggests that everything does depend on everything else.

3.2 Model Specification

The analysis of the relationship between stock market prices volatility and macroeconomic variables' volatility is built on the theoretical framework above and as adapted from [1]. According to macroeconomics hypothesis stock market prices are influenced by changes in money supply, interest rate, inflation and other macroeconomic indicators. The macroeconomic variables used in this paper are Industrial Production Index, IP (proxied by GDP), Consumer Price Index, CPI (proxied by inflation rate), money supply, MS (measured by broad money, M2), exchange rate, EXC (Naira/USD), and base lending rate BLR (proxied by interest rate), hence stock market prices will be proxied by all share index .

Taking into cognizance the above theories of stock market prices behaviour, the model of volatility can be expressed as:

$$SMPV = f(GDP, INF, EXCH, INT, MS) -----------$$

Where,

SMPV = Stock market prices volatility, GDP = Gross domestic product, INF = Inflation rate

EXCH = Exchange rate, INT = Interest rate and MS = Money supply

Conversion of Macroeconomics Variables to Their Volatility Form

The process of converting macroeconomic variables to their volatility form is given below:

(i) Let the macroeconomics variable represent Y_t

(ii) Let the log of macroeconomics variable represent Y_t^*

(iii) Take the first difference or lag Y_t^* by one i.e. Y^*_{t-1}

(iv) Find the relative change in the variable $(dY_t^*) = Y_t^* - Y^*_{t-1}$

(v) Find the mean of the relative change in the variable i.e. $d\bar{Y}_t^*$

(vi) Then we have $X_t = dY_t^* - d\bar{Y}_t^*$

Hence, X_t is the mean-adjusted relative change in the macroeconomics variables. Now we can use X^2_t as a measure of volatility.

Measures for volatility

In this research work, the volatility in stock market prices and macroeconomic variables is estimated by using GARCH models. The GARCH models introduced by [38] have been the most commonly employed class of time series models in the recent finance literature for studying volatility. The power of irresistible attraction of the models is its ability to capture both volatility clustering and unconditional return distribution with heavy tails. Since the GARCH methodology is well known, this paper will only provide a brief description of the models and their application to the variables being studied. In general, the GARCH (*p*,*q*) can be presented as follow:

$$Y_t = \lambda_0 + \sum_{i=1}^{k} \lambda_1 Y_{t-1} + \varepsilon_t \text{---}(\text{eqn } 3.2)$$

Where, $\varepsilon_t \sim N(0, \sigma_t^2)$

$$\sigma_t^2 = \rho + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-1}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-1}^2 \text{ – – – – – – – – – – – – – – – –}$$

The estimation of GARCH model involves the joint estimation of a mean and conditional variance equation. Equation (3.2), the conditional mean equation, is an autoregressive process of order *k* (AR (*k*)). Parameter λ's is the constant, *k* is the lag length, ε_t is the heterosedastic error term with its conditional variance (σ_t^2). Equation (2) is the conditional variance equation specified as the GARCH (*p*,*q*) model where *p* is the number of ARCH terms, and *q* is the number of GARCH terms. Several literature show that (for instance, study by [39], [40], [41], [42], and [43], among others), a simple GARCH model is parsimonious and generally gives significant results. Therefore, this paper will use AR(1)-GARCH(1,1) models to estimate the predicted volatility of the stock market prices and all macroeconomic variables lending rate) being studied.

3.3 Estimation Techniques

The first thing is to conduct a test of time series properties of the variables that will be examined. The classical econometric theory is anchored on the assumption that the observed data come from a stationary process, that is, a process whose means and variances are constant over time. Any series that is not stationary is said to be non-stationary. The rationale behind stationarity test is the fact that most economic variables evolve, grow and change over time in both real and nominal terms. This is so because a substantial part of economic theory generally deals with long-run equilibrium relationships generated by market forces and behavioural rules. Consequently, running a regression among such economic variables with the false assumption that they are stationary will result in spurious regression. [44] and [45]. It therefore follows that any analysis, forecast and policy recommendation based on such results would be meaningless. These problems are avoided by determining the order of integration of the variables. To conduct this stationary test, several approaches are employed in applied econometrics, prominent among these are the Philip-Perron (PP) test and Augmented Dickey Fuller (ADF) test. If the variables are non-stationary in levels, they are differenced at least once to make them stationary. However, differencing a variable may lead to a loss of long-run information. Thus, to determine whether a long run relationship exists between the dependent variable and the explanatory variables, co integration test is conducted.

After this, the relationship between stock market prices volatility and macroeconomic variables volatility will be examined using a two-variable vector autoregressive (VAR) model as shown in the Equation (3.4) and Equation (3.5).

$$SMPV_t = \delta_0 + \sum_{i=1}^{i} \alpha SMPV_{t-1} + \sum_{j=1}^{j} \beta MVV_{jt-1} + \mu_{1t} \text{ – – – – – – – –}$$

$$MVV_t = \theta + \sum_{i=1}^{k} \alpha VM_{t-1} + \sum_{i=1}^{l} \beta SMPV_{t-1} + \mu_{2t} \text{ – – – – – – – – – –}$$

In the equation above SMPV and MVV are the conditional volatility in the stock market and macroeconomic variables, respectively. These regressions will determine whether or not conditional stock market volatility can be predicted by conditional macroeconomic volatility and also, the reverse: the ability of conditional stock market volatility to predict conditional macroeconomic volatility. For this purpose, VAR Granger causality tests will be conducted to test the causality relationship between stock market prices volatility and macroeconomic variables volatility individually. In all estimation processes, the lag length for VAR models will be determined using Akaike Information Criterion (AIC). The Wald statistics will be used to test the following hypothesis; the volatilities of macroeconomic variables do Granger cause stock market prices volatility in Nigerian stock market.

Following the above is the regression analysis using OLS estimation techniques which will be carried out to identify the direction of relationship between stock market prices volatility and macroeconomic variables. Hence eqn 3.1 which is in its implicit form can be expressed in explicit form as thus:

$$VASI = \alpha_0 + \alpha_1 VGDP + \alpha_2 VINF + \alpha_3 VINT + \alpha_4 VEXCH + \alpha_5 VMS + \mu ----------- (eqn3.6)$$

Where,
VASI = Volatility All share index
Other is as defined previously

In the model represented by equation (3.6) above, the alphas are the parameters to be estimated and u is the error term that captures other variables not explicitly included in the model.

To test the reliability of our regression estimates, various diagnostic statistics will be used. These include the R^2 (i.e. coefficient of multiple determination), the R-2 (i.e. the adjusted coefficient of multiple determination), the F-test and Durbin-Watson (D.W test). Moreover, the significance of individual variables will be tested using the t-test. Finally, a test of volatility of the various variables used in the research work using GARCH (1,1) model in order to calculate the predicted volatility for all series will be conducted. The sources of these data include: Central Bank of Nigeria database (online), Nigerian Stock Exchange Fact book (various issues) and IMF-International Financial Statistics (online).

IV. ESTIMATION AND ANALYSIS OF RESULTS

4.1 Unit Root Test

This study commence it empirical analysis by first testing the properties of the time series used for analysis. We perform a unit root test on each of the variable since the variables are time series in nature. This enables us to avoid the problems of spurious result that are associated with non-stationary time series models. The test is conducted using two different unit root models. That is, the Augmented Dickey Fuller (ADF) model and the Philips-Perron (PP) model. During estimation, we estimated two models from the general framework where the first model suppresses the trend element, and take on the constant term and the second model estimates the general framework to accounts for both the constant and trend. The essence of using all these testing procedures is for confirmatory purpose and the result of the unit root test is shown in table 1 below:

Table 1: Unit Root Test for Stationarity

VARIABLE	Augmented Dickey-Fuller (ADF) Test			Phillip-Perron (PP) Test		
	CONSTANT	CONSTANT &TREND	STATUS	CONSTANT	CONSTANT &TREND	STATUS
VLASI	-3.975571*	-4.242234*	I(0)	-4.060840*	-4.264087*	I(0)
VLGDP	-8.265983*	-8.422011*	I(0)	-8.693079*	-9.367844*	I(0)
VLINT	-7.488180*	-7.423483*	I(0)	-7.497189*	-7.431249*	I(0)
VLINF	-5.107574*	-6.145650*	I(0)	-5.037632*	-6.610882*	I(0)
VLEXCH	-6.435333*	-6.387781*	I(0)	-6.408609*	-6.357433*	I(0)
VLMS	-5.151880*	-5.242474*	I(0)	-3.976888*	-3.956045**	I(0)

SOURCE: Author’s Computation

Notes: * indicates significant at one percent or a rejection of the null of no unit root at the one percent level
** indicates significant at five percent or a rejection of the null of no unit root at the five percent level

- In the model without trend: Level form: -3.6067 (1%), -2.9378 (5%) and -2.6069 (10%). In the model with trend: Level form: -4.2092 (1%), -3.5279 (5%) and -3.1949 (19%).

From the result presented in table 4.1 above, it was observed that the null hypothesis of non-stationarity is rejected at 5% and 1% critical value for ADF and PP with trend and without trend respectively. This means that the variables are stationary at levels, which is integrated of the same order. After establishing stationarity, next is the examination of the co-integration relationship among the variables.

4.2 Cointegration Test

Having established the unit root properties of the variables, the combination of two or more nonstationary variables could however be stationary if these series share a common long-run equilibrium relationship. In this case, these variables are said to be cointegrated. Thus, given the time series characteristics of the variables, this study further investigates employing (Trace Staistics) and (Maximum Eigenvalue) using methodology proposed by [47]. Hence, the result of the co-integration test (that is the existence of a long term linear relation) is presented in Table 2 below:

Table 2: Result of Johanson Cointegration

Sample (adjusted): 2000Q2 2012Q4						
Included observations: 51 after adjustments						
Trend assumption: Linear deterministic trend						
Series: VLASI VLEXCH VLGDP VLINF VLINT VLMS						
Lags interval (in first differences): 1 to 2						
TRACE STATISTIC						
Unrestricted Cointegration Rank Test (Trace)						
Hypothesized No. of CE(s)	Eigenvalue (5%)	Trace Statistic(5%)	0.05 Critical Value	Eigenvalue (1%)	Trace Statistic(1%)	0.01 Critical Value
None *	0.631955	136.9476	95.75366	0.928729	240.3477	104.9615
At most 1 *	0.494534	85.97053	69.81889	0.429237	103.0019	77.81884
At most 2 *	0.354629	51.17451	47.85613	0.391263	73.84131	54.68150
At most 3*	0.222409	28.84009	29.79707	0.340708	48.03016	35.45817
At most 4 **	0.171715	16.01084	15.49471	0.278925	26.36753	19.93711
At most 5 **	0.117979	6.402536	3.841466	0.164776	9.362862	6.634897
* denotes rejection of the hypothesis at the 5%(1%) level						
Trace test indicates 3 cointegrating eqn(s) at the 0.05 level						
Trace test indicates 6 cointegrating eqn(s) at the 0.01 level						
MAX-EIGEN STATISTIC						
Hypothesized No. of CE(s)	Eigenvalue (5%)	Maxi-Eigen Statistic (5%)	0.05 Critical Value	Eigenvalue (1%)	MaxiEigen Statistic (1%)	0.01 Critical Value
None **	0.631955	50.97708	40.07757	0.928729	137.3458	45.86900
At most 1 *	0.494534	34.79602	33.87687	0.429237	29.16063	39.37013
At most 2	0.354629	22.33442	27.58434	0.391263	25.81115	32.71527
At most 3	0.222409	12.82925	21.13162	0.340708	21.66264	25.86121
At most 4	0.171715	9.608304	14.26460	0.278925	17.00466	18.52001
At most 5 **	0.117979	6.402536	3.841466	0.164776	9.362862	6.634897
*(**) denotes rejection of the hypothesis at the 5%(1%) level						
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level						
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level						

SOURCE: Author's Computation

From Table 2 above, it is observed that the Trace test statistic indicates three cointegrating equations at the 5% level of significance and six cointegrating equations at 1% significant level. While the Max-Eigenvalue test indicates two co integrating equations at the 5% level of significance and one cointegrating equations at 1% significant level. Based on the evidence above, we can safely reject the null hypothesis (H_0) which says that there are no cointegrating vectors and conveniently accept the alternative hypothesis of the presence of cointegrating vectors. Thus, we can conclude that a long run relationship exists among the variables. This result means that in Nigeria's case, the hypothesis of no cointegration among the variables (VLASI, VLDGP, VLINT, VLINF, VLEXH and VLMS) should be rejected.

4.3 Causality Estimate

This section present the causal relationship between volatility of stock market prices proxy with all share index of the stock exchange and volatility of macroeconomic variables as suggested for the likely transmission channels of volatility of stock market prices in Nigeria. Causality does not necessarily imply correlation in the sense that the result obtained may not explain whether the relationship is positive or negative. However, stock market prices volatility and Volatility of macroeconomics variables, as widely suggested by many scholars in the literatures are construed to be related both negatively and positively, in other words, the dimension of the relationship is unclear.

In testing for Granger causality, two variables are usually analyzed together, while testing for their interaction. All the possible results of the analyses are four:

(i) Unidirectional Granger causality from variable Yt to variable Xt.
(ii) Unidirectional Granger causality from variable Xt to Yt
(iii) Bi-directional causality and
(iv) No causality

In estimating the two-variable autoregressive model (VAR) stock market prices volatility and volatility of macroeconomic variables being studied, the Akaike information criterion (AIC) was used in determining the lag length of the respective VAR model. And, based on the estimated VAR model, the Granger causality tests have been carried out.

Here, we present the main results obtained from the Wald Granger-causality analysis done in the study. Fifteen pairs of variables were modeled as seen in table 4.3 below: The six variables considered are represented as follows:

(i) Stock market prices volatility proxy ASI (VLASI) – A
(ii) Industrial production index proxy GDP (VLGDP)- B

(iii) base lending rate proxy Interest rate VLINT- C
(iv) Consumer Price Index proxy inflation VLINF-D
(v) Exchange rate, VLEXCH- E
(vi) Money Supply (VLMS)- F

Table 3 Results of Wald Granger causality tests

WALD TEST	OBS	CHI-SQUARE	WALF P-VALUE	DECISION	TYPE OF CAUSALITY
A↗B	51	1.143020	0.7667	DNR H0	No causality
B↗A	51	1.451979	0.6934	DNR H0	No causality
C↗B	51	0.815160	0.8458	DNR H0	No causality
B↗C	51	5.895781	0.1168	DNR H0	No causality
D↗B	51	1.070462	0.7842	DNR H0	No causality
B↗D	51	0.763768	0.8581	DNR H0	No causality
E↗B	51	1.181106	0.7575	DNR H0	No causality
B↗E	51	1.276630	0.7347	DNR H0	No causality
F↗B	51	2.059920	0.5601	DNR H0	No causality
B↗F	51	2.077968	0.5564	DNR H0	No causality
C↗A	51	8.898274	0.0258	Reject H0	Uni-directional causality
A↗C	51	5.550502	0.1356	DNR H0	No causality
C↗D	51	1.031182	0.7937	DNR H0	No causality
A↗D	51	3.726916	0.2925	DNR H0	No causality
E↗A	51	10.19513	0.0126	Reject H0	Bi-directional causality
A↗E	51	11.31845	0.0101	Reject H0	Bi-directional causality
F↗A	51	2.251417	0.4107	DNR H0	No causality
A↗F	51	8.828616	0.0317	Reject H0	Uni-directional causality
D↗C	51	2.588372	0.4595	DNR H0	No causality
C↗D	51	1.031182	0.7937	DNR H0	No causality
E↗D	51	0.782523	0.8536	DNR H0	No causality
D↗E	51	0.648540	0.8852	DNR H0	No causality
F↗E	51	1.249431	0.7412	DNR H0	No causality
E↗F	51	72.03394	0.0000	Reject H0	Uni-directional causality
C↗E	51	0.477983	0.9237	DNR H0	No causality
E↗C	51	1.349680	0.7174	DNR H0	No causality
C↗F	51	7.811588	0.0411	DNR H0	Uni-directional causality
F↗C	51	1.114223	0.7736	DNR H0	No causality
D↗F	51	3.146265	0.3696	DNR H0	No causality
F↗D	51	0.828317	0.8427	DNR H0	No causality

SOURCE: Author's Computation

Alpha (α) = 0.05
Decision rule: reject H0 if Wald P-value < 0.05.
Key: DNR = Do not reject;
↗ = does not Granger cause.

Table 3 above presents the Granger causality tests from the bi-variate VAR model for testing the extent to which conditional stock market prices volatility can be predicted/predict conditional macroeconomic variables' volatility. The Wald statistics for testing the power of the macroeconomic variables volatility in predicting stock market prices volatility is also presented. Based on Wald statistics, it is stated that only the volatility of two macroeconomic variables, VLEXCH and VLINT significantly Granger cause the volatility in stock market prices in Nigeria. Meanwhile, in terms of the ability of stock market volatility prices to predict macroeconomic variables' volatility, it was revealed that volatility of stock market prices Granger cause volatility in exchange rate and money supply. The result also has shown that, volatility in interest rate and exchange rate Granger cause volatility in money supply at the 5% level.

The limitation of Granger causality test is that it does not provide the sign of relationship, which is very important in order to have a clear perception on the direction and the significant of the relationships between the variables. To overcome this, further analysis was conducted using regression analysis.

4.4 Regression Result Analysis

In the regression analysis, the volatility of stock market prices are regressed with all macroeconomic variables' volatilities as discussed previously under this study as independent variables.

Table 4: Estimation results on the OLS regression between stock market prices volatility and macroeconomic variables volatilities.

Independent Variables	Coefficient	t-Statistic	Prob.
Constant	0.018298	2.955356	0.0048
VLGDP	0.045057	0.151404	0.8803
VLINT	-0.213449	-0.369054	0.0037
VLINF	-0.000299	-0.418588	0.6774
VLEXCH	10.27652	5.094577	0.0000
VLMS	0.000224	1.716850	0.0925

SOURCE: Author's Computation

R^2 = 0.574544; Adjusted R^2 = 0.519809; F-statistics = 8.669844(Prob. = 0.000007)
*Significant at 5% level, Durbin-Watson Stat= 1.928335

Table 4 above presents the finding from the regression analysis of conditional stock market prices volatility on all the macroeconomic variables' volatilities. We found that only volatility in exchange rate, interest rate and volatility in money supply is statistical significance at 5%, 5% and 10% level of significance respectively. This is in contrast with the Granger causality tests where we found out that VLEXCH and VLINT are statistically important for VLASI. As expected, all coefficients of macroeconomic variables' volatilities are positive except VLINF and VLINT.

However, In terms of magnitude of effect, a unit increase change in exchange rate of naira vis-à-vis U.S dollar (VLEXCH), industrial production (VLGDP) and percentage increase in changes in money supply (VLMS) will increase the stock market prices volatility of the Nigerian Stock Exchange (NSE) by 10.2765, 0.0450 and 0.00022 respectively. The coefficient of VLEXCH is relatively large compared to other coefficients. This indicates that VLEXCH volatility is an important factor in determining the volatility in stock market prices in Nigeria.

Also, other incorporated determinants of stock market prices volatility such as, interest rate (VLINT) and consumer's prices index volatility (VLINF) shows that a unit decrease in their volatility will increase stock market prices volatility by 0.2134 and 0.0003 respectively.

Although, the F-statistic result shows that all the volatility in macroeconomic variables-(i.e. exchange rate volatility (VLEXCH), consumer price index (VLINF), interest rate (VLINT), broad money supply (VLMS) and industrial production (VLGDP))-incorporated are simultaneously significant at 5% critical level given the F-value from table 4.4 as 0.000007.

Meanwhile, in term of explanatory power, the result shows that the overall coefficient of determination (R^2) shows that the equation has a good fit with 57 percent of dependent variable explained by the explanatory variables in the equation. The reason for being a good fit is that it is statistically above the bench mark of 50 percent. As the adjusted (R^2) tends to purge the influence of the number of included explanatory variables, the (R^2) of 0.519 shows that having removed the influence of the explanatory variables, the model is still of good fit and the dependent variable explained by the equation by 51 percent, hence, in terms of the goodness of fit we can say that the test is fair. The Durbin Watson (D.W) statistics of 1.93 as it is not significantly farther from the bench mark, we can conclude that there is no auto- correlation or serial correlation in the model specification; hence the assumption of linearity is not violated.

4.5 Measurement of Volatility

Here, the result of eqn 3.2 and 3.3 estimated is presented, it is intended to model the volatility of the stock market prices and the volatilities of macroeconomics variables affecting it. The result is presented in the below table 4.5

Table 5: Estimation results of GARCH (1,1) model and diagnostics

Variable	**Coefficient**	**Std Error**	**Z-Statistic**	**Prob.**
		Mean Equation		
C (λ_0)	0.010211	0.013960	0.731464	0.0000
VLASI(-1) λ_1	0.524557	0.202137	2.595056	0.0095
		Variance Equation		
C (P)	0.001128	0.001229	12.91754	0.0000
Resid(-1)^2 (αi)	0.140157	0.289937	8.483405	0.0288
Garch(-1) (βj)	0.561602	0.512459	8.195897	0.0131
VLGDP	-0.013271	0.016041	-0.827291	0.4081
VLINT	-0.014641	0.040908	11.35790	0.0004

VLINF	-4.28E-05	4.77E-05	-0.897289	0.3696
VLEXCH	0.004466	0.227241	11.01965	0.0003
VLMS	-1.36E-05	1.61E-05	7.842966	0.0392

Residual Diagnostic

Test	Hypothesis	Decision	Result	Conclusion
Q-Statistic	H0: There is no serial correlation. H1: There is serial correlation.	Accept H0 if p-value >5% & vice versa	P-values>5%	No serial correlation
ARCH LM-Test	H0: There is no ARCH Effect H1: There is ARCH Effect	Accept H0 if p-value >5% & vice versa	P-value>5%	No ARCH Effect
Normality Test	H0:Residuals are normally distributed H1: Residuals are not normally distributed	Accept H0 if p-value >5% & vice versa	P-value<5%	Not normally distributed

SOURCE: Author's Computation

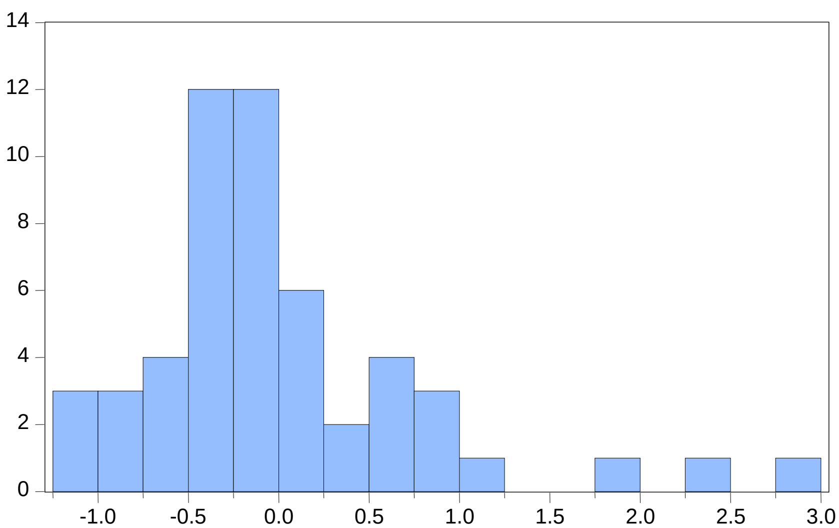
From table 5 above, using the normal Gaussian distribution, ARCH effect is found significant. It means that information about previous values of stock market prices influence today's stock market prices volatility i.e σ_t^2 in eqn 3.3. Also, GARCH is also found significant meaning that previous period volatility in stock market prices can influence today's stock market prices volatility. It then means that stock market prices volatility is influenced by its own ARCH and GARCH factors of its own shocks.

Volatility in exchange rate, interest rate and money supply are also significant meaning that volatility in exchange rate, interest rate and money supply or outside shock influenced the volatility in stock market prices in Nigeria.

Volatility in gross domestic product and inflation are not significant meaning that volatility in gross domestic product and inflation cannot be transmitted to volatility in stock market prices.

Residual diagnostic test result also from table 4.5 above shows that null hypothesis of no serial correlation and no ARCH effect is accepted given their respective P-value which is greater than 5% level of significance. While the normality test shows that alternative hypothesis is accepted given the P-value which is less than 5% level of significance

.



Series: Standardized Residuals	
Sample 1999Q4 2014Q4	
Observations 61	
Mean	0.004800
Median	-0.203339
Maximum	2.868214
Minimum	-1.092412
Std. Dev.	0.787718
Skewness	1.625000
Kurtosis	6.265877
Jarque-Bera	46.87948
Probability	0.000000

4.6 Summary of Findings

The results from bi-variate VAR Granger causality tests show that out of five macroeconomic variables' volatility examined, only volatility in EXCH and INT significantly Granger-caused the volatility in stock market prices. Between the two variables that was found significant, only in the case of VLEXCH that the causality relationship runs from VLASI to VLEXCH therefore showing a Bi-directional relationship between exchange rate and stock market prices. In the case of VLMS, the direction of causality is from interest rate volatility, exchange rate volatility and stock market prices volatility.

Consistent with Granger causality tests, the results from regression analysis also found that only VLEXCH and VLINT out of five macroeconomic variables' volatility studied is statistically significant at 5% level. Based on the regression analysis, the variables which have a significant relationship with stock market prices volatility in Nigeria is exchange rate volatility and interest rate volatility. The relationship between stock market prices volatility and exchange rate volatility is positive and the size of the coefficient is relatively high indicating a significant influence of exchange rate volatility on stock market volatility pries in Nigeria. The low explanatory power from the regression analysis indicates that the volatilities of all macroeconomic variables used in regression played very minor role in the volatility of stock market prices in Nigeria.

From the measurement of volatility result, it can be deduced that both ARCH and GARCH factors influenced stock market prices volatility and shows that stock market prices volatility result from its own shock. Exchange rate, interest rate and money supply are outside shock that influenced stock market prices volatility while volatility in gross domestic product and inflation shows no connection with stock market prices volatility. Hence, the diagnostic test shows no serial correlation and no ARCH effect which are a good signal of a good model but it shows that the residuals are not normally distributed which is the weakness of this model. However, it has been suggested by scholars that non-normality in the residual may not be a serious problem as the estimators are still consistent.

5. Conclusion

In conclusion, we can infer from our findings that evidence in support of the existence of the relationship between stock market volatility prices and macroeconomic variables' volatility has been established in developing countries like Nigeria. However, irrefutable decision cannot be drawn as only three out of five macroeconomic variables being studied have a relationship with stock market prices volatility given the result from GARCH (1,1) model. The volatility in GDP, inflation and money supply were not found to Granger-caused, and not significantly related to stock market prices volatility. Only volatility in interest rate and exchange rate does Granger -cause stock market prices volatility; while from the regression analysis, only interest rate volatility and exchange rate are significantly related to stock market prices volatility. This finding is admissible in the case of developing countries with the supremacy of non-institutional investors and the existence of information asymmetry problem among investors which could account for the weak relationship between stock market prices volatility and macroeconomic variables' volatilities. Hence, on the basis of the F-Statistic result, the null hypothesis that "macroeconomics variables' volatility has no significant relationship with stock market prices volatility in the Nigerian stock market" is rejected at 5% significance. Therefore, we conclude that some of the macroeconomics variable's volatility granger-cause stock market prices volatility in Nigeria. The explanatory power and Durbin-Watson test also depict that the test is very fair.

References

[1] Zukarnain Zakaria and Sofian Shamsuddin (2012,"Empirical Evidence on the Relationship between Stock Market Volatility and Macroeconomics Volatility in Malaysia" Journal of Business Studies Quarterly 2012, Vol. 4, No. 2, pp. 61-71.

[2] Rajni, M. & Mahendra, R. (2007). Measuring Stock Market Volatility in an Emerging Economy. International Research Journal of Finance & Economics 8,126-133 The Journal of political Economy, Vol. 81, No. 3, pp. 637 – 654.

[3] Mollah, S. A. (2009). "Stock Return & Volatility in the Emerging Stock Market of Bangladesh". Journal of the Academy of Business & Economics, 43 (2),29-78.

[4] Abken, P. A. & Nandi, S. (1996). "Options & Volatility". Economic Review; December, pg.21-35.

[5] Karolyi, G. A. (2001) "Why Stock Return Volatility Really Matters", *Preliminary and Incomplete version*, February 2001.

[6] Mordi, F. I. (2006). Behaviour of Share Prices in the Nigerian Stock Market & the R&om Walk Hypothesis: University of Nigerian Research Publications.

[7] Lahaye, J., Laurent, S., and Neely, C. J., 2009. Jumps, jumps and macro announcements. Working Paper of Federal Reserve Bank of St. Louis, No 2007-032, Revised Version.

[8] Hanousek, J., Kocenda, E., and Kutan, A. M., 2008. The reaction of asset prices to macroeconomic announcements in new eu markets: evidence from intraday data.

[9] Joulin, A., Lefevre, A., Grunberg, D., and Bouchaud, J.-P., 2008. Stock price jumps: news and volume play a minor role. http://arxiv.org/abs/0803.1769.

[10] Bouchaud JP, Potters M. 2004. Theory of Financial Risk and Derivative Pricing: From Statistical Physics to Risk Management Cambridge, UK: Cambridge Univ. Press.

[11] Corradi, V., Distaso, W. and Mele, A., 2006. Macroeconomic determinants of stock market volatility and volatility risk-premia. Working Paper. University of Warwick, UK.

[12] Lee, B. S. (1992). Causal relationships among stock returns, interest rates, real activity, and inflation. Journal of Finance, 47, 1591-1603.

[13] Dropsy, V. Nazarian-Ibrahimi, F. (1994). Macroeconomic policies, exchange rate regimes and national stock markets. International Review of Economics and Finance, 3, 195- 220.

[14] Ibrahim, M. H., (1999). Macroeconomic Variables and Stock Prices in Malaysia: An Empirical Analysis. Asian Economic Journal, Vol. 13, No. 2, pp. 219-231.

[15] Park, K., Ratti, R. A. (2000). Real activity, inflation, stock returns, and monetary policy. Financial Review, 35, 59-78.

[16] Wongbanpo, P., Sharma, S. C. (2002). Stock market and macroeconomic fundamental dynamic interactions: ASEAN-5 countries. Journal of Asian Economics, 13, 27-51.

[17] Mukhopadhyay, D., Sarkar, N. (2003). Stock return and macroeconomic fundamentals in model-specification framework: Evidence from Indian stock market. Indian Statistical Institute, Economic Research Unit, ERU 2003-05 Discussion Paper, 2003, 1-28.

[18] Fabozzi, F. J., Tunaru, R., Wu, T. (2004). Modeling volatility for the Chinese equity markets. Annals of Economics and Finance, 5, 79-92.

[19] Caporale, G. M., Howells, P. G. A., Soliman, A.M. (2004). Stock market development and economic growth: the causal linkage. Journal of Economic Development, 29, 33-50.

[20] Abugri, Benjamin A. (2008). Empirical relationship between macroeconomic volatility and stock returns: Evidence from Latin American markets. International Review of Financial Analysis, 17, 396-410.

[21] Raju, M. T., & Ghosh, A. (2004). Stock Market Volatility – An International Comparison. Securities and Exchange Board of India, Working Paper Series No. 8.

[22] Chowdhury, S. S. H., and Rahman, M. A. (2004). On the Empirical Relation between Macroeconomic Volatility and Stock Market Volatility in Bangladesh. The Global Journal of Finance and Economics, Vol. 1, No. 2, pp. 209-225.

[23] Döpke, J., Hartmann, D., & Pierdzioch, C. (2005). Forecasting stock market volatility with macroeconomic variables in real time. Banking and Financial Studies 2006, 01, Deutsche Bundesbank, Research Centre. Discussion Paper Series 2.

[24] Chinzara, Z., Aziakpono, M.J. (2009), Dynamic Returns Linkages and Volatility Transmission between South African and World Major Stock Markets. Working Paper Number 146.

[25] Mahmood, W. M., Dinniah N. M. (2009). Stock returns and macroeconomic variables: Evidence from the six Asian-Pacific countries. International Research Journal of Finance and Economics, 30, 154-164.

[26] Rahman, A. A., Mohd Sidek, N. Z., and Tafri, F. H. (2009). Macroeconomic Determinants of Malaysian Stock Market. African Journal of Business Management, Vol. 3 (3), pp. 95-106.

[27] Alagidedea, P., Panagiotidisb, T. (2010), Can Common Stocks Provide a Hedge against Inflation? Evidence from African Countries. Review of Financial Economics, 19, 91-1000.

[28] Arjoon, R., Botes, M., Chesang, L.K., Gupta, R. (2010), The Long-Run Relationship between Inflation and Real Stock Prices: Empirical Evidence from South Africa. Department of Economics Working Paper Series2010- 28, University of Pretoria.

[29] Xiufang Wang (2010) "The Relationship between Stock Market Volatility and Macroeconomic Volatility: Evidence from China" International Research Journal of Finance and Economics, ISSN 1450-2887 Issue 49, Euro Journals Publishing, Inc.

[30] Gupta R., Modise, M.P. (2011), Macroeconomic Variables and South African Stock Return Predictability. working paper.

[31] Chinzara, Z. (2011), Macroeconomic Uncertainty and Conditional Stock Market Volatility in South Africa. South African Journal of Economics, 79, 27-49.

[32] Wang, X. (2011). The Relationship between Stock Market Volatility and Macroeconomic Volatility: Evidence from China. Journal of Chinese Economic and Finance, 2, pp. 67-77

[33] Amadi S.N., Onyema J.I. and T.D. Odubo (2002): "Macroeconomic Variables and Stock Prices. A Multivariate Analysis". Africa Journal of Development Studies, 2(1), 159-164.

[34] Nwokoma N.I. (2002), "Stock Market Performance and Macroeconomic Indicators Nexus in Nigeria". An empirical investigation' *Nigerian Journal of Economic and Social Studies,* 44-62.

[35] Oseni, I. O., & Nwosa, P. I. (2011). Stock market volatility and macroeconomic variables volatility in Nigeria: an exponential GARCH Approach. European Journal of Business and Management, 3(12), 43-54.

[36] Smith, L. H. (1990) Stock Prices Behaviour in the American Economy. American Economic Review. Proceedings 71, (419- 430).

[37] Business Day Newspaper, February 19, 2009, Pg. 9.

[38] Bollerslev T. (1986), "Generalized autoregressive conditional heteroscedasticity". Journal of Econometrics. 31. p. 307-327.

[39] Akgiray, V. (1989). Conditional Heteroscedasticity in Time Series of Stock Returns: Evidence and Forecasts. *The Journal of Business*, Vol. 62, No. 1, pp. 55-88.

[40] Conally, R. A. (1989). An Examination of the Robustness of the Weekend Effect. *Journal of Financial and Quantitative Analysis*, Vol. 24, pp. 133-169.

[41] Baillie, R. T., and DeGennaro, R. P. (1990). Stock Return and Volatility. *Journal of Financial and Quantitative Analysis*, Vol. 25, pp. 203-214.

[42] Bera, A. K., and Higgins, M. L. (1993). ARCH Models: Properties, Estimation and Testing. *Journal of Economic Survey*, Vol. 7, pp. 305-362.

[43] Floros, C. (2008). Modelling Volatility Using GARCH Models: Evidence from Egypt and Israel. *Middle Eastern Finance and Economics*, 2, pp. 31-41.

[44] Granger, C. and Newbold, P. (1974), Spurious Regressions in Econometrics. *Journal of Econometrics 2:111-120*

[45] Chhiber, A. and Wijnbergen, S. V. (1988). Public Policy and Private Investment in Turkey. *World Bank Working Paper Series WB/27/03.*

[46] Johansen, S. and Juselius, K. (1990). Maximum Likelihood Estimation and Inferences on Cointegration with applications to the demand for money. Oxford Bulletin of Economics and Statistics , 52, 169 – 210.