Application of Generalized Autoregressive Conditional Heteroschedasticity Model on Inflation and Share Price Movement in Nigeria

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ABSTRACT

In the past, studies on the linkage between share prices movement and inflation has been subjected to extensive research by academics, researchers, practitioners and policy makers since the 1990s. Most studies in the industrialized economies showed the existence of negative relationship between share price movement and inflation. Consequently, this paper utilized generalized autoregressive conditional heteroschedasticity (GARCH) model and investigated the influence of inflation on share price movement in Nigerian stock market, using quarterly data for the period 1981 to 2012. The findings of this paper suggest that the GARCH terms of the share price movement in Nigeria depicted a variance of autoregressive conditional heteroscedastic behaviour. Furthermore, share price movement and inflation exhibited a collective volatility of about 0.0015% during the study period. Share price movement exhibit a volatile shock of about 79% in behaviour while a 1% increase in inflation leads to about 0.15% decrease in share price movement in Nigeria. In addition, a 1% increase in market capitalization leads to about 66.8% increase in share price movement in Nigeria. Therefore, stabilizing inflation will deepen the Nigerian stock market the more thereby leading to a trickling down effect on the stock market capitalization. Hence, policies geared towards the reduction and stabilization of inflation to at least, single digit is recommended to the Nigerian monetary authorities.

Keywords: Inflation, Share Price, Generalized Autoregressive Conditional Heteroschedasticity, Influence, Stock Market
JEL Classifications: E31, G00, G10, G12

1. INTRODUCTİON

The influence of inflation on any economy is various and can be positive or negative at the same time. However, negative influence of inflation include an increase in the opportunity cost of holding money, uncertainty over future inflation, which may discourage investment and savings, and if inflation is rapid enough, shortages of goods as consumers will begin hoarding out of concern that prices will increase in the future. More so, positive influence involve, ensuring that central banks can adjust real interest rates (INTR) (to mitigate recessions) and encourage investment in non-monetary capital projects.

Therefore, when the general price level rises, each unit of currency buys fewer goods and services. Consequently, inflation reflects a reduction in the purchasing power per unit of money - a loss of real value in the medium of exchange and unit of account within the economy. A chief measure of price inflation is the inflation rate (INF), the annualized percentage change in a general price index (normally the consumer price index) over time. Corrado and Jordan (2002) observed the influence of INF amongst other factors on the stock market performance. As a result of this, policy makers noticed inflation as one of the major factors that derail any economy if not well taken care of.

However, the stock market as a common feature of a modern economy has reputed functions to perform in a bid to promoting the growth and development of the economy. The market is an economic institution; which promotes efficiency in capital formation and allocation. It enables governments and industry to raise long-term capital for financing new projects, and expanding and modernizing industrial and commercial concerns and hence, undertakes investments in the stock market in long term, which however, implies that any development that could affect the

stability of the economy usually has serious influence on the performance of the stock market and/or the movement of the share price in the market.

1.1. Statement of the Problem

The problem of inflation in Nigeria has continued to disturb the monetary authority and as a result, they have tirelessly continued to search for remedies. Hence, the movement of inflation in the Nigerian economy can be seen in Figure 1.

Figure 1 shows the quarterly movement of inflation in Nigeria from the last quarter of 1981 (1981Q4) to the last quarter of 2012 (2012Q4). The choice of the last quarter of the years under consideration is due to the fact that the fourth quarter (Q4) of every year marks the end of each fiscal year in Nigeria. Hence, from the graph, it can be seen that the rate of inflation in Nigeria on quarterly basis is not stable. The rate of inflation in Nigeria was relatively stable between 1981Q4 and 1987Q4 but thereafter, it increased sharply up to the last quarter of 1988. It however falls with a very steep slope from 1989Q4 to 1990Q4. Thereafter, it increased again although, with a gentle slope from 1991Q4 to 1994Q4. During this period, the economy experienced high inflationary pressure brought about by fiscal expansion noticed in the 1988 budget, the debt for equity swaps conversion method adopted by the Government of Nigeria and the drastic contraction in monetary policy, all accounted for this high inflationary pressure that bedevilled the economy throughout the early 1990's. Between 1995Q5 and 1996Q4, it decreased very sharply and with a gentle slope after this period reaching its minimum at 1999Q4 with a rate of about 0.22 but thereafter, it increased again to 2000Q4.

In addition, the increase in the inflationary pressure in this period was attributed to fiscal deficit expansion which caused a rise in money supply with a knock-on effect on domestic credit of the private sector of the economy (Central Bank of Nigeria, CBN; 2007). After this quarter, it continued to fluctuate but remained relatively stable between 2009Q4 and 2012Q4. Therefore, from the fore going, inflationary pressure in Nigeria can be largely attributed to structural factors such as; real income reduction caused by fluctuation in oil revenue, high nominal wages and debt obligation in form of expansionary fiscal deficit. Consequently, if this INF is not stabilized, it may continue to discourage investments in the real sector and the Stock Market thereby, slowing economic growth of the country. This is because, inflation creates uncertainty in the economy and uncertainty makes both domestic and foreign investors unwilling to invest.

However, in the Stock market, Stocks listed in Nigeria are traded on the floor of the Nigerian Stock Exchange (NSE) while the Securities and Exchange Commission (SEC) is the apex regulatory body which oversees the activities and affairs of the major players on the floor of the Stock Exchange. Although the SEC deregulated the securities pricing in 1993, abolished in the 1995, both the Exchange Control Act of 1962 and the Nigerian Enterprise Promotion Decree of 1989, and demanded the reorganization of the Nigerian Sock Exchange to make it more dynamic and mobile in the provision of adequate liquidity of investment to bring up the operation of the exchange to international standard and attract

foreign portfolio investors. These developments in the Nigeria capital market contributed positively to the growth of the market, which was also evidenced in the increase in market capitalization and level of volume traded in the equity market.

Consequently, the NSE all share index (ASI) improved and henceforth, provided a composite picture of the financial health of listed equities. Hence, the movement of the ASI in the NSE Market can be seen in a Figure 2.

Figure 2 shows the movement of the Nigerian Stock share prices on the quarterly basis. The study also adopted the last quarter of the years under review (that is; from 1981Q4 to 2012Q4). It can be observed from the graph that the share price movement of the Nigerian Stock market also fluctuates hence, it is not stable. Therefore, from the graph, it can be seen that it was relatively stable at the early years under review (that is; from 1981Q4 to 1994Q4). Thereafter, it started rising gently in a fluctuating manner until it reached its highest point in the last quarter of 2008 (that is; 2008Q4). This period was marked by an improvement in the Nigerian economy.

However, the collapse of the world economy did not excuse that of Nigeria. Many stock markets of countries from USA to Britain, from China to Japan, Russia, France and others experienced serious trouble brought about by global financial crises. The world is indeed a global village and interrelatedness of world economies is much evidenced that any development in any part of the world affects other parts as well. Consequently, the Nigerian Stock market was not insulated from the global crisis. Thus, ASI plummeted with a very steep slope from its highest point

Figure 1: Actual inflation growth rate movement in Nigeria
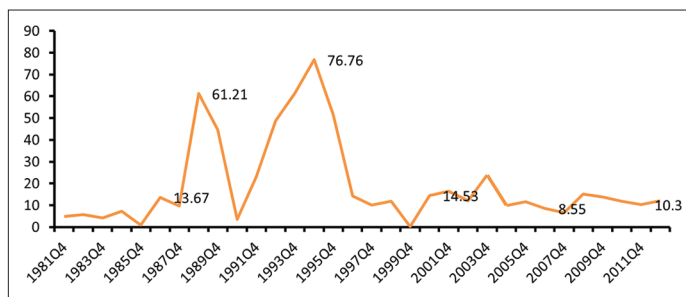
Source: Authors' computation from data extracted from CBN (2012) Bulletin

Figure 2: Share price movement in Nigerian stock market
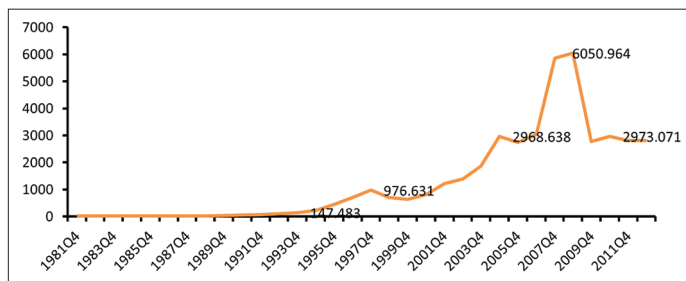
Source: Authors' computation from data extracted from CBN (2012) Bulletin

of 605096.4 basis point in 2008Q4 to 277098.6 basis point in 2009Q4. Thereafter, it increased gently but fluctuated gradually from 2010Q4 to 2012Q4 without any sign of falling.

Thus, it is pertinent to note here that the stock market is of great interest to economists and policy makers because of the perceived benefits to the economy. Therefore, in Nigeria, looking at the influence of inflation and market capitalization on share price movement of the Nigerian stock market has many policy implications for investors, researchers, and policy makers.

1.2. Performance of Nigerian Stock Market - Stylized Fact with Graph

The NSE was established in September 15,1960 but it started business on June 5, 1961 with 19 securities listed and traded on the Lagos Stock Exchange. The Lagos Stock Exchange was renamed and made part of the NSE in December 5, 1977 through the recommendation of the Government Financial System Review Committee held in 1976. The NSE has about thirteen branches established in major commercial cities in Nigeria with corporate head quarters in Lagos Nigeria. The major exchange of stocks of large enterprises is traded in the NSE while small and medium scale enterprises are listed and traded in the Second tier Securities Market. Consequently, the study presents market capitalization (Mcap) and ASI in Figure 3 based on quarterly data, by utilizing the last quarter of the years under review (Q4), to show their performances and movements.

It can be seen from Figure 3 that between 1981Q4 and 1995Q4, market capitalization (Mcap) and ASI sub-summed each other. This shows that the market was relatively stable but, after this period, both of them started rising and fluctuating in a gentle slope with ASI being above mcap up to 2005Q4 where mcap increased sharply with a very steep slope and became above ASI. This rise in mcap also made ASI to rise but as mcap reached 2007Q4 and fall sharply with a steep slope to 2008Q4, ASI was relatively horizontal and stable. Thereafter, both of them fall freely with a very steep slope to 2009Q4 and started increasing again from 2010Q4. But as mcap was increasing in a fluctuating and with a very steep slope without any sign of falling after 2012Q4, ASI fluctuated in a relatively stable manner without any sign of increase or decrease up to 2012Q4.

Moreover, in Figure 4, the study presented number of deals traded in the Nigerian stock market (NODEALS), value of deals traded in the Nigerian stock market (VODEALS) and ASI in the Nigerian stock market. This figure can be seen Figure 4.

From Figure 4, it can also be seen that the number of deals traded in the Nigerian stock market (NODEALS), value of deals traded in the Nigerian stock market (VODEALS) and ASI in the Nigerian stock market sub-summed each other between 1981Q4 and 1999Q4 thereby, making them to be relatively stable within this quarterly periods.
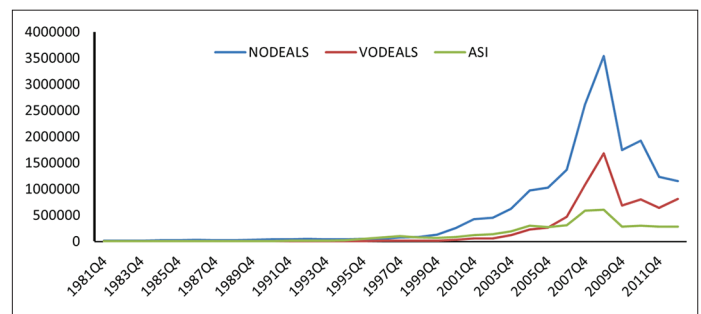
Worthy of note here is that all these variables (NODEALS, VODEALS and ASI) follow the same pattern of movement. Thus, from 2010Q4, all these variables started rising gently in

Figure 3: Market performance and share price movement
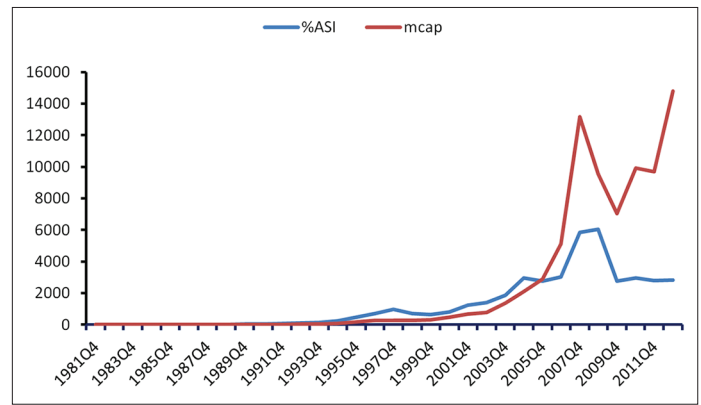
Source: Authors' computation from data extracted from CBN (2012) Bulletin

Figure 4: Number, value of shares traded and all share index

Source: Authors' computation from data extracted from CBN (2012) Bulletin

a fluctuating way but, NODEALS remained higher of all the three variables as they move along their path. As the movement continued, VODEALS and ASI subsumed each other up to 2006Q4 where VODEALS now became higher than ASI till 2012Q4. After this point, NODEALS continued to remain higher of all the three variables. This is followed by VODEALS and lastly ASI.

Another interesting thing in the figure is that between 2010Q4 and 2012Q4, as NODEALS fluctuate decreasingly without any sign of increase in the next quarter, VODEALS fluctuated increasingly with a sign of increasing in the next quarter while, ASI fluctuated in a relatively stable way without any sign of increase or decrease.

2. LITERATURE REVIEW

2.1. Theoretical Literature

The major theoretical literatures that connected inflation and share price movement of the stock market are reviewed in this section. These theories are more pronounced in the Fisher (1930) hypothesis on INTR and inflation, and that of proxy hypothesis of Fama (1981).

The generalized Fisher (1930) hypothesis states that equity stocks represent claims against real assets of a business; and as such, may serve as a hedge against inflation. If this holds, then investors could sell their financial assets in exchange for real assets when expected inflation is pronounced. This argument

of stock market serving as a hedge against inflation may also imply that investors are fully compensated for the rise in the general price level through corresponding increases in nominal stock market returns and thus, the real returns remain unaltered. Hence, Fisher (1930) posited that nominal INTR is entirely a sign of the existing information in relation to the likely future values of the rate of inflation. Fisher (1930) hypothesis on INTR and inflation suggested that there is a positive relationship between INTR and inflation (Berument and Jelassi, 2002). The Fisher (1930) hypothesis is now known as ''the Fisher effect'' in the economic literature. Fisher effect states that expected nominal rates of interest on financial assets should move one-to-one with expected inflation Crosby (2001). Therefore, Fisher hypothesis in its strict sense, presupposes that there exists a positive homogeneous relationship of degree one between stock return and inflation (Luintel and Paudyal, 2008).

However, on inflation and stock price movement theory, Fama (1981) introduced the proxy-hypothesis to explain the predominance of negative stock price movement and/or return to inflation trend. The main principle of which Fama (1981) introduced its theory was based on the proxy-effect hypothesis. Fama's version of the proxy-effect theory was based on the observed negative relationship that exists between inflation and stock price and/or returns, which appears to be spurious since this relationship is a result of the positive relationship that exist between stock returns and expected economic activity and an inverse relationship between expected economic activity and inflation. This theory was later supported and expanded by Lee (1998) who posits that inflation simply serves as a proxy for expected economic activity in a statistical relationship between stock returns and inflation.

The inflation illusion hypothesis of Modigliani and Cohn (1979) point's out, that the real effect of inflation is caused by money illusion. According to Baekaert and Engstrom (2009), inflation illusion suggest that when expected inflation rises, bond yields duly increase, but because equity investors incorrectly discount real cash flows using nominal rates, the increase in nominal yields leads to equity under-pricing and vice versa. Lee (1998) on the proxy hypothesis posits that the negative relationship between inflation and stock returns is spurious and really only proxies for the positive relationship between stock returns and real variables. Consequently, former testes of the proxy hypothesis have been done using actual values instead of forecasted values for the real activity variable. However, McCarthy et al., 1990 did not empirically find a support for the proxy hypothesis using only forecasted variables.

2.2. Empirical Literature

Olufisayo (2013) examined the relationship that exists between inflation and stock price index in Nigeria over the period 1986 - 2010, using the vector error correction model (VECM). The results of the study confirmed the existence of long run relationship between inflation and stock price index thereby, providing evidence in support of Fisher effect in the short run and long run. Consequently, the study concluded that stocks are good inflation hedges both in the short and long run. In the same vein,

Omotor (2010) looked at the linkage that exists between stock prices and inflation. More so, the study noted that the problem in this research area has been the apparent anomaly of the negative relationship between inflation and stock market returns as most studies in the industrialized economies have shown. As a result of these, the author investigates the relationship using NSE monthly and quarterly data for the period 1985 to 2008. The findings show that stock market returns may provide an effective hedge against inflation in Nigeria.

Umaru and Zubairu (2012) investigated the impact of inflation on economic growth and development in Nigeria from 1970 and 2010. The study applied the Augmented Dickey-Fuller (ADF) technique in testing for unit root property of the time series. It also applied the Granger causality test on gross domestic product (GDP) and inflation. The results of unit root suggest that all the variables in the model were stationary while, the results of causality tests suggested that GDP granger causes inflation whereas, inflation does not granger cause GDP. The results also revealed that inflation has a positive impact on economic growth through encouraging productivity and output level and on evolution of total factor productivity. From the findings, the researcher concluded that good performance of an economy in terms of per capita growth may therefore be attributed to the rate of inflation in the country. Moreover, they recommended that concerted effort should be made by policy makers to increase the level of output in Nigeria by improving productivity and supply in order to reduce the prices of goods and services (inflation) so as to boost the growth of the economy since inflation can only be reduced to the barest minimum by increasing output level (GDP).

In like manner, Haroon and Jabeen (2013) conducted a study on the relationship and impact of macroeconomic variables. These variables include; 3-Months, 6-Month, 12 Month Treasury bill rate (proxy of INTR), consumer price ındex, wholesale price ındex and sensitive price ındex (proxy for ınflation), and Karachi Stock Exchange-KSE 100 Share index. Using monthly data collected on these variables from the period of July 2001 to June 2010, the study utilized the coefficient of correlation and regression analysis to test the study's hypothesis. The results showed that there was significant relationship between macroeconomic variables and KSE-100 share index. The study further revealed significant impact of treasury bills on KSE-100 index.

Olugbenga (2011) investigated the impact of macroeconomic indicators on stock prices in Nigeria. The study adopted secondary data on stock prices of selected firms and six macroeconomic variables between 1985:1 and 2009:4 by utilising a panel model for the analysis. The macroeconomic indicators used in the research work were: Money supply (BRDM), INTR, exchange rate (ECHR), INF, oil price and GDP. The empirical findings of the study revealed that macro economic variables have varying significant impact on stock prices of individual firms in Nigeria. Apart from INF and money supply, all the other macroeconomic variables have significant impacts on stock prices in Nigeria. The study therefore concluded with empirical evidences that trends in macroeconomic variables can be used to predict movement of stock prices to a great extent in Nigeria.

Malaolu et al. (2013) conducted a research on the determinants of stock price movements in Nigeria claiming that it has been done on theoretical basis with no quantitative empirical evidence to support their postulations. Consequently, the study examined the macroeconomic determinants of stock price movements in Nigeria using detailed econometric framework in order to provide the foundation for evidence-based policies. Both the long-run and short run dynamic relationships between the stock price movement and the macroeconomic variables were analyzed with time series data that spanned from 1985 to 2010 using the Engle-Granger two-step cointegration test. The study established that there is no cointegration between the variables, indicating the absence of long run relationship. More so, the results of the regression indicated that the monetary policy variables (real ECHR, real INTR and money supply) as well as political instability were not determinants of stock price movements in Nigeria; however, inflation was found to be a major determinant of stock price movements. The study therefore recommended that the monetary authorities (that is the CBN) and policy makers should pay attention to changes in money supply and inflation in view of their sensitivity to stock price movements in Nigeria.

In a study carried out by Gunu (2009), he examined the macroeconomic variables responsible for share price fluctuation in Nigeria. Secondary data of Nigerian stock market covering a period of 1980-2006 were used, and a multiple regression analysis was utilized to analyse the data. The results of the study show that inflation, money supply, total deficits, index of industrial production, INTR and GDP influence stock prices. It was therefore recommended by the study that in order to monitor and control stock prices in Nigeria through macroeconomic variables, emphasis should be given to money supply, GDP, and total deficits.

Daferighe and Charlie (2012) investigated the impact of inflation on stock market performance in Nigeria using time series data for 20 years from 1991 -2010. Regression analysis was used to evaluate the influence of inflation on various measures of stock market performance; market capitalization (MCAGDP), total value traded ratio (TVMS), percentage change in (%ΔASI) and turnover ratio (TOR). It was revealed by the study's results that these measures were negatively related to inflation in convergence to a priori expectation except for TOR which showed a positive relationship. This seemingly low level of influence of inflation, ranging between 14.6% and 0.3%, revealed that stock market investments are regarded as a good hedge against inflation in Nigeria. Consequently, the study recommended that the SEC and the NSE should engage in public enlightenment and improve on corporate governance framework to encourage more investment and improve transactions in the market considering its present low level of activities. More so, the CBN should formulate and use policy statements that will maintain inflation at low ebb in order not to erode the value of gains by investors on stock.

Agu and Agu. (2009) utilised three approaches to investigate the relationship between stock pricing and behaviour of the stock market on one the hand and, micro and macroeconomic fundamentals in the Nigerian economy on the other using primary and secondary data. The primary data was analyzed using

charts and figures as well as estimates from a censored logistic model while the secondary data was modelled using an error correction approach. The long run value of the ASI in the time series model was obtained using a single equation approach that relates the dependent variable to fundamental values of its core explanatory variables. Two equations were estimated thereafter, the first showing the relationship of the long run ASI with major indicators in the economy and the second showing the relationship of the actual value of the ASI with same set (or augmented sets) of indicators. The results from both the two sources largely corroborate the other. Data from the primary survey indicated that the key drivers of share prices, particularly for the boom period, were neither broad macroeconomic indicators (though such factors as INF and macro instability were noted to affect it) nor key indicators of the health of the firm. Prices were clearly shown to be much above levels and this could have been determined by such indicators as; posted profits of firms, amounts paid out as dividend and regularity of such dividend payout.

In contrast, stakeholders saw price setting behaviour as dominant in the market and largely driving stock prices for the boom period. Such price setting behaviour seems to have been strongly aided by weak regulatory capacity of key institutions in charge of the market. However, reframed as censored logit equations, the same results were obtained by the study. Secondary data analysis equally showed that the relationship between actual levels of the ASI for the period 1990 through 2007 were not driven by "expected" variables. While its fundamental values were driven by such monetary and relative price variables, actual values were driven by external sector variables and prices. Output was largely insignificant either for fundamental or actual movements in the ASPI.

Maku and Atanda (2010) examined critically the long-run macroeconomic determinants of stock market performance in Nigeria between 1984 and 2007. The properties of the time series variables were examined using the ADF unit root test and most of the incorporated variables in the study were found to have unit roots at level. The Augmented Engle-Granger Cointegration test result revealed that the stock market performance in Nigeria was mainly determined by macroeconomic forces in the long-run. However, the empirical analysis showed that the NSE ASI was more responsive to changes in ECHR, INF, money supply, and real output. The entire incorporated macroeconomic variables were found to have simultaneous and significant impact on the Nigerian capital market performance in the long-run. The study therefore recommended that investors should pay close attention to ECHR, inflation, money supply, and economic growth rather than Treasury bill rate in the long-run while taking their investment decision.

Udegbunam and Eriki (2001) examined the empirical relation between stock prices and inflation in Nigeria using time series data and a simple stock price model relating to stock prices inflation. The results showed that inflation influences the behaviour of stock prices; and that the economic activity, INTR, money stock and financial deregulation have impact on stock prices. Osamwonyi and Evbayiro-Osagie (2012) attempted to determine the relationship between macroeconomic variables

and the Nigerian capital market index. The study considered the yearly data of several macroeconomic variables of INTR, INF, ECHR, fiscal deficit, GDP and money supply from 1975 to 2005; trying to reveal the relative influence of these variables on the 'ASI' of the Nigerian capital market. In pursuance of this, the VECM was adopted to study the short-run dynamics as well as long-run relationship between the stock market index and the six selected macroeconomic variables from the Nigerian economy. The major finding of the study was that macroeconomic variables influence stock market index in Nigeria. It was recommended by the study that the adoption of appropriate economic policies will be beneficial to the stock market index (a proxy for stock prices) and this in turn will result to growth in the capital market.

Ajao and Oseyomon (2010) examined the predictive content of some leading economic indicators to future stock prices within the framework of a standard discounted model. An ordinary least square (OLS) regression analysis was applied in order to model the long term relationship between macroeconomic variables (GDP, inflation, INTR, money supply, ECHR and industrial production index) and stock prices (ASI) in Nigeria. The results of the study revealed that there exists a significant positive relationship between stock market returns and all the utilised macroeconomic variables except the INTR which had a negative relationship with stock prices during the period under consideration (1984-2006). The study therefore recommended that investors and portfolio managers should deepen their understanding of the risk return relationship, pricing of macroeconomic risk as well as diversifications implications in Nigerian stock market. More so, policy makers should play active role in influencing the expected risk premium and volatility on stock markets through use of macroeconomic policy.

Amadasu (2012) noted in his study that there is need to know what influence the Nigerian stock market. Therefore, he noted that the index of all share prices (SMI), is a barometer for growth of the stock market and therefore that of the economy. Consequently, the study attempted to investigate the dynamic effect on or relationship with the SMI using co-integration on yearly data between 1975 and 2009. The finding indicated that some relationships exist among them, though not significant. It was therefore recommended by the study that the authorities should manage these variables and enhance exports to improve growth because of the long-run negativity of the ECHR.

Kimani and Mutuku (2013) investigated the impact of inflation, Central Depository System (CDS) and other macroeconomic variables (including deposit rate, GDP, terms of trade, and the net effective ECHR) on the Nairobi stock market performance using quarterly data from the Central Bank of Kenya and the Nairobi Stock Exchange (NSE) for the period December 1998 to June 2010. Unit root test based on the formal ADF test procedure revealed that the set of variables was I(1) process while the Johansen-Juselius VAR based cointegration test procedure revealed more than 4 cointegrating relationships. Consequently, an error correction model was estimated and the results revealed that 27 percent of the departure from equilibrium is cleared every quarterly. The cointegrating model indeed showed that there

was a negative relationship between inflation and stock market performance in Kenya. In addition, the CDS was shown to have a positive and significant impact on the stock market performance.

Yogaswari et al. (2012) constructed a model to examine the effect of macroeconomic variables on the stock price movement in Indonesia Stock Exchange. Three variables of macroeconomics (inflation, INTR, and ECHR) were used as independent variables. Jakarta Composite Index (JCI), agriculture sector, and basic industry sector stock price were used as dependent variable. The monthly time series data were gathered from Bank Indonesia and Yahoo Finance over the period of January 2007- December 2011. In addition, multiple regression analysis was applied by the study to construct a quantitative model showing the relationship between macroeconomics and stock price. The results of the study indicated that significant relationship occurred between macroeconomics variable (inflation, INTR, and ECHR) and stock price in JCI, agriculture sector (AALI.JK), and basic industry sector (JPFA.JK). The change in inflation gave positive impact, while change in INTR and inflation gave negative impact to the stock price in JCI, agriculture sector, and basic industry sector.

In addition, from the reviewed literature, it is pertinent to note that out of the very few studies existed in this area in Nigeria, emphasis were more on the use of VECM (Osamwonyi and Evbayiro-Osagie, 2012; Olufisayo, 2013); panel data analysis model (Olugbenga, 2011); Engle-Granger two-step cointegration test (Maku and Atanda, 2010; Malaolu et al., 2013); multiple regression analysis based on OLS technique (Gunu, 2009; Ajao and Oseyomon, 2010; Daferighe and Charlie, 2012); censored logistic model and error correction approach (Agu and Agu, 2009) and simple stock price model (Udegbunam and Eriki, 2001) in investigating the relationship between inflation and share price movement in Nigeria. However, as a value added to already existing studies, the application of generalized autoregressive conditional heteroschedasticity (GARCH) model is deemed necessary to examine if share price movement in Nigeria is depicted a variance autoregressive conditional heteroscedastic in behaviour which was neglected in previous studies.

3. DATA AND METHODOLOGY

3.1. Data
The data set for this study were weekly data obtained from the CBN Statistical Bulletin (2012). Data included in the study are share prices of the Nigerian stock market (proxied by ASI), INF, and market capitalization. The choice of this study period is to capture some period of time when the NSE witnessed an overwhelming increase in government stock which exceeded the equities of industrial companies (that is, years below 1990); however this trend changed from 1991 and above.

3.2. Model Specification
The framework of the study is built on GARCH and EGARCH model. The standard GARCH model allows the conditional variance to be dependent upon previous own lags. The basic structure of the symmetric normal GARCH model is GARCH (1, 1) given by Brooks (2008). The GARCH model is used to

measure conditional variance in share price movement and inflation as shown in equation (1) below. Following the approach in Narayan et al. (2008) and Ghosh (2011), the study characterized the linkage between share price movement and inflation with the aid of GARCH (p, q) and EGARCH (p, q) models. The mean equation is given below as:

$$Asi_t = a + \beta Inf_t + v_t \tag{1}$$

Where,
Asi is the Asi (a proxy for share price), Inf is actual inflation v_t, is the white noise residual $N(0, \sigma_t^2)$, and t, is the time variable.

However, in terms of the second moment, the variance equation for the GARCH (p, q) is of the form given below:

$$\sigma_t^2 = \theta + \sum_{i=1}^{p} \phi_i v_{t-i}^2 + \sum_{i=1}^{q} \varphi_i \sigma_{t-j}^2 \tag{2}$$

Where;
The conditions $\theta > 0, |\varphi_1| < 1$ and $(1 - \varnothing_1 - \varphi_1) > 1$ hold in the case of a GARCH (1, 1) model.

Equation (2) expresses the conditional variance as a linear function of p lagged squared disturbances and q lagged conditional variances. In other words, volatility today depends upon the volatilities for the previous q periods and upon the squared residual for the previous p periods. Often GARCH models with small values of p and q do a very good estimate of volatility with the p = q = 1 case sometimes being adequate (Narayan et al., 2008; Ghosh, 2011).

Therefore, considering the fact that GARCH model cannot account for size effects and does not allow for any direct feedback between the conditional variance and the conditional mean, exponential GARCH model suggested by Nelson (1991), is introduced to establish the size effect of share price movement on inflation in Nigeria.

Similarly, the EGARCH model which allow for oscillation in the conditional variance can be written as:

$$\log(\sigma_t^2) = \omega + \sum_{i=1}^{p} \alpha_i \left| \frac{u_{t-i}}{\sigma_{t-i}} \right| + \sum_{k=1}^{r} \lambda_k \frac{u_{t-k}}{\sigma_{t-k}} + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-j}^2) \tag{3}$$

The parameters of equation (3) include the mean of the volatility equation, the size effect (α) which is suggestive of the magnitude of the increase in volatility regardless of the direction of shock. The estimate of β captures the persistence of shocks and λ is the sign effect. In addition, to trace the impact of inflation and market capitalization on share price movement, the model in equation (4) is adopted and can be given as follows:

$$Asi_t = \beta_0 + \beta_1 Inf_t + \beta_2 \sum \psi_t + \varepsilon_t \tag{4}$$

Where,
Asi is the Asi (a proxy for share price), Inf, is the actual inflation. $\sum \psi_t$ represents the control variable that is included in the model.

β_1 is the coefficient of the explanatory variable and β_2 is the coefficient of the control variable while β_0 and ε_t are constant and the error term respectively. Considering the specification of equation (4) above, the model is transformed to incorporate both the core variables and the control variable as can be seen in equation (5) below:

$$Asi_t = \beta_0 + \beta_1 Inf_t + \beta_2 Mcap_t + u_t \tag{5}$$

Where,

Mcap is market capitalization, β_2 is the coefficient of the market capitalization and u_t is the error term while, others remain as defined above. In order to scale the variable (Asi) because of its extreme large values relative to Inf and Mcap, Asi was logged and all the time series properties were tested ranging from unit root, heteroskedasticity, and autocorrelation test. This requires transforming the model in the level of integration of the variables. Therefore, the model in equation (5) is transformed into equation (6) as shown below;

$$\Delta lnAsi_t = \beta_0 + \beta_1 \Delta Inf_t + \beta_2 \Delta Mcap + u_t \tag{6}$$

The variables remained as defined above. ln is the natural logarithm of the variable, while Δ is the difference operator capturing the level of integration of the variables.

4. RESULTS AND DISCUSSION

First, we examine if the variables in the regression model are stationary. This is to investigate the asymptotic validity and to know if the usual t-ratios follow a t-distribution. However, the summary of the study's findings are presented and discussed as shown in Table 1.

Table 1 shows the unit root test results of the variables used in the model. From the table above, it can be seen that all the variables are integrated of order one. The results were got after the ADF test for unit root at level, after checking whether trend and intercept affects it, proved insignificant and that of the first difference were significant. This finding is consistent with the work done by Kimani and Mutuku (2013) which subjected the set of variables used for the study to unit root test based on ADF test procedure and revealed that the set of variables followed I(1) process.

From the results of the GARCH output seen in Table 2, it can be seen that point estimates, standard errors, z-statistics, and the probabilities of the estimated coefficients were reported. The variables of the model were run at their respective levels of integration but the natural logarithm of the share price was taken to scale up the variable.

The GARCH regression results above indicated that the share price average at 0.0036, which relative to share price today, shows the extent of share price movement in the Nigerian Stock Market. Also the GARCH terms t-ratio is statistically significant (7.16), which implies that the variance is autoregressive conditional heteroscedastic in behaviour. Hence, the share price (Asi) and

Table 1: Unit root test results

Variables	ADF t-statistic	1% level	5% level	10% level	Order of integration
D(LOG (ASI))	−40.82891	−2.566349	−1.941013	−1.616572	I~(1)
D(ACTINFGR)	−40.82891	−2.566349	−1.941013	−1.616572	I~(1)
D(MCAP)	−40.82891	−2.566349	−1.941013	−1.616572	I~(1)

ADF: Augmented Dickey Fuller, MCAP: Market capitalization, ASI: All share ındex

Table 2: GARCH model results

Dependent variable=D(LOG(ASI))				
Variables	Coefficients	Standard error	z-statistic	P
C	0.0,03,622	0.0,01,710	2.1,18,010	0.0342
D(Inf)	−0.0,01,514	7.56E-05	−20.01799	0.0000
D(MCAP)	6.68E-05	9.58E-07	69.74445	0.0000
Variance equation				
C	0.0,00,526	0.0,00,284	1.851435	0.0641
RESID(-1)^2	−0.0,06,192	0.0,00,277	−22.32776	0.0000
GARCH(-1)	0.7,94,815	0.1,10,895	7.1,67,303	0.0000

GARCH: Generalized autoregressive conditional heteroschedasticity, ASI: All share ındex, MCAP: Market capitalization

inflation (Inf) exhibit a collective volatility of about 0.0015% during this period which is relatively low.

From the result above, share price exhibit a volatile shock of 79% in its behaviour while a 1% increase in inflation leads to about 0.15% decrease in share price movement in Nigeria within the study period. This shows that the shock effect is negative and relatively very significant in explaining reasons for volatility in share price, since the probability value of the GARCH term (GARCH(-1)) is 0.0000. This by implication implies that if the INF is high, the tendency is that as the real income declines, the investor ends up selling their assets including stocks to enhance their purchasing power. The reverse is the case when inflation is low, when this happens, the investors would like to acquire more assets, with stock not exclusive. In essence, the high INF exhibit negative shock on share prices while low INF is expected to exhibit a positive shock on share prices and/or boosts the share prices of the Nigerian stock market. However, this finding is in harmony with the works of Malaolu et al. (2013) which indicated inflation as the major determinant of stock price movements in Nigeria. More so, it also justifies the works of Daferighe and Charlie (2012), and Udegbunam and Eriki (2001) which revealed that inflation is negatively related to share price.

Moreover, as the GARCH(-1) term shows that share price exhibit a volatile shock of 79% in its behaviour, a 1% increase in market capitalization leads to about 66.8% increase in share price movement in Nigeria within the study period. This therefore, indicates that the shock effect is positive and relatively very significant in explaining reasons for volatility in share price since the probability value of the GARCH term (GARCH(-1)) is 0.0000. This by implication implies that market capitalization exhibits a positive and significant shock on share price in the Nigerian stock market. Hence, the higher, the market capitalization, the higher would be the tendency of real income increasing thereby, making investors to acquire more assets including stocks. This positive shock exhibited by market capitalization on share prices

is expected on the average to boost the share prices of the Nigerian stock market. Therefore, as the market capitalization increases, the market players tend to increase their activities by improving their investment due to the envisaged market performance resulting from increase in movement of share prices. Hence, the increase in investor's confidence increases the level of investment in the market because of the quest for profit maximisation which may emanate from the expectation of consistent increase movement in share price.

Moreover, the GARCH residual graph that shows the movement of the residual of the model is presented Figure 5.

From Figure 5 it can be seen that the residual follows the same pattern with that of the actual and fitted graphs. This shows that the estimated elements of the residual fit the GARCH model very well. Furthermore, the study looked at the static forecast equation graph of the model as can be seen Figure 6.

From Figure 6, it can be seen that the ASIF forecast follows the same pattern with actual ASI. Therefore, the graph also indicated that the in-sample predictions are similar for the conditional variances of share price and the inflation, and that the dynamic forecasts converge to similar levels. It also shows that the ARCH and GARCH parameters cause substantial time-varying volatility. The forecast of variance of ASI equation ranges from lows of just over 0.0000 to highs 0.0025. However, from the results of the model, it was observed that the influence of inflation on share price movement is significant since it shows that high volatility occurred within the study period as can be seen in the graph. This therefore suggests evidence of volatility clustering behaviour of the forecast variance of the share prices in Nigerian Stock Market within the study period.

The study also looked at the GARCH conditional standard deviation and the GARCH conditional variance. These graphs are given in Figures 7 and 8 respectively. However, a look at the two graphs shows that they are similar thereby, indicating that the conditional standard deviation of share price and its conditional variances are the same, and as such, the dynamic forecasts converge to similar levels. These graphs are given in Figure 7.

From the above figures (Figures 7 and 8), it can be seen that the ARCH and GARCH parameters cause substantial time-varying volatility. However, as the conditional standard deviation of share price ranges from lows of just over 0.00 to highs 0.05, the predicted conditional variance of share price ranges from lows of just over 0.0000 to highs 0.0025. This implies that the dynamic forecasts converge to similar levels. In other words, the graph shows that the predicted conditional variances vary substantially over time thereby, suggesting the presence of volatility clustering behaviour

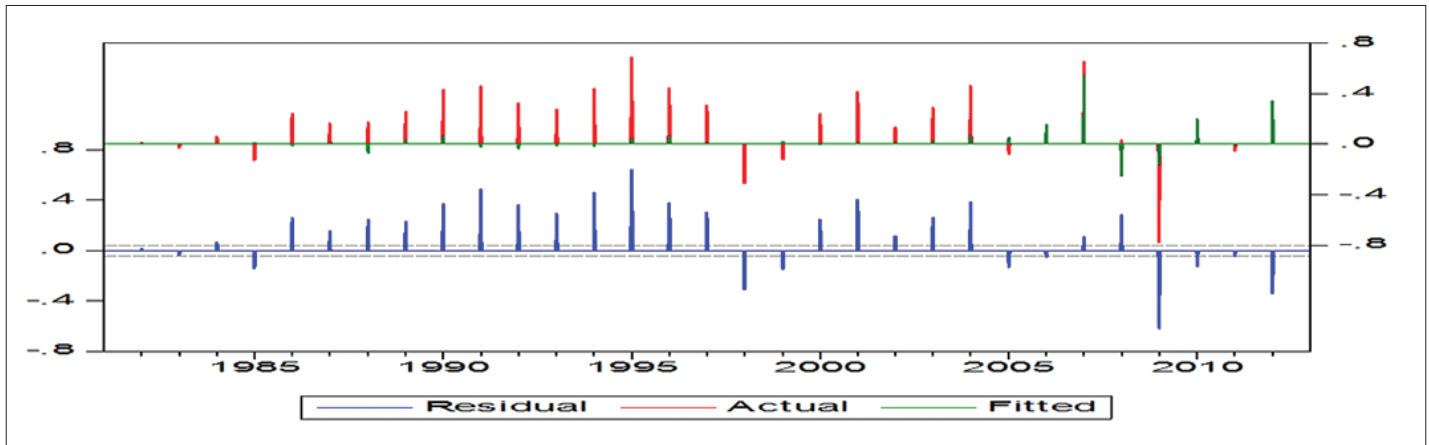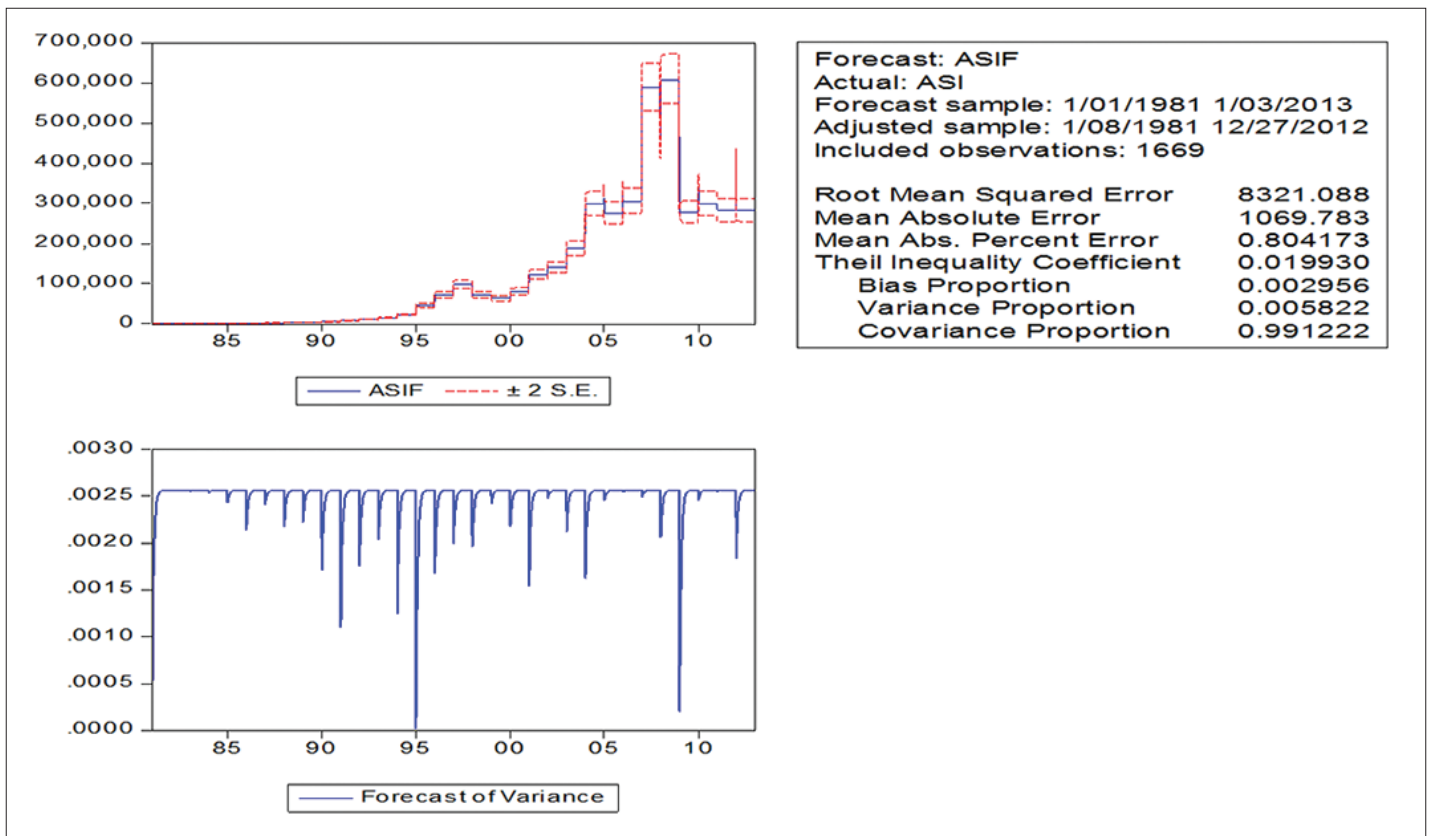**Figure 5:** Generalized autoregressive conditional heteroschedasticity residual graph

Figure 6: Static forecast equation graph

Forecast: ASIF
Actual: ASI
Forecast sample: 1/01/1981 1/03/2013
Adjusted sample: 1/08/1981 12/27/2012
Included observations: 1669

Root Mean Squared Error	8321.088
Mean Absolute Error	1069.783
Mean Abs. Percent Error	0.804173
Theil Inequality Coefficient	0.019930
Bias Proportion	0.002956
Variance Proportion	0.005822
Covariance Proportion	0.991222

of the conditional standard deviation and conditional variance of the share prices in Nigerian Stock Market within the study period. Moreover, the histogram of normality was also looked at and the graph suggests that error term is normally distributed. This can be seen in Figure 9.

From Figure 9, it can be seen that the probability of the standardized residual is 0.00000, which shows that it is very significant. The Jarque-Bera test of statistic also shows that the residual is significant thereby, implying that the error term or the residual is normally distributed.

Furthermore, this study has empirically shown the linkage between share prices movement and inflation in Nigeria. It has therefore contributed to the already existing literature on share prices movement and inflation which has been subjected to extensive research by academics, researchers, practitioners and policy makers world over since the 1990s. Using GARCH, this study has succeeded in showing that the GARCH terms of the share price movement in Nigeria depicted a variance of autoregressive conditional heteroscedastic behaviour which served as a point of departure from other studies. Also, share price movement and inflation in Nigeria exhibited a collective volatility of about 0.0015% during the study period. Moreover, the study has shown that stabilizing inflation will deepen the Nigerian stock market the more thereby leading to a trickling down effect on the stock market capitalization which is as well consistent with studies by Malaolu et al. (2013); Daferighe and Charlie (2012) and Udegbunam and Eriki (2001).

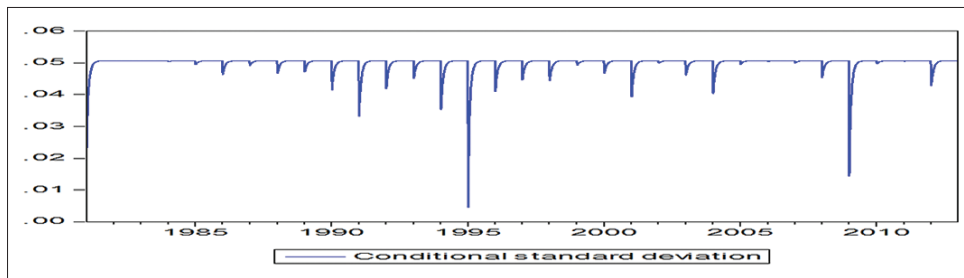**Figure 7:** Generalized autoregressive conditional heteroschedasticity standard deviation graph

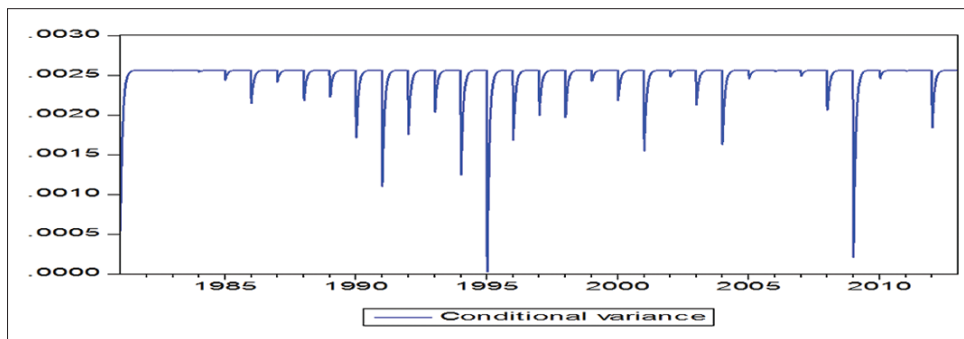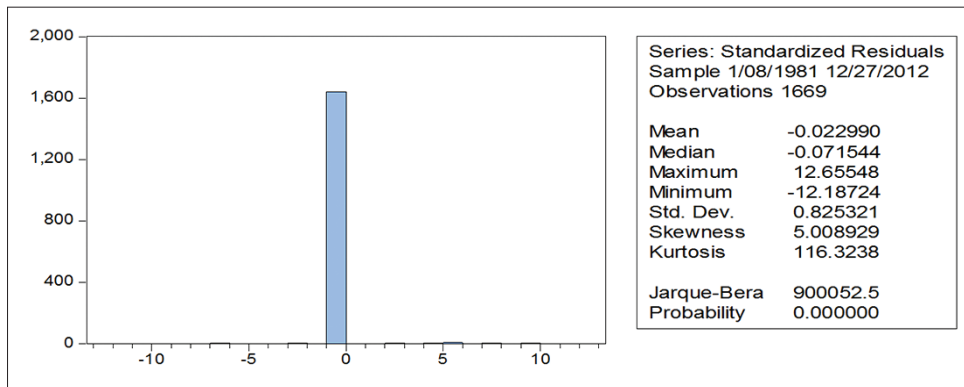**Figure 8:** Generalized autoregressive conditional heteroschedasticity conditional variance graph

Figure 9: Generalized autoregressive conditional heteroschedasticity histogram of normality graph

5. CONCLUSION AND RECOMMENDATIONS

From the results of the study, it was found from the GARCH regression results that the share price average at 0.0036, which relative to share price today, shows the extent of share price movement in the Nigerian Stock Market. More so, the GARCH terms depicted a variance of autoregressive conditional heteroscedastic behaviour. Furthermore, the share price (Asi) and inflation (Inf) exhibited a collective volatility of about 0.0015% during the study period which is relatively low.

Also, share price exhibit a volatile shock of 79% in its behaviour while a 1% increase in inflation leads to about 0.15% decrease in share price movement in Nigeria within the study period. This shows that the shock effect is negative and relatively very significant in explaining reasons for volatility in share price, since the probability value of the GARCH term is 0.0000. This by implication implies that if the INF is high, the tendency is that as the real income declines, the investor ends up selling their assets including stocks to enhance their purchasing power. The reverse is the case when inflation is low.

In addition to the above, a 1% increase in market capitalization leads to about 66.8% increase in share price movement in Nigeria within the study period. This therefore, indicates that the shock effect is positive and relatively very significant in explaining reasons for volatility in share price since the probability value of the GARCH term is 0.0000. This by implication implies the higher, the market capitalization, the higher would be the tendency of real income increasing hence, making investors to acquire more assets including stocks. This positive shock exhibited by market capitalization on share prices is expected on the average to boost the share prices of the Nigerian stock market.

However, this counters the belief of some economists who believe that the influence of inflation on share prices movement is investment neutral. The belief that many investors in the stock market suffer from a form of "money illusion," investors make mistakes that a rise in nominal rate of interest is a rise in the real

rate and as a result, undervalue stocks in a period of higher inflation is corrected by this study. Hence, the monetary authorities in Nigeria should pursue policies geared toward reducing inflation to at least, a single digit, and make it relatively stable.

REFERENCES

Agu, C.C., Agu, C. (2009), Behind the crash: Analysis of the Roles of Macroeconomic Fundamentals and Market Bubbles in the Nigeria Stock Exchange, Paper for Presentation at the African Econometric Society Conference, Sheraton Hotel, Abuja; 8-10th July.

Ajao, M.G., Oseyomon, E.P. (2010), The predictive content of some leading economic indicators on stock prices. Journal of Research in National Development, 8(1), 1-8.

Amadasu, D.E. (2012), Interest rate, Inflation rate and exchange rate influence on the Nigerian stock market index. International Journal of Arts and Humanities, Bahir Dar, Ethiopia, 1(3), 357-366.

Brooks, C (2008), "Introductory Econometrics for Finance" Published by Cambridge University Press.

Baekaert, G., Engstrom, E.C. (2009), Inflation and the stock market: Understanding the fed model. NBER Working Paper No. W15024. Available from: http://www.ssrn.com/abstract=1413588.

Berument, H., Jelassi, M.M. (2002), The fisher hypothesis: A multi-country analysis. Applied Economics, 34, 1645-1655.

Central Bank of Nigeria. (2007), The Dynamics of Inflation. Central Bank of Nigeria Report Abuja, Occasional Paper, No. 32.

Corrado, C.J., Jordan, B.D. (2002), The Fundamentals of Investments Valuation and Management. 2nd ed. USA: McGraw-Hill Companies Inc.

Crosby, M. (2001), Stocks returns and inflation. Austrialia Economics Papers, 40, 156-165.

Daferighe, E.E., Charlie, S.S. (2012), The impact of inflation on stock market. Performance in Nigeria. American Journal of Social and Management Sciences, 3(2), 76-82.

Fama, E.F. (1981), Stock returns, real activity, inflation, and money. The American Economic Review, 71(4), 545-565.

Fisher, I. (1930), The Theory of Interest. New York: Macmillan.

Ghosh, S. (2011), Examining crude oil price - Exchange rate nexus for India during the period of extreme oil price volatility. Applied Energy, 88, 1886-1889.

Gunu, U. (2009), Environmental factors influencing fluctuation of share prices on Nigeria stock exchange market. African Research Review, An International Multi-Disciplinary Journal, Ethiopia, 3(5), 199-212.

Haroon, M.A., Jabeen, H. (2013), Impact of macro-economic variables on share price behavior of Karachi stock exchange. Pakistan Journal of Commerce and Social Sciences, 7(3), 493-504.

Kimani, D.K., Mutuku, C.M. (2013), Inflation dynamics on the overall stock market performance: The case of nairobi securities exchange in Kenya. Economics and Finance Review, 2(11), 1-11.

Lee, U. (1998), A test of the proxy-effect hypothesis: Evidence from the Pacific Basin countries. Quarterly Journal of Business and Economics, 37(3), 40-52.

Luintel, K.B., Paudyal, K. (2008), Stock returns and inflation: Some new evidence. Economics and Finance Working Papers, Brunel University. 01-08. Available from: http://www.bura.brunel.ac.uk/handle/2438/894. [Last retrieved on 2015 Mar 14].

Maku, O.E., Atanda, A.A. (2010), Determinants of stock market performance in Nigeria: Long-run analysis. Journal of Management and Organizational Behaviour, 1(3), 1-9.

Malaolu, V.A., Ogbuabor, J.E., Orji, A. (2013), Determinants of stock price movements in Nigeria: Evidence from monetary variables. Journal of Economics and Sustainable Development, 4(14), 61-66.

McCarthy, J., Najand, M., Seifert, B. (1990), Empirical tests of the proxy hypothesis. Financial Review, 25, 251-263.

Modigliani, F., Cohn, R.A. (1979), Inflation, rational valuation, and the market. Financial Analysts Journal, 35, 24-44.

Narayan, P.K., Narayan, S., Prasad, A. (2008), Understanding the oil price – Exchange rate nexus for the Fiji Islands. Energy Economics, 30(5), 2686-2696.

Nelson, D, (1991), Conditional heteroschedasticity in asset return: A new approach. Econometrica, 59, 347-370.

Olufisayo, A.O. (2013), Stock prices and inflation: Evidence from Nigeria. American Journal of Economics, 3(6), 260-267.

Olugbenga, A. (2011), The impact of macroeconomic indicators on stock prices in Nigeria. Developing Country Studies, 1(2), 1-14.

Omotor, D.G. (2010), Relationship between inflation and stock market returns: Evidence from Nigeria. Journal of Applied Statistics, 1(1), 1-15.

Osamwonyi, I.O., Evbayiro-Osagie, I. (2012), The relationship between macroeconomic variables and stock market index in Nigeria" Kamla-Raj. Journal of Economics, 3(1), 55-63.

Udegbunam, R.I., Eriki, P.O. (2001), The empirical relationship between stock price and share price movement in Nigeria. Journal of Financial Management and Analysis, 14(1), 1-9.

Umaru, A., Zubairu, A.A. (2012), Effect of inflation on the growth and development of the Nigerian economy (An empirical analysis). International Journal of Business and Social Science, 3(10), 183-191.

Yogaswari, D.D., Nugroho, A.B., Astuti, N.C. (2012), The effect of macroeconomic variables on stock price volatility: Evidence from Jakarta composite index, agriculture, and basic industry sector. Academic Journal, International Proceedings of Economics Development and Research, 46, 96-100.