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EVALUATING GOOD AND BAD NEWS DURING PRE AND POST FINANCIAL MELTDOWN: NIGERIAN STOCK MARKET EVIDENCE

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Abstract
The Nigerian stock market, prior to the 2007-09 global financial crisis witnessed growth but the market encountered sharp reversal from 2007 due to the global financial crisis. This study evaluates good and bad news on the Nigerian stock market with regards to the policy responses as a result of the meltdown. The study used the TGARCH, EGARCH and PGARCH models under three error distributional assumptions for data covering January 2010 to December 2016 using the All Share Index to generate the return series. Findings shows that good news impact return more than negative news of the same magnitude before the meltdown while bad news insignificantly impact return more than positive news after the meltdown. The study concludes that there is information asymmetry in the Nigerian stock market. Thus, it is recommended that on-line real time access to share price movement for investors should be introduced to improve liquidity level and enhance free flow of relevant securities information.

JEL Classification: C58, G14

Keywords: financial meltdown, news, stock market, GARCH, Error distribution

1. Introduction

The subprime mortgages transactions in the United States are part of the factors causing the financial crisis of 2008-2009. The crisis led to loss of confidence in the credit markets worldwide as a result of liquidation of banks and non-bank institutions worldwide (Farhi & Cintra, 2009; Prates & Cintra, 2010). The crisis spread to developing countries but it was originally anticipated that the impact on Africa would be insignificant because of the low level of Africa financial market integration into global financial markets, but the impact was very serious on Africa (Kaberuka, 2009; Osakwe, 2010). The crisis affected African countries through its impact on local stock markets and led to an increase in stock market volatility. From December 2007 and January 2010 the Nigerian, Kenyan, Zambian and Egyptian stock market

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index declined by 62%, 35%, 27% and 30% respectively. Between 2007 and 2008, the Namibian, Mauritius and Egyptian stock market lost about 55%, 41% and 36% of their market value respectively (Osakwe, 2010).

The Nigerian stock market, prior to the 2007-09 global financial crisis witnessed considerable growth in market capitalization from N764.9 billion in December 2002 (which was a 10% share of the total gross domestic product at current market prices) to N13.181 trillion (64% share of the total gross domestic product at current market prices) by December 2007 (CBN, 2014). In 2008, market capitalisation reduced by 45.8%, a sharp reversal of growth from 2007, when the market grew by 74.7%. The market turnover ratio dropped from 21.86% in 2008 to 13.26% in 2009, the decline in stock prices was attributed to the global financial crisis (Okereke-Onyiuke, 2009 & 2010).

The Nigerian stock market since inauguration has experienced a lot of hitches (e.g. paucity of tradable shares, corrupt practices, the global financial crises, etc.) which have delayed its operational competences. There has also been the debate concerning the volatility persistence of stock prices, the asymmetric properties and risk-return relationship of stock in the Nigerian stock market (Bekaert & Wu 2000; Karolyi, 2001; Olowe, 2009). Meanwhile, the Nigerian stock market experienced growth in market capitalization and All Share Index from 2001 till the second quarter of 2008. The market experienced serious decline in its indicators afterwards, due to the negative impact of the financial meltdown of 2007-2009.

The policy response and actions taken by the government and the Nigerian stock market authority to mitigate the effect of the meltdown of 2007-2009 include among others:

- The reduction of the transaction fees on the Nigerian stock market by 50%;
- 1% maximum share price loss limit on daily price movement and 5% Share price gain limit was imposed but was later put at 5% in October 2008 for either way. This has now been reviewed in the rule book afterwards;
- The strict enforcement of listing requirements with zero tolerance for infractions and subsequent de-listing of nineteen (19) inactive companies;
- Introduction of rules on share buy back with a limit of 15.0%.

In addition, the Nigerian stock exchange was rebranded and reformed into three (3) boards; the main board, premium board and the Alternative Securities Market (ASeM). The depository receipt, securities lending, unit trust listing, exchange traded fund are some of the initiatives of the Securities and Exchange Commission (SEC) and the Nigerian Stock Exchange (NSE) during and after the 2007-2009 meltdown.

The reform was to cushion the effect of the financial crisis of 2007-2009 on the investors' returns on the Nigerian Stock Exchange. Thus, there is the need to evaluate good and bad news on the market to enable stakeholders know whether there is the need to reverse some or all of the reform policy or better still, to consider other policy implementation that will enhance returns performance in the market, minimize risk and boost investors' return.

Therefore, the objective of this study is to evaluate the good and bad news in the Nigerian stock market in pre and post 2007-2009 financial meltdown. Studies prior to this were done before, during or after the financial meltdown (Atoi 2014; Bala & Asemota 2013; Emenike 2010; Olowe 2009; Hamadu & Ibiwoye 2010; Emenike & Aleke 2012; Ajayi & Nageri, 2016*;* among others). Thus, this study is significant

because the evaluation of the good or bad news is long overdue as a result of policy change during the 2007-2009 meltdown which affects the prices of shares in the Nigerian Stock Exchange. This study contributes to literature by showing the difference in good or bad news on the stock market return. The study also compares the stock market reaction to news during the pre and post meltdown as a result of policy responses and measures in the market during the meltdown of 2007-2009. The study offer recommendations to the stock market regulators and policy maker to enhance the performance of the stock market.

The scope of the study is to evaluate good and bad news in the pre and post financial meltdown, making Nigeria Stock Exchange the reference point, using the All Share Index (ASI). Weekly data of the ASI was used covering the period of January 2001 till December 2016, divided into pre-financial crisis period (January 2001 till March 2008) and the post financial crisis period.

Section II of the paper defines the reviews of relevant literature. Sections III and IV shows the methodology employed in the study and the discussion of findings respectively. Section V provides the summary of findings, conclusion, and recommendations.

2. Literature Review

This subsection reviews relevant literatures on the concept of leverage effect with relevant theories and review of empirical studies on leverage effect.

2.1. Conceptual Issues

Leverage effect is the relationship between stock returns and volatility (implied and realised), volatility rises during stock price reduction. Leverage effect occurs as a result of the change in market valuation of firm's equity in its capital structure, with an increase in leverage leading to an increase in stock price volatility (Figlewski & Wang, 2000). The cause of the 2007-2009 financial crisis was the market in mortgage-backed securities. An extensive increase in global liquidity which led to a drop in the price of credit and in turn led to an increase in demand and price of mortgages (Gorton, 2011).

One major important information of the 2007-2009 crisis are the useful forecast of when the bubble will burst and the consequence, for relevant and related securities connected to the mortgage-backed securities boom. The least predictable market to play an essential role in the subprime crisis was the stock market. Nevertheless, the stock market was very late in identifying news of the crisis (Gilson & Kraakman, 2014). The most reasonable answer is that the cost of obtaining and interpreting information about quoted stock prices was not stress-free for traders in the equities markets (Bartlett, 2010).

2.2. Theoretical Clarification

Leverage effect was attributed to Black (1976) in his original paper where daily data from 1964 to 1975 sample of 30 stocks was used. The study establish the relationship between volatility and stock returns. The portfolio level equivalents of

the estimates of leverage effect, is “summed market return” and the “market volatility estimate”, obtained by the average of the additive returns and the volatility estimates respectively.

Black (1976) proposes two possible explanations for leverage effect: first is the “direct causation” effect. This is the causal effect from stock returns to volatility changes which means that decrease in firm’s equity value cause negative return on its stock and increase leverage of the stock. Second is the “reverse causation” effect. This is the causal effect from volatility changes to stock returns as a result of changes in tastes and technology. The changes cause an increase in the uncertainty about the returns from investments. As a result of the increase in expected future volatility, stock prices decrease and the expected return from the stock increase in order to prompt investors to continue to hold the stock.

2.3. Empirical Review

According to Engle (1982), an adequate volatility model should sufficiently models heteroscadasticity in the disturbance term and captures the stylized fact (volatility clustering, Auto-Regressive Conditional Heteroscadasticity (ARCH) effect and asymmetry) inherent in stock return series. The famous volatility models used in most studies include Auto-Regressive Conditional Heteroscadasticity (ARCH) and its extensions, such as Integrated GARCH proposed by Engle and Bollerslev (1986), Generalized ARCH introduced by Bollerslev (1986), Schwert (1989), and Taylor (1986), Threshold GARCH first introduced by Glosten, Jaganathan, and Runkle (1993) known as GJR-GARCH modified by Zakoïan (1994), Exponential GARCH proposed by Nelson (1991), Power GARCH generalised by Ding, Engle and Granger (1993), GARCH-in-Mean model introduced by Engle, Lilien and Robins (1987), the standard deviation GARCH model introduced by Taylor (1986) and Schwert (1989), Fractionally Integrated GARCH model of Baillie, Bollerslev, and Mikkelsen (1996) among others (Atoi, 2014).

In Most cases, first-order GARCH models have extensively been proven to be adequate for modeling and forecasting financial time series (Adewale, Olufemi, & Oseko, 2016; Fasanya & Adekoya, 2017; Atoi, 2014; Ahmed & Suliman, 2011; Alberg, Shalit & Yosef, 2008; Bera & Higgins, 1993; Engle, 2001; Goudarzi, 2013 & 2014; Goudarzi & Ramanarayanan, 2011; Hamadu & Ibiwoye, 2010; Hansen & Lunde, 2004; Hsieh, 1991; Okpara & Nwezeaku, 2009; Olowe, 2009; Su, 2010; Zivot, 2009). For example, Hamadu and Ibiwoye (2010), examine the volatility of daily stock returns of Nigerian insurance stocks. The result of ARCH (1), GARCH (1, 1) TARCH (1, 1) and EGARCH (1, 1) shows that EGARCH is a better model than the other two models in modelling stock price returns evaluation and forecasting.

Okpara and Nwezeaku (2009) examined the effect of idiosyncratic risk and beta risk on returns of randomly selected fourty one (41) companies listed on the Nigerian stock exchange during the period of 1996-2005. The result of the EGARCH (1, 3) model shows less volatility persistence and establishes the existence of leverage effect in the Nigeria stock market. Olowe (2009) investigated the relationship between stock returns and volatility in Nigeria using EGARCH-in-mean model in the light of banking reforms, insurance reform, stock market crash and the global financial crisis. The result indicates that volatility is persistent, there is leverage effect and there is positive but insignificant relationship between stock return and risk.

Adewale et al. (2016) examined persistence of shock and news in Nigerian stock market, using monthly stock returns from January 1985 to December 2014. Result indicates higher volatility persistence during pre-break, and lower volatility persistence during post-break period with no evidence of asymmetry. Kuhe, (2018) investigates the volatility persistence in Nigerian stock market and findings posits that there exist high volatility persistence of shocks in the return series during July 1999 to June, 2017. Nevertheless, there exist significant reduction in volatility persistence in the face of structural breaks.

3. Methodology

This section discusses the method that was employed for the research work. It includes model specifications, sources and types of data, population and sample size, and method of data analysis to achieve the objectives.

3.1. Model Specification

Volatility model should sufficiently capture heteroscedasticity in the error term and also the volatility clustering, the Auto-Regressive Conditional Heteroscedasticity (ARCH) effect and the asymmetry in the series (Engle, 1982). Thus, the Auto-Regressive Conditional Heteroscedasticity (ARCH) and the model extension and variants were adopted for this research works.

3.1.1 Mean Equation

After checking for unit root and before estimating the ARCH models using the ASI return series, it is necessary to check for the presence of ARCH effects and volatility clustering in the residuals of the conditional return equation. The conditional return equation is estimated using the Ordinary Least Square (OLS) regression model as follows:

$$ASI_{rt} = C + \alpha ASI_{rt_{t-1}} + \varepsilon_{1t} \quad 3.1$$

The equations 3.23 implies that the current ASI return series depends not only on previous values of ASI_{rt}, but also on the mean/constant (C) value of ASI_{rt} and the error term (ε_{1t}). The error term is tested for ARCH effect and volatility clustering and from which the conditional variance equation are derived for the ARCH models in this research.

3.1.1.1 A Priori Expectation of Mean Equation

The a priori expectation of the mean equation is that the error term should exhibit volatility clustering and ARCH effect at 5% significant level.

3.1.2 The ARCH Models

The conditional variance equation was modeled in a way that it incorporates the ARCH processes of ε_{1t}^2 with (*p*) lagged. The general form of the conditional variance, including (*p*) lag of the residuals is as follows:

$$\sigma_t^2 = C + \alpha_1 \varepsilon_{nt-1}^2 + \ldots\ldots\ldots\ldots + \alpha_1 \varepsilon_{nt-p}^2 \quad 3.2$$

Equation (4) is what Engle (1982) referred to as the linear ARCH (*p*) model because of the inclusion of the (*p*) lags of the ε_{nt}^2 in the variance equation. Therefore an ARCH (1) model is

$$\sigma_t^2 = C + \alpha_1 \varepsilon_{nt-1}^2 \quad 3.3$$

Equation 3.2 (ARCH (1) model) indicates that the next period's return variance (from the mean equation residual) only depends on last period's squared residual (shock in the return mean equation) so a crisis that caused a large residual would not have the sort of persistence that is observed after actual crises. The ARCH variant models that was used in this research to achieve the objectives are:

3.1.2.1 The Exponential GARCH Model

According to Brooks (2002), negative shock to financial time series may lead to increased volatility more than a positive shock of the same magnitude. In the case of equity returns, such asymmetries are typically attributed to leverage effects.

The Exponential GARCH (EGARCH) model was proposed by Nelson (1991) to model the above stated phenomenon. The model allows for asymmetric effects between positive and negative news on asset returns. The specification of the EGARCH model according to Nelson (1991) is:

$$log(\sigma_t^2) = \omega + \sum_{i=1}^{p} \alpha_i \left|\frac{\varepsilon_{t-i}}{\sigma_{t-i}}\right| + \sum_{k=1}^{r} \gamma_i \frac{\varepsilon_{t-k}}{\sigma_{t-k}} + \sum_{j=1}^{q} \beta_j \log(\sigma_{t-i}^2) \quad 3.4$$

when ε_{t-i} is good or positive news the total effect is measured by $(1+\gamma_i)|\varepsilon_{t-i}|$ and when ε_{t-1} is bad or negative news the total effect is measured by $(1-\gamma_i)|\varepsilon_{t-1}|$. The EGARCH covariance stationary is provided by $\sum_{i=1}^{q} \beta_j$<1. Bad news can have a larger impact on volatility, and the value of γ_k is expected to be negative. The mean return equations and the return variance EGARCH model used in this research is as follows:

$$ASI_{rt} = C + \alpha_t ASI_{rt_{-1}} + \varepsilon_{1t} \text{ Mean return equation for } ASI_{rt} \quad 3.5$$

$$log(\sigma_t^2) = \omega + \alpha_i \left|\frac{\varepsilon_{t-1}}{\sigma_{t-i}}\right| + \gamma_i \frac{\varepsilon_{t-1}}{\sigma_{t-1}} + \beta_j \log(\sigma_{t-1}^2) \text{ Return variance equation EGARCH} \quad 3.6$$

3.1.2.1.1 A Priori Expectation of EGARCH Model

The EGARCH model stipulates that to measure the impact of negative news on volatility persistence in return, $\gamma_i < 0$

3.1.2.2 The Threshold GARCH Model

The Threshold GARCH (TGARCH) model also known as the GJR-GARCH was introduced by Glosten, et al (1993) and the Threshold ARCH (TARCH) model proposed independently by Zakoïan (1994) allows for asymmetric effects between positive and negative news on asset returns. The general specification of the TGARCH/TARCH model is given as:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{i=1}^{\gamma} \gamma_i \, \varepsilon_{t-i}^2 d_{t-i} + \sum_{j=1}^{q} \beta_j \, \sigma_{t-i}^2 \qquad 3.7$$

where $d_{t-i} = \begin{cases} 1 & if \ \varepsilon_{t-i} < 0 \\ 0, & if \ \varepsilon_{t-i} \geq 0 \end{cases}$.

In equation 3.12, depending on whether ε_{t-i} is above or below the threshold value (d_{t-1}) of zero, ε_{t-i} has different effects on the return variance σ_t^2: when ε_{t-i} is positive news, the total effect is given by $\alpha_i \varepsilon_{t-i}^2$ and when ε_{t-i} is negative news, the total effect is given by $(\sigma+\gamma_i)\varepsilon_{t-1}^2$. Therefore, it is expect that the value of γ_i is to be positive for bad news to have a larger impact on volatility. The mean return equation and the return variance TGARCH/TARCH model used in this research is as follows:

$$ASI_{rt} = C + \alpha_t ASI_{rt_{-1}} + \varepsilon_{1t} \text{ Mean return equation of } ASI_{rt} \qquad 3.8$$

$$\sigma_t^2 = \omega + \alpha_i \varepsilon_{t-1}^2 + \gamma_i \varepsilon_{t-1}^2 d_{t-1} + \beta_j \sigma_{t-1}^2 \text{ Return variance equation TGARCH/TARCH} \qquad 3.9$$

where d_{t-1} = 1 if $\varepsilon_{t-1}^2 < 0$ and $d_{t-1} = 0$ if $\varepsilon_{t-1}^2 > 0$.

3.1.2.2.1 A Priori Expectation of TGARCH Model

The TGARCH model stipulates that to measure the impact of negative news on volatility persistence in return, $\gamma_i > 0$.

3.1.2.3 The Power GARCH Model

The Power GARCH/Asymmetric Power ARCH (PGARCH/APARCH) was introduced by Ding et al (1993) also measures the impact of negative return news on the magnitude of volatility which is referred to as leverage effect. The general specification of the PGARCH/APARCH model is given as:

$$\sigma_t^{\delta} = \omega + \sum_{i=1}^{p} \alpha_i \left(|\varepsilon_{t-1}| - \gamma_i \varepsilon_{t-1}\right)^{\delta} + \sum_{j=1}^{q} \beta_j \, \sigma_{t-j}^{\delta} \quad 3.10$$

where $\delta > 0$ and $-1 < \gamma_i < 1$. The effect of ε_{t-1}upon $\sigma_t$is through the function γ_i. If $\gamma_i = 0$, a positive news $\varepsilon_t > 0$ has a higher impact on volatility than negative news $\varepsilon_t < 0$. The mean return equation and the return variance PGARCH/APARCH model that was used in this research is as follows:

$$ASI_{rt} = C + \alpha_t ASI_{rt_{-1}} + \varepsilon_{1t} \quad \text{Mean return equation of } ASI_{rt} \quad 3.11$$

$$\sigma_t^{\delta} = \omega + \alpha_i \left(|\varepsilon_{t-1}| - \gamma_i \varepsilon_{t-1}\right)^{\delta} + \beta_j \sigma_{t-j}^{\delta} \quad \text{Return variance equation PGARCH/APARCH} \quad 3.12$$

3.1.2.3.1 A Priori Expectation of PGARCH Model

The PGARCH/APARCH model stipulates that to measure the impact of negative news on volatility persistence in return, $\gamma_i > 0$.

3.1.3 Distributional Assumptions

GARCH models are estimated using the Maximum Likelihood Estimation (MLE) process (Coffie, 2015) assumes that the error distribution is normal (Gaussian), though Nelson (1991) opined that the error exhibits non-normal distribution densities. Thus, to estimate the ARCH model, there is the need for the assumption of conditional distribution for the error terms.

In this study, three (3) conditional distributions for the standardized residuals of returns innovations; the Gaussian distribution, student's-t distribution, and the Generalised Error Distribution (GED) are used in the empirical analysis.

The Gaussian (normal) distribution is expressed as:

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} \, e^{-(x-\mu)^2/\sigma^2} \quad 3.13$$

where μ is the mean value and σ^2 is the variance of the error from the return equation. The standard Gaussian distribution considers the mean value (μ) = 0 and variance (σ^2) = 1.

The student's-t distribution is given as:

$$f(x) = \frac{\Gamma\left[\frac{v+1}{2}\right]}{\sqrt{v\pi\left[\frac{v}{2}\right]\left(1+\frac{x^2}{v}\right)^{\frac{v+1}{2}}}} \quad 3.14$$

where v is the degree of freedom ($v > 2$), if v tend to ∞, the student's-t distribution converges to the Gaussian distribution with an implied kurtosis of $k = \left(\frac{6}{v} - 4\right) + 3$ for all $v > 4$.

The Generalised Error Distribution (GED) is a symmetric distribution and platykurtic with the following density function:

$$f(x) = \frac{ve^{\frac{1}{2}|\frac{x}{\lambda}|}}{\lambda 2^{\frac{v+1}{v}}\Gamma 1/v} \quad 3.15$$

where $\lambda = [\frac{2^{-2/v}\,\Gamma 1/v}{\Gamma 3/v}]^{1/2}$.

It includes the normal distribution if the parameter v has a value of two and when $v < 2$ indicates fat tail distribution.

3.1.4 Measurement of Variables and Nature of Data

The type of data used for this study is mainly secondary which are sourced through the Nigerian Stock Exchange. The research population is the Nigerian Stock Exchange, using the All Share Index return as the performance indicators and the return series is defined as:

$$ASI_{rt} = \frac{(ASI_t - ASI_{t-1})}{ASI_{t-1}} \quad 3.16$$

where ASI_t is All Share Index at time t (particular/current week in this case) and ASI_{t-1} is All Share Index at time $t-1$ (current/particular week minus previous week).

The sample size was the weekly All Share Index for the period of 2001 till 2016 divided into pre and post financial meltdown. The period was chosen based on the event window (the 2008-2009 financial crisis) of the research.

The unit root test, the ARCH effect test and volatility clustering attribute of the All Share Index return were done and analysed. The descriptive statistics of the All Share Index return were explained to determine the suitability of using the data in GARCH variant models. Also, GARCH model and its extensions were estimated and analyzed which provided answers to the research questions.

4. Data Analysis and Discussion

This section presents the descriptive statistics of the data, including the volatility clustering feature and ARCH effect, the unit root test, the mean and variance equations. The ARCH variant models under various distributional assumptions are presented in order to answer the research questions and to achieve the objectives of the study.

The All share Index return series used in the study covers the period of Jan 2001 till Dec 2016 and it was divided into periods before and after the meltdown. The segmentation of the periods was determined using the period at which the return started going down as a result of the meltdown as the period before the meltdown while the period the return started picking up gradually as the period after the meltdown. The graphical representation is presented in Figure 4.1.

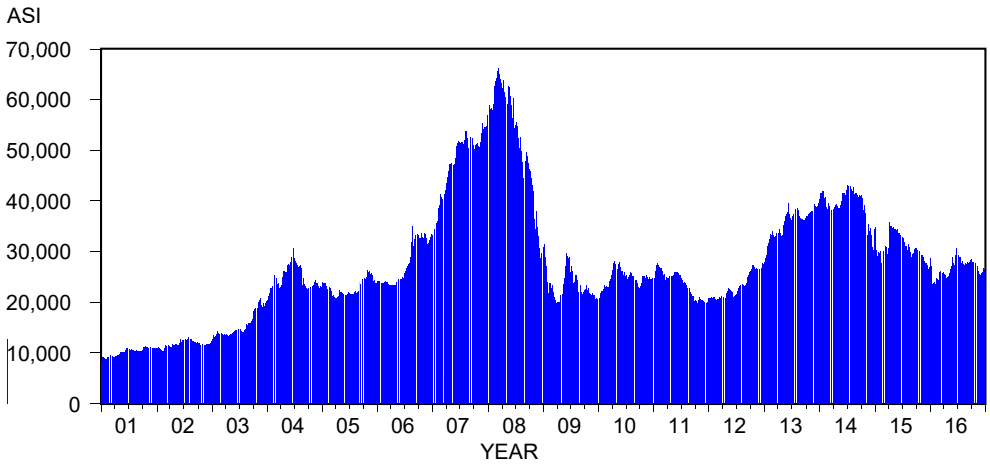

Figure 4.1: Weekly All Share Index on the Nigerian Stock Exchange (Jan 2001 - Dec 2016)
Source: *Author's computations, 2018.*

Figure 4.1 indicates that the All Share Index on the Nigerian Stock Exchange increased from less than 10,000 points in Jan. 2001 to the peak at over 60,000 points in March 2008 and then started to decline to less than 20,000 points in April 2009. The index started to increase gradually by fluctuating between the 20,000 points and 30,000 points between April 2009 and Sept. 2011 and then to more than 40,000 points in April 2009. Therefore, between the period of March 2008 and April 2009 the Nigerian Stock Exchange All Share Index was affected by the global financial meltdown of 2008-2009 crisis and thus the pre meltdown period is Jan 2001 till March 2008 while the post meltdown period is April 2009 till Dec 2016.

4.1 Unit Root Tests

The All Share Index return series was tested to determine the order of integration using Augmented Dickey Fuller (ADF) and the Phillips-Perron unit root test statistics.

Table 4.1: ADF and PP Unit Root Test Result of All Share Index Return (2001-2016)

ASIR (2001-2016)	t-Statistics	P-Value	ASIR (2001-2016)	Adjusted t-Statistics	P-Value
ADF test statistics	-27.04330	0.0000	PP test statistics	-27.58421	0.0000
Critical values:			Critical values:		
1%	-3.437976		1%	-3.437976	
5%	-2.864796		5%	-2.864796	
10%	-2.568558		10%	-2.568558	

Source: *Author's computations, 2018.*

The unit root test results of the entire All Share Index return series covering from 2001 till 2016 indicates that the null hypothesis should be rejected as shown by the P-values of both the ADF and the Phillip-Perron statistics of 0.0000 respectively in table 4.1, which means that the series has no unit root (stationery series).

4.2 Descriptive Statistics

The summary statistics of the stationary All Share Index returns on the Nigerian Stock Exchange from 2001 till 2016 is presented in Figure 4.2.

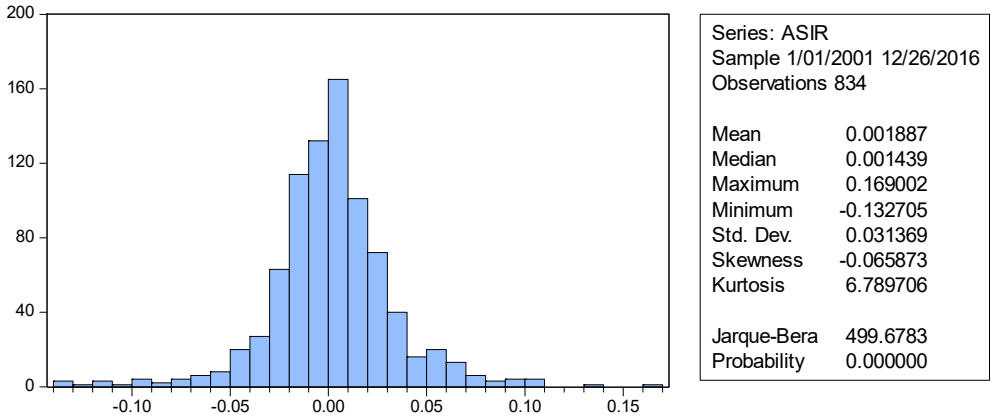

Figure 4.2: Descriptive Statistics of All Share Index Return (2001-2016)
Source: *Author's computation, 2018.*

Figure 4.2 reveals positive mean weekly returns of 0.001887 and the standard deviation which measures the riskiness of the return was 3.14%. The 21.5% difference between the minimum and maximum returns shows the level of price variability of return on the Nigerian Stock Exchange over the period. The skewness of -0.065873 is less than 0 (skewness of a normal distribution is 0) which shows that the stationary All Share Index returns on the Nigerian Stock Exchange from 2001 till 2016, on average, is negatively skewed relative to the normal distribution, indicating non-symmetric series. The kurtosis of 6.789706 is higher than 3 (kurtosis of a normal distribution is 3) which shows that the stationary All Share Index returns on the Nigerian Stock Exchange from 2001 till 2016, on average, is leptokurtic.

To support the skewness and kurtosis, the Jarque-Bera statistics (combination of skewness and kurtosis as asymptotic normality) with a value of 499.68 and a corresponding p-value of 0.0000, the null hypothesis of normal distribution cannot be accepted for the stationary All Share Index returns on the Nigerian Stock Exchange from 2001 till 2016.

4.3 Conditional Return/Mean Equation, ARCH Effect Test and Volatility Clustering

The conditional mean return equation of the All Share index return series is given by the OLS regression in equation (3.1) for the whole series. The test for the presence of ARCH effect and check for volatility clustering is also conducted on the residual of the conditional mean/return equations of the return series.

Table 4.2: Conditional Return/Mean Equation of All Share Index Return (2001-2016)

Dependent Variable: All Share Index return 2001-2016				
Variables	Coefficient	Standard Error	t-Statistic	P-Value
C	0.001671	0.001081	1.545181	0.1227
ASIR(-1)	0.068072	0.034435	1.976816	0.0484

Source: *Author's computations, 2018.*

Table 4.3: ARCH Effect Result of All Share Index Return (2001-2016)

Test Statistics	Value	P-Value
F-statistics	47.36208	0.0000
Observed R^2	44.91611	0.0000

Source: *Author's computations, 2018.*

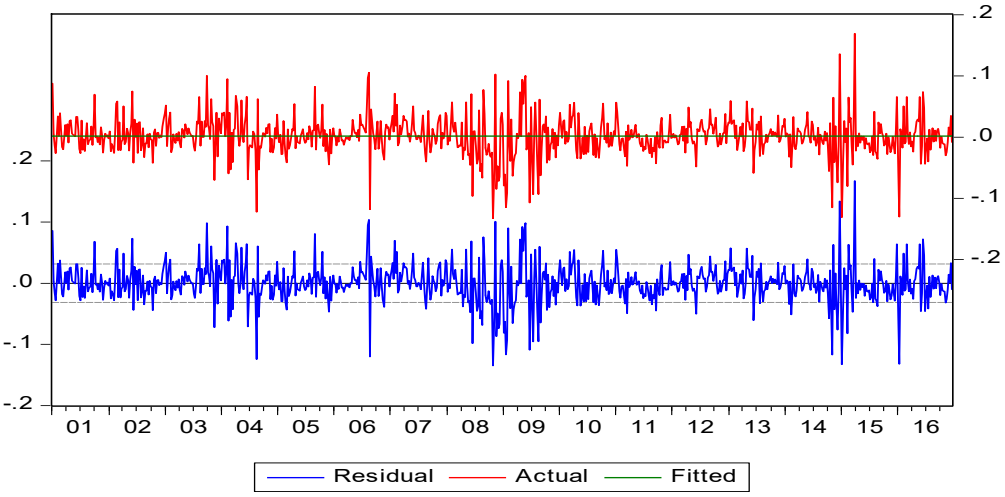

Figure 4.3: Volatility Clustering for Weekly All Share Index Return (Jan. 2001-Dec. 2016)
Source: *Author's computations, 2018.*

The conditional return/mean equation result for the whole All Share Index return series is shown in Table 4.2. The ARCH effect test on the residual of the conditional return/mean equation of whole All Share Index return series is also shown in Table 4.3 with the F-Statistics and the observed R square values having corresponding P-values of 0.0000. This indicates that the null hypothesis is rejected meaning that there is ARCH effect in the residuals of the mean equation of All Share Index return series of 2001 till 2016 on the Nigerian Stock Exchange.

In the same vein, the residual of the mean equation also exhibit volatility clustering as shown in Figure 4.3. Figure 4.3 shows that return series oscillates around the mean value (mean reverting) showing that volatility of stock returns is low for consecutive period till 3rd quarter of 2003 (low volatility followed by low volatility for a prolonged period) and volatility is high for another consecutive period till 3rd

quarter of 2004 (high volatility followed by high volatility for a prolonged period). This feature of low volatility followed by low volatility for a prolonged period and periods of high volatility followed by high volatility for a prolonged period is sustained throughout the period.

4.4 EGARCH, TGARCH and PGARCH Models under the Distributional Assumptions

The objective of this study investigates the leverage effect of All Share Index return in the Nigerian Stock Exchange. Three (3) GARCH model variants (TGARCH, EGARCH and PGARCH) in equations 3.5, 3.6, 3.8, 3.9, 3.11 and 3.12 was employed for this purpose. The best fit model to measure leverage on the Nigerian Stock Exchange was also determined using the information criterion values for the periods before and after the meltdown. The estimates of the GARCH volatility variants model are presented in Table 4.4 - 4.9 under the three (3) distributional assumptions for the periods before and after the meltdown.

Table 4.4: EGARCH Result for All Share Index Returns before the Meltdown

Parameters	Gausian Distribution		Student's-t Distribution		Generalised Error Distribution	
	Estimates	P-Value	Estimates	P-Value	Estimates	P-Value
ω	-3.600938	0.0001	-3.357485	0.0027	-3.449198	0.0071
α_i	0.425184	0.0000	0.464896	0.0004	0.447181	0.0016
β_j	0.554590	0.0000	0.589288	0.0001	0.579662	0.0006
γ_i	0.188268	0.0012	0.222173	0.0181	0.201432	0.0386
AIC	-4.510513		-4.617320		-4.613668	
SC	-4.447682		-4.544018		-4.540366	
HQ	-4.485569		-4.588219		-4.584567	

Source: *Author's computations, 2018.*

Table 4.4 is the EGARCH estimates of the All Share Index return on the Nigerian Stock Exchange before the meltdown. The values of γ_i under the three (3) distributional assumptions are positive and significant with the p-values of less than 5% under the three (3) distributional assumptions. Since the EGARCH model expect the value of $\gamma_i < 0$ and should be significant to measure the impact of negative news on volatility persistence in return. The result therefore, shows that the All Share Index return volatility responds more to positive (good) news than it respond to negative (bad) news of the same magnitude on the Nigerian Stock Exchange before the meltdown indicating the absence of leverage effect. The best fit estimates is the estimate of the student's-t distributional assumption as indicated by its lowest values of AIC, SIC and HQ selection criterions.

The TGARCH results of All Share Index return on the Nigerian Stock Exchange before the meltdown is shown in table 4.5. The values of γ_i under the three (3) distributional assumptions are negative. γ_i is not significant with p-values of more than 5% under the two (2) distributional assumptions (student's-t and generalized error distributions) but significant with p-values of less than 5% under Gaussian/normal distributional assumption. Since the TGARCH model stipulates that the value of $\gamma_i > 0$ and be significant to show that bad (negative) news impact

return volatility. The result therefore, implies that the All Share Index return volatility responds more to positive (good) news than it does to negative (bad) news of the same magnitude on the Nigerian Stock Exchange before the meltdown indicating no leverage effect. The best fit estimate is the estimate of student's-t distributional assumption as indicated by its lowest values of AIC, SIC and HQ selection criterions.

Table 4.5: TGARCH Result for All Share Index Returns before the Meltdown

Parameters	Gausian Distribution		Student's-t Distribution		Generalised Error Distribution	
	Estimates	P-Value	Estimates	P-Value	Estimates	P-Value
ω	0.000539	0.0000	0.000427	0.0002	0.000429	0.0001
α_i	0.508752	0.0025	0.684586	0.0202	0.590221	0.0344
β_j	-0.069307	0.2704	0.080761	0.5758	0.051166	0.7492
γ_i	-0.421652	0.0099	-0.583358	0.0497	-0.496082	0.0828
AIC	-4.511180		-4.617299		-4.611301	
SC	-4.448349		-4.543997		-4.537998	
HQ	-4.486236		-4.588198		-4.582199	

Source: *Author's computations, 2018.*

Table 4.6 is the PGARCH estimates of the All Share Index return on the Nigerian Stock Exchange before meltdown. The values of γ_i under the three (3) distributional assumptions are negative and significant with the p-values less than 5%. Since the PGARCH model expect the value of γ_i > 0 and be significant to measure the impact of negative news on volatility persistence in return. The result therefore, means that the All Share Index return volatility responds more to positive (good) news than it does to negative (bad) news of equal magnitude on the Nigerian Stock Exchange before the meltdown also showing that there was no leverage effect. The best fitted estimates are the estimates of student's-t distributional assumption as indicated by its lowest values of AIC, SIC and HQ selection criterions.

Table 4.6: PGARCH Result for All Share Index Returns before the Meltdown

Parameters	Gausian Distribution		Student's-t Distribution		Generalised Error Distribution	
	Estimates	P-Value	Estimates	P-Value	Estimates	P-Value
ω	0.017738	0.0000	0.013260	0.0034	0.013396	0.0076
α_i	0.275832	0.0000	0.296394	0.0008	0.283553	0.0025
β_j	0.098903	0.5644	0.275756	0.1398	0.258257	0.2279
γ_i	-0.594108	0.0000	-0.616583	0.0031	-0.587484	0.0093
AIC	-4.520745		-4.622894		-4.618755	
SC	-4.457914		-4.549591		-4.545452	
HQ	-4.495801		-4.593792		-4.589653	

Source: *Author's computations, 2018.*

Table 4.7 is the EGARCH estimates of the All Share Index return on the Nigerian Stock Exchange after the meltdown. The values of γ_i under the three (3) distributional assumptions are negative but not statistically significant with the p-values of more than 5% under the three (3) distributional assumptions. Since the EGARCH model expect the value of γ_i< 0 and should be significant to measure the impact of negative news on volatility persistence in return. The result therefore, shows that the All Share Index return volatility responds more to negative (bad) news than it respond to positive (good) news of the same magnitude on the Nigerian Stock Exchange after the meltdown but not significant. This shows that there is insignificant leverage effect. The best fit estimate is the estimate of the student's-t distributional assumption as indicated by its lowest values of AIC, SIC and HQ selection criterions.

Table 4.7: EGARCH Result for All Share Index Returns after the Meltdown

Parameters	Gausian Distribution		Student's-t Distribution		Generalised Error Distribution	
	Estimates	P-Value	Estimates	P-Value	Estimates	P-Value
ω	-0.896216	0.0000	-1.029234	0.0008	-0.968353	0.0007
α_i	0.396051	0.0000	0.421471	0.0000	0.402033	0.0000
β_j	0.918586	0.0000	0.901778	0.0000	0.909339	0.0000
γ_i	-0.026341	0.5220	-0.033144	0.5654	-0.032853	0.5633
AIC	-4.419304		-4.461270		-4.461114	
SC	-4.359655		-4.391680		-4.391524	
HQ	-4.395687		-4.433716		-4.433560	

Source: *Author's computations, 2018.*

The TGARCH results of All Share Index return on the Nigerian Stock Exchange after the meltdown is shown in table 4.8. The values of γ_i under the three (3) distributional assumptions are positive and not statistically significant with the p-values of more than 5% under the three (3) distributional assumptions. Since the TGARCH model stipulates that the value of γ_i > 0 and be significant to show that bad (negative) news impact return volatility. The result therefore, implies that the All Share Index return volatility responds more to negative (bad) news than it does to positive (good) news of the same magnitude on the Nigerian Stock Exchange after the meltdown but not significant. This also indicates the presence of insignificant leverage effect. The best fitted estimates are the estimates of the generalized error distributional assumption as indicated by its lowest values of AIC, SIC and HQ selection criterions.

Table 4.8: TGARCH Result for All Share Index Returns after the Meltdown

Parameters	Gausian Distribution		Student's-t Distribution		Generalised Error Distribution	
	Estimates	P-Value	Estimates	P-Value	Estimates	P-Value
ω	0.000076	0.0001	0.000082	0.0093	0.000078	0.0075
α_i	0.227709	0.0011	0.207216	0.0200	0.204319	0.0230
β_j	0.659695	0.0000	0.666262	0.0000	0.666659	0.0000
γ_i	0.057570	0.5081	0.078312	0.4977	0.078015	0.4946
AIC	-4.428428		-4.466387		-4.466420	
SC	-4.368779		-4.396797		-4.396830	
HQ	-4.404811		-4.438833		-4.438867	

Source: *Author's computations, 2018.*

Table 4.9 is the PGARCH estimates of the All Share Index return on the Nigerian Stock Exchange after meltdown. The values of γ_i under the three (3) distributional assumptions are positive and not statistically significant with the p-values of more than 5% under the three (3) distributional assumptions. Since the PGARCH model expect the value of $\gamma_i > 0$ and be significant to measure the impact of negative news on volatility persistence in return. The result therefore, means that the All Share Index return volatility responds more to negative (bad) news than it does to positive (good) news of equal magnitude on the Nigerian Stock Exchange after the meltdown but not significant**.** This shows that there exist insignificant leverage effect. The best fit estimate is that of the generalized error distributional assumption as indicated by its lowest values of AIC, SIC and HQ selection criterion.

Table 4.9: PGARCH Result for All Share Index Returns after the Meltdown

Parameters	Gausian Distribution		Student's-t Distribution		Generalised Error Distribution	
	Estimates	P-Value	Estimates	P-Value	Estimates	P-Value
ω	0.002437	0.0001	0.002703	0.0075	0.002562	0.0066
α_i	0.232733	0.0000	0.233793	0.0000	0.228678	0.0000
β_j	0.733187	0.0000	0.725635	0.0000	0.731003	0.0000
γ_i	0.031381	0.7800	0.037662	0.8017	0.047045	0.7610
AIC	-4.429468		-4.467155		-4.467240	
SC	-4.369820		-4.397565		-4.397650	
HQ	-4.405851		-4.439601		-4.439686	

Source: *Author's computations, 2018.*

In summary, the results of the EGARCH, TGARCH and PGARCH indicated that positive news impact return volatility on the Nigerian Stock Exchange more than negative news of the same magnitude before the meltdown while negative news insignificantly impact return volatility more than positive news on the Nigerian Stock Exchange after the meltdown. This result indicates the absence of leverage effect before the meltdown while there exists insignificant leverage effect after the meltdown.

The student's-t distributional assumption estimates was found to be the best fitted estimates under the three (3) models for period before the meltdown while the PGARCH model gives the best estimate for the period before the meltdown. The student's-t estimates was found to be the fitted estimates under the EGARCH after the meltdown while the generalized error distributional assumption estimates was the best fitted under the TGARCH and PGARCH after the meltdown with the PGARCH model providing the best estimate for the period after the meltdown.

Overall, the null hypothesis of no significant impact of good or bad news on return volatility in the Nigerian Stock Exchange is rejected; therefore, the All Share Index return on the Nigeria Stock Exchange respond to good news before the meltdown while the All Share Index return on the Nigeria Stock Exchange insignificantly respond to bad news after the meltdown.

4.5. Diagnostic Checking

The diagnostic check was conducted on the residuals of student's-t distributional assumption estimates under the PGARCH model for the period before the meltdown while the residuals of the generalized error distributional assumption estimate under the PGARCH model was check for model appropriateness (diagnostic check) for the period after the meltdown. The ARCH effect test and the serial correlation test results of the fitted PGARCH models are presented in Table 4.10 and 4.11.

Table 4.10: ARCH Effect Test Result of fitted PGARCH Models

Test Statistics	PGARCH 2001 - 2016		PGARCH before meltdown		PGARCH after meltdown	
	Student's-t Distribution		Student's-t Distribution		Generalised Error Distribution	
	Value	P-Value	Estimates	P-Value	Estimates	P-Value
F-statistics	0.021711	0.8829	0.426350	0.5142	0.065259	0.7985
Observed R^2	0.021762	0.8827	0.428152	0.5129	0.065576	0.7979

Source: *Author's computations, 2018.*

Table 4.10 is the ARCH effect test result of the fitted model residuals of the PGARCH models used for objective four. The p-values of the f-statistics and the observed R^2 are more than 5% significant level therefore the null hypothesis of no ARCH effect is accepted. This indicates that the fitted PGARCH models estimates under the selected distributional assumptions have no ARCH effect.

Table 4.11: Correlogram of Standardized Residual Square Test Results for Fitted Models

	PGARCH Model 2001 – 2016				PGARCH Model before meltdown				PGARCH Model after meltdown			
Lag	AC	PAC	Q-Stat	P	AC	PAC	Q-Stat	P	AC	PAC	Q-Stat	P
1	-0.005	-0.005	0.0219	0.882	0.034	0.034	0.4326	0.511	-0.013	-0.013	0.0662	0.797
2	0.04	0.04	1.3653	0.505	0.012	-0.013	0.4897	0.783	0.045	0.045	0.8897	0.641
3	-0.042	-0.041	2.8195	0.42	-0.018	-0.017	0.6105	0.894	-0.028	-0.027	1.2133	0.75
4	-0.05	-0.053	4.9597	0.291	-0.013	-0.012	0.675	0.954	-0.022	-0.024	1.4034	0.844
5	-0.031	-0.028	5.7491	0.331	0.021	0.022	0.85	0.974	-0.022	-0.02	1.5969	0.902
6	-0.051	-0.049	7.9466	0.242	-0.056	-0.058	2.0434	0.916	-0.022	-0.021	1.7977	0.937
7	0.097	0.095	15.837	0.027	0.05	0.054	2.9992	0.885	0.103	0.104	6.1816	0.519
8	-0.005	-0.005	15.86	0.044	0.031	0.026	3.368	0.909	-0.022	-0.02	6.3847	0.604
9	0.04	0.026	17.212	0.045	0.018	0.016	3.4875	0.942	0.011	-0.001	6.4334	0.696
10	0.011	0.014	17.316	0.068	-0.002	-0.003	3.4889	0.967	0.01	0.016	6.4754	0.774
11	-0.052	-0.05	19.649	0.05	-0.015	-0.009	3.5725	0.981	-0.11	-0.11	11.543	0.399
12	0.045	0.05	21.377	0.045	0	-0.004	3.5726	0.99	0.087	0.09	14.682	0.259
13	-0.004	0.013	21.394	0.065	0.026	0.031	3.8418	0.993	-0.046	-0.033	15.578	0.273
14	0.043	0.029	22.951	0.061	0.097	0.095	7.4895	0.914	0.049	0.025	16.595	0.278
15	0.023	0.028	23.42	0.076	0.051	0.044	8.4937	0.902	-0.01	0.001	16.634	0.341
16	-0.038	-0.046	24.629	0.077	-0.023	-0.026	8.7042	0.925	-0.059	-0.073	18.114	0.317
17	-0.028	-0.031	25.293	0.088	-0.051	-0.047	9.7223	0.915	-0.019	-0.018	18.26	0.373
18	-0.05	-0.029	27.438	0.071	-0.022	-0.017	9.9166	0.935	-0.055	-0.027	19.561	0.358

L, AC, PAC, Q-Stat and P indicate the lags, the autocorrelation function, the partial correlation function, the Ljung–Box Q–Statistic and the probability respectively.
Source: *Author's computations, 2018.*

The serial correlation test result is shown in Table 4.11 under the autocorrelation function, the partial correlation function, the Ljung–Box Q–Statistic and the probabilities with lag 1 to lag 18 for the residuals of the fitted PGARCH models. The probability values from lag 1 to 18 are all more than 5% significant level, suggesting that the null hypothesis of no serial correlation is accepted. Thus, the diagnostic test of ARCH effect and serial correlation of the fitted PGARCH model estimates and findings are good for policy consideration, implementation and professional practice.

In summary, the diagnostic check results of ARCH effect and serial correlation test indicated that the GARCH model and its variant do not have ARCH effect and no serial correlation in the residuals of the fitted model.

4.6. Discussion of Findings

The objective of this study investigates the impact of good or bad news on the All Share Index return volatility on the Nigerian Stock Exchange and the objective was achieved using three (3) GARCH model variants (TGARCH, EGARCH and PGARCH) in equations 3.5, 3.6, 3.8, 3.9, 3.11 and 3.12. Findings shows that All Share Index return volatility responds more to positive (good) news than it does to negative (bad) news of equal magnitude on the Nigerian Stock Exchange during the period before the meltdown as indicated by the estimates of EGARCH, TGARCH and PGARCH. The result is in contrast with Ahmed and Suliman (2011), Atoi (2014), Alagidede and Panagiotidis (2009), Emenike (2010), Goudarzi and Ramanarayanan (2011), Okpara and Nwezeaku (2009), Olowe (2009), Su (2010). Volatility responds more to negative (bad) news than it respond to positive (good) news of the same magnitude on the Nigerian Stock Exchange after the meltdown which is against the findings of Bekaert and Wu (2000), Coffie (2015), Emenike and Aleke (2012), Mun, Sundaram and Yin (2008), Uyaebo, Atoi and Usman (2015), but not significant.

Student's-t distributional assumptions estimates was found to give best result in tandem with the findings of (Atoi 2014) for the period before the meltdown while the generalized error distribution gives the best estimate after the meltdown. The APARCH model provides the overall best estimate for all the periods which is in agreement with Atoi 2014, Rahman, Rahman and Hossain (2013), but contrast the findings of Su (2010), Alberg, Shalit and Yosef (2008), Coffie (2015), Onwukwe, Bassey and Isaac (2011). In general the findings follows the assertion of Osarumwense (2015) that impact of good or bad news on return volatility do not only depend on the asymmetric model but also the choice of the error distribution matters.

5. Conclusion and recommendations

The results of the three (3) GARCH model variants (TGARCH, EGARCH and PGARCH) used for objective four indicates that All Share Index return volatility responds more to positive (good) news than it does to negative (bad) news of equal magnitude on the Nigerian Stock Exchange for the period before the meltdown while volatility responds more to negative (bad) news than it respond to positive (good) news of the same magnitude on the Nigerian Stock Exchange after the meltdown but not significant. The result also indicates that the PGARCH model is the best before and after the meltdown, student's-t distributional assumption is the best for

estimation for the period before the meltdown while the generalized error distribution provide the best estimate for period after the meltdown. The findings rejected the null hypothesis which stated that there is no significant impact of good or bad news on return volatility in the Nigerian Stock Exchange before and after the financial meltdown.

All the fitted models were tested for appropriateness (diagnostic test) to ascertain their desirability for policy consideration and implementation. The residual of the models were all found to have no ARCH effect and no serial correlation which are both desirables of a good fitted model. This means that the findings of this study are appropriate for policy consideration. However, the limitation of this study is that not all the GARCH model that measure news are employed, thus subsequent research should focus on other GARCH models not employed and compared with this finding.

It was therefore, concluded that return volatility on the Nigerian stock exchange responds more to good news before the meltdown of 2008-2009 while return volatility responds more to bad news after the meltdown. This has led to information asymmetry between investors and has made the information environment of the Nigerian stock market not conducive and unattractive for shrewd investors.

Grounded on the findings and conclusions drawn from this study and the need to strengthen and improve the Nigerian stock market, this study recommended that there is the need for on-line real time access to share price movement for investors and also minimise operational (dealing) bottleneck. This will not only improve the liquidity level and enhance free flow of relevant securities information on the Nigerian Stock Exchange but will also improve investor's confidence and discourage information imbalance in the market.

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