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Macroeconomic news announcements and asymmetric volatility of stock returns: The Nigerian case

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Abstract

This paper investigates the effect of macroeconomic news announcements on the volatility of stock returns in Nigeria using daily closing prices of the All-Share Index from The Nigerian Stock Exchange from 2000 to 2015. This period is divided into two equal subperiods — from 2000 to 2007, and from 2008 to 2015 — to properly examine the effect of the 2008 global financial crisis on the volatility of stock returns in Nigeria. We extend existing literature by augmenting the AR-EGARCH econometric model with macroeconomic news announcements to specify both the conditional mean and volatility equations under the Generalized Error Distribution function. The empirical results reveal an insignificant effect of macroeconomic news announcements on stock returns. This implies that investors respond passively to macroeconomic news and it also confirms the weak-form efficiency of the market with evidence of asymmetries. The asymmetric parameters are negative in all the periods under study but only significant in 2000-2007, suggesting that bad news is positively correlated with volatility and negatively correlated with returns while the opposite is true for good news. The sums of ARCH and GARCH coefficients ($\alpha + \beta$) are above unity in all cases, indicating evidence of volatility persistence that takes a long time to attenuate.

Keywords:

Asymmetric volatility, Stock returns, Generalized error distribution function, Macroeconomic news, Volatility persistence.

JEL classification: G15, G19.

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Noticias macroeconómicas y asimetría en la volatilidad de los rendimientos bursátiles: **el caso nigeriano**

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Resumen

En este artículo se estudia el efecto de las noticias de carácter macroeconómico en la volatilidad de los rendimientos bursátiles. Para ello se utiliza información diaria de cierre del ALL-Share Index de la Bolsa de Valores de Nigeria, para el periodo 2000-2015. Este periodo ha sido dividido en dos subperiodos: 2000-2007 y 2008-2015, con el objetivo de evaluar el efecto de la crisis financiera global sobre la volatilidad de los rendimientos bursátiles en Nigeria. Este artículo aporta a la literatura existente sobre la cuestión un modelo AR-EGARCH, cuya especificación se aumenta con el anuncio de noticas macroeconómicas, con distribución de error generalizada. Los resultados obtenidos muestran la no significatividad del efecto del anuncio de noticias macroeconómicas sobre los rendimientos bursátiles. Ello implica una respuesta pasiva de los inversores ante tales noticias, a la vez que confirma la debilidad de la eficiencia del mercado y las evidencias de asimetría. El parámetro de asimetría es negativo en los dos subperiodos considerados (así como en el periodo total objeto de estudio), sugiriendo que las malas noticias están correlacionadas positivamente con la volatilidad y negativamente con los rendimientos bursátiles, y viceversa. Sin embargo, los resultados solo son significativos en 2000-2007. La suma de los coeficientes ARCH y GARCH ($\alpha + \beta$) sugiere una persistencia en volatilidad que necesita un largo periodo de tiempo para atenuarse.

Palabras clave:

Volatilidad asimétrica, rendimientos bursátiles, distribución de error generalizada, noticias macroeconómicas, persistencia en volatilidad.

1. Introduction

The nexus between macroeconomic news announcements and the volatility of stock returns is important for risk management, portfolio construction and asset allocation, and also provides a basis for monetary policy decisions. Macroeconomic factors can be sources of systematic risk and volatility (Cakan, 2012). Existing literature on this subject is mixed, with ample evidence from advanced economies and few studies on emerging markets. It has been observed that this subject has not attracted much research attention in Nigeria; thus this investigation into the influence of macroeconomic news announcements will advance the knowledge on the risk behaviour of stock returns in Nigeria.

Macroeconomic news is announced by the constituted authorities to inform the public about the state of the economy. Prominently, the National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN) are charged with releasing news on inflation, unemployment, Gross Domestic Product (GDP), as well as on the Monetary Policy Rate, Exchange Rate, Money Supply, and the Balance of Payments. This news is made public via scheduled and unscheduled announcements.

This news about the economy has two effects: positive (good news) and negative (bad news). It is positive when the good news is positively correlated with returns and negatively related to volatility, and vice versa. One of the determinants of the effect of macroeconomic announcements on the volatility of stock returns is the state of the economy. Nigeria is a monolithic economy, relying on crude oil as major source of revenue to sustain the economy. A crude oil price shock in the international futures market is bad news for the economy as this will positively correlate with volatility in the foreign exchange market, and by extension, negatively relate to stock returns. The instability in the exchange market may cause inflation and interest rates to go up.

The effect of macroeconomic news announcements on the volatility of stock returns depends on a number of factors: the state of the economy (Andersen *et al.*, 2007), the content of the information (Nelson, 1991), the distribution density function, the types of news, and the market efficiency. The state of the economy relates to whether it is a developed, emerging or developing economy, and whether the economy in question is expanding or contracting. Ample evidence has shown that in a developed market, asymmetric volatility of stock returns is minimal compared to emerging and developing economies. Returns tends to be positively correlated with economies undergoing an expansionary trend and negatively with contracting economies.

On the contents of news, Bomfim (2000) states that the effect of news announcements on the volatility of stock returns is zero if there is no difference between the actual and projected/survey news. This is not the case when the content generates a

surprise. Bauwens *et al.* (2005) and Nowak *et al.* (2009) assume that if an announced figure for a real activity variable is larger than the market expectations and the variable contributes to economic growth, the news is classified as positive; otherwise, it is negative. Along the same lines, Boyd *et al.* (2005) define good economic news as a situation where the actual announcement is better than expected and bad news where actual announcements are worse than expected. Nelson (1991) states that news is bad when the lagged error term is less than zero ($\varepsilon_{t-1} < 0$) and good news when the lagged innovation is greater than or equal to zero ($\varepsilon_{t-1} \geq 0$). Nelson (1991) therefore states that the total impact of good news on volatility is measured as $(1+\gamma)|\varepsilon_{t-1}|$; and bad news as $(1-\gamma)|\varepsilon_{t-1}|$, where γ represents the asymmetric or leverage effect.

Another determinant relates to the distribution function of returns and volatility. The distributions can be Gaussian or normal, Student's *t*, Generalized Error Distribution (GED), and Skewed Student. Stock returns distribution is normal in a perfect market where prices of stocks fully reflect all available information. The best model in this market is the classical linear regression. In reality, stock return behaviour is not always normal, hence the need for other distribution functions. The efficiency of the market also determines the effect of macroeconomic news announcements on stock returns. Fama (1970) empirically shows that stock prices fully reflect available information (be it public, private or insider information) in a perfect market. In an efficient market, Fama (1970) states that stock returns are normally distributed and investors have homogenous expectations of the distribution of market returns and risk. Engle (2001) claims that volatility is obviously a response to news, which must be surprise, although the timing of the news may not be a surprise and this gives rise to predictable components of volatility, such as economic announcements.

The objective of this paper is to investigate the effect of macroeconomic news announcements on the asymmetric volatility of stock returns in Nigeria before and during the global financial crisis of 2008. This will help to determine whether macroeconomic news is a source of systematic risk in a weak-form efficient stock market.

The paper is structured into five sections. After this introductory section is the literature review. Section 3 shows the methodology used in the article, section 4 is devoted to the empirical results, and section 5 concludes.

2. Literature review

Engle (1982) pioneered the Autoregressive Conditional Heteroskedastic (ARCH) model which was extended and generalized by Bollerslev (1986) as the GARCH model. These models are symmetric, and fail to capture the leverage effect. They are linear functions

of the lag squared of the past residuals and variance, and do not capture the asymmetries in the stock returns. They only measure the size and not the sign and assume that both bad and good news have the same effect on volatility. Engle (2001) states that ARCH/GARCH models thus far have ignored information on the direction of returns; only the magnitude matters and there is no convincing evidence that the direction does affect volatility. The only thrust of these models is that the variance of the error term is time-varying, capturing volatility clustering and leptokurtosis (Alberg *et al.,* 2008). However, financial time series usually exhibit a set of distinctive characteristics in terms of volatility distribution. One of the prominent characteristics of financial time series is asymmetry in stock returns volatility (Wdowinski and Malecka, 2010). To accommodate the asymmetry that exists in many financial time series, numerous asymmetric GARCH models have been developed. To that end, the GARCH models have been modified and extended in many ways to overcome problems inherent to the models and to capture asymmetries in volatility of stock returns. The modified asymmetric GARCH models are the Exponential GARCH (EGARCH) model by Nelson (1991), the GJR-GARCH model by Glosten *et al.* (1993), the Asymmetric GARCH (AGARCH) model by Engle and Ng (1993), the Threshold GARCH (TGARCG) by Zakoian (1994), the Power GARCH (PGARCH) model by Ding *et al.* (1993) and the Quadratic GARCH (QGARCH) model developed by Sentana (1995). The central tenet of the proposed models is that good (bad) news of the same magnitude is negatively (positively) correlated with volatility.

Nelson's EGARCH model captures both size (magnitude) and sign effects in a non-linear formulation. Since negative shocks tend to have a bigger impact on volatility, the leverage or asymmetric coefficient (γ_i), is often assumed to be negative (Tsay, 2005). The asymmetric effect of the EGARCH model measures the response of market participants to positive (good news) and negative (bad news) shocks. Volatility is high when investors respond to bad news and low when they respond to good news. The high volatility stemming from bad news results in a decrease in market price, while low volatility from good news results in an increase in market price.

As for the empirical review, and focusing only on the area under study and some neighbouring countries, mixed findings have been reported on macroeconomic news announcements and the asymmetric volatility of stock returns in advanced and emerging economies. Adjasi *et al.* (2008) used the EGARCH model and found a negative correlation between exchange rate volatility and stock market returns with strong evidence of an asymmetric effect and volatility shocks in stock returns on the Ghana Stock Exchange. Aliyu (2010) applied the QGARCH model to assess the impact of inflation on stock market returns and volatility in Nigerian and Ghanaian stock exchanges. He found that the inflation rate and its three-month average significantly affect stock market volatility in the two countries. Results for Nigeria found only weak evidence to support the idea that bad news exerts a more adverse

effect on stock market volatility than good news of the same magnitude, while for Ghana good news boosts volatility more than bad news does. Olweny and Omondi (2011) employed EGARCH and TGARCH models to investigate the effect of macroeconomic factors on the stock return volatility in the Nairobi Securities Exchange, Kenya. The macroeconomic dataset includes the foreign exchange rate, interest rate and inflation rate. They document evidence of non-normality, excess kurtosis and symmetry in the distribution of stock returns. The results showed that the foreign exchange rate, interest rate and inflation rate affect stock returns volatility with evidence of an asymmetric effect. Fedorova *et al.* (2014) used the EGARCH model to examine the impact of euro area macroeconomic announcements on CIVETS (Colombia, Indonesia, Vietnam, Egypt, Turkey and South Africa) stock markets. Their results revealed a nexus between euro area macroeconomic announcements and CIVETS stock markets, with euro area macroeconomic news affecting CIVETS stock market volatility. Evidence on the impact of overall European macroeconomic news on stock market volatility is found for Colombia, Vietnam, Egypt and Turkey. Finally, it was documented that negative news has a leverage effect for most CIVETS stock markets, as greater volatility is generated by negative than by positive shocks. Olowe (2009) also used EGARCH-in-mean model to investigate the relationship between stock returns and volatility in Nigeria in the light of banking reforms, insurance reform, a stock market crash and the global financial crisis. The results revealed little evidence on the relationship between stock returns and volatility and showed that banking reform and the stock market crash negatively impact stock returns, while insurance reform and the global financial crisis have no impact on stock returns. Emenike (2010) used the GJRGARCH (1,1) model to examine the Nigerian equity market and found evidence of volatility clustering, leverage effects, volatility persistence, and a fat-tailed distribution for the Nigerian stock returns data. Oseni and Nwosa (2011) employed the AR(k)-EGARCH (p, q) model to examine the impact of macroeconomic variables on the volatility of stock market returns in Nigeria for the periods 1986 to 2010. Their results revealed evidence of a bi-causal relationship between stock market volatility and real GDP volatility and no causal relations between stock market volatility and the volatility in the interest rate and inflation rate.

3. Data and methodology

3.1. Data

This paper used a high-frequency daily closing prices time series of All-Share Index (ASI) data obtained from The Nigerian Stock Exchange (NSE). The macroeconomic news dataset consists of inflation rate (IFN), monetary policy rate (MPN), exchange rate (EXN) and crude oil price (OPN) data obtained from the National Bureau of

Statistics (NBS), CBN and Index Mundi website; dummy variables are used to proxy the days with macroeconomic news announcements. Announcement days take a value of one, and other days zero.

More specifically, the dataset consists of 3940 daily observations of the NSE-ASI for the period from January 3, 2000 to December 31, 2015. For a better analysis, the period is divided into two shorter periods: January 3, 2000 to December 31, 2007, covering 1959 observations; and January 2, 2008 to December 31, 2015, totalling 1981 observations. The reason for doing so was to evaluate the effect of macroeconomic news announcements on the volatility of stock returns before and during the global financial crisis that started in 2008.

Descriptive statistics for the historical daily closing price index are computed from the above data. They include not only the mean, standard deviation, skewedness, and kurtosis but also residual diagnostic tests for non-normality, non-linearity, autocorrelation, and heteroskedasticity, coupled with information criteria to determine the best-fit models for the study.

As usual, the natural logs were applied to the ASI data in order to obtain the stock returns (R_t), which is the dependent variable. The return is squared to enable us to estimate the volatility. However, the return series was purged of unit roots by taking differences to ensure stationarity. Then, the unconditional mean and the conditional variance were estimated (the latter by using a generalized error distribution (GED) function). Model selection was based on maximum likelihood (ML) and information criteria, and the results from the diagnostic tests were also of help. Estimation and forecasting was carried out with OxMetrics 6.3 econometric package.

3.2. Methods

3.2.1. Estimating daily stock returns

As outlined above, before the application of GARCH models, ASI was transformed from its level I(0) form by taking its first difference to enable us to obtain a change (stock return) and then purge the data series of the presence of unit roots. Equation 1 can be expressed in level form where the logarithm of the stock market index at time t is related to the index at time $t-1$ as shown below:

$$R_t = \ln\left[P_t / P_{t-1}\right]. \qquad (1)$$

R_t denotes the stock returns at time t, $\ln(P_t)$ is the natural log of the daily market index at time (t) and $\ln(P_{t-1})$ at time ($t-1$).

3.2.2. Estimating the conditional mean model

Equation 2 is known as the first-order autoregressive process AR (1) and describes the dynamic interrelationships among the stationary variables whereby the explanatory variable (R_{t-1}) is the lagged value of the dependent variable (R_t). The autoregressive process is a difference equation as shown below:

$$R_t = \mu + \lambda_1 R_{t-1} + \varepsilon_t, \qquad t = 1,2,\ldots,T, \tag{2}$$

where μ is a constant (or mean average), λ_1 is the coefficient of the lagged returns, and the random variable $\varepsilon_t \sim N(0,1)$ is assumed to be normally distributed. $\lambda_1 > 0$ indicates that the present returns are positively related to the past returns. They are negatively correlated if $\lambda_1 < 0$, and not correlated when $\lambda_1 = 0$.

3.2.3. Estimating the conditional mean model with macroeconomic news announcements

Equation 2 is augmented with macroeconomic news variables as shown in equation 3:

$$R_t = \mu + \lambda_1 R_{t-1} + \eta_2 M_{IFNt} + \eta_3 M_{EXNt} + \eta_4 M_{MPNt} + \eta_5 M_{OINt} + \varepsilon_t. \tag{3}$$

The coefficients to be estimated are μ, λ_1, η_2, η_3, η_4, and η_5, where η_2, … η_5 are the model coefficients for *IFN, EXN, MPN* and *OIN* news, respectively. *M* is a macroeconomic announcement dummy taking the value of 1 on announcement days and 0 otherwise. In this case, ε_t is assumed to be a Gaussian innovation: $\varepsilon_t = z_t \sigma_t \sim N(0,1)$. *Z* is the standardized return, and σ is the variance of error term, which is assumed to be constant.

3.2.4. Estimating the symmetric volatility model with macroeconomic news announcements

The Bollerslev (1986) GARCH model was extended to incorporate macroeconomic news as shown in Equation 4:

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 + \eta_2 M_{IFNt} + \eta_3 M_{EXNt} + \eta_4 M_{MPNt} + \eta_5 M_{ONt} + \varepsilon_t, \tag{4}$$

where σ_t^2 indicates symmetric volatility; ω is the intercept; α_i, the ARCH parameter representing symmetric effects of the model (Fedorova, 2014); ε_{t-i}^2 represents the ARCH effect; β_j, the GARCH parameters that measure the persistence of conditional volatility; and σ_{t-j}^2, the GARCH effect. The coefficients to be estimated are ω, α, and β respectively, with $\omega > 0$, $\alpha_i > 0$, $i = 1,\ldots,q$, $\beta_j > 0$, $j = 1,\ldots,p$ and $\sum_{i=1}^{q} \alpha_i + \sum_{j=1}^{p} \beta_j < 1$.

3.2.5. Estimating the asymmetric volatility model with macroeconomic news announcements

Nelson's (1991) EGARCH (p,q) model is extended to include the macroeconomic news effect as shown in equation 5:

$$\log(\sigma_t^2) = \omega + \sum_{j=1}^{p} \beta_j \log(\sigma_{t-j}^2) + \sum_{i=1}^{q} \alpha_i \left| \frac{\varepsilon_{t-i}}{\sigma_{t-i}} \right| + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sigma_{t-k}} + \eta_2 M_{IFNt} + \eta_3 M_{EXNt} + \eta_4 M_{MPNt} + \eta_5 M_{ONt} + \varepsilon_t . \quad (5)$$

Equation 5, can be re-written as:

$$\log \sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i g(Z_{t-i}) + \sum_{j=1}^{p} \beta_j \log \sigma_{t-j}^2 + \eta_2 M_{IFNt} + \eta_3 M_{EXNt} + \eta_4 M_{MPNt} + \eta_5 M_{ONt} + \varepsilon_t , \quad (6)$$

where $g(Z_t) = \theta Z_t + \gamma \left(|Z_t| - E(Z_t) \right)$, σ_t^2 is the log conditional variance, $\omega, \beta, \alpha, \theta, \gamma$ are coefficients to be estimated and Z_t is a standardized normal variable. $g(Z_t)$ allows the sign and the magnitude of Z_t to have different effect on the volatility. Since $\log \sigma_t^2$ may be negative, there are no (or fewer) restrictions on the parameters. The coefficient γ measures the asymmetric effect or leverage effect of the macroeconomic news shocks on volatility. The presence of asymmetric effects can be tested by the hypothesis that $\gamma = 0$. If $\gamma = 0$, it implies a symmetric effect, that is, positive and negative shocks of the same magnitude have the same effect on the volatility of stock returns.

The effect is asymmetric if $\gamma \neq 0$. If $\gamma < 0$, (negative and significant), then positive shocks (good news) generate less volatility than negative shocks (bad news) of the same magnitude. When $\gamma > 0$, (positive and significant), it signifies that positive innovations are more destabilizing than negative innovations (Chang Su, 2010). When $\varepsilon_{t-1} > 0$ (positive, or there is "good news"), the total effects of ε_{t-1} is $(1+\gamma)|\varepsilon_{t-1}|$. Conversely, there is "bad news" when $\varepsilon_{t-1} < 0$ (negative) with ε_{t-1} having total effects of $(1-\gamma)|\varepsilon_{t-1}|$ (Zivot, 2009). Bad news is empirically expected to have a larger impact on volatility and the value of γ.

The persistence of conditional volatility irrespective of anything that happens in the market is measured by coefficients $(\alpha+\beta)$ (in the popular (1,1) specification). When $(\alpha+\beta)$is relatively large (>1), then the mean reversion of volatility takes a long time following a crisis in the market (Alexander, 2009). Since $\ln(\sigma_t^2)$ is modelled, the significant advantage of EGARCH models is that even if the parameters are negative, the conditional variance $\ln(\sigma_t^2)$ is guaranteed to be positive.

4. Empirical results

The descriptive statistics in Table 1 show that average daily returns of 0.12, 0.04, and –0.03 per cent were recorded between 2000 and 2007, 2008 and 2015, and 2000 and 2015, respectively. The highest value for average daily returns was recorded between

2000 and 2007, ascribed largely to the bank recapitalization effect where margin facilities were granted to the private sector for share acquisitions. This trend was reversed to –0.03 per cent between 2008 and 2015 due to the effect of the global financial crisis. In view of the above, the overall daily average returns fell to 0.04 per cent between 2000 and 2015. The highest volatility measured by the standard deviation (1.16%) explained the negative returns recorded between 2008 and 2015, while the lowest volatility of 1.07% accounted for the highest returns recorded between 2000 and 2007. The skewedness and kurtosis values of the daily returns are: 0.22 and 27.70; 0.18 and 45.76; and 0.28 and 14.5, for the periods 2000-2015; 2000-2007; and 2008-2015, respectively. This means the returns are characterized by asymmetry and a fat-tailed distribution. The null hypothesis for the kurtosis coefficients that conform to the normal distribution value of 3.0 is rejected, indicating that all distributions are highly leptokurtic.

● Table 1. **Descriptive statistics for daily stock returns**

Period	Mean	Std. Dev.	Skew	Kurt	JB	ADF	Q-Stat	ARCH-LM	Observations
2000-2015	0.000428	0.011184	0.223273	27.69615	100158.0*	-34.14600*	350.49*	758.9804*	3940
2000-2007	0.001221	0.010739	0.185448	45.76222	149271.3*	-22.03159*	89.578*	464.0701*	1959
2008-2015	-0.000356	0.011556	0.283248	14.57980	11094.6*	-30.30114*	261.44*	415.3809*	1981
P-value					0.0000	0.0000	0.0000	0.0000	

*Note: Std.dev., Skew, Kurt, JB, ADF, Q-stat, and ARCH-LM are Standard Deviation, Skewedness, Kurtosis, Jarque-Bera, Augmented-Dickey Fuller, Correlogram of residuals, and Heteroskedasticity statistics, respectively, while * implies significance at the one-percent level.*

The results of the diagnostic tests also show that the Jarque-Bera statistics, which stand at 100158.0, 149271.3, and 11094.64 for the three periods under study, rejects the null hypothesis of normal distribution at the one-percent significance level. Going forward, the series of the returns is not normally distributed. The correlogram residual test displayed by *Q*-statistics (348.95, 464.99, and 261.44) is significant at one percent indicating autocorrelation in daily market returns. The ADF (–34.15, –22.032, and –30.30) statistics exhibited no unit root in the data and are significant at one percent. There is also evidence of ARCH effect (758.98, 464.07; and 415.38) in the stock returns which makes GARCH the best modelling option. Overall, the examination reveals that the historical behaviour of the daily stock market returns in Nigeria exhibits asymmetry, fat tail, heteroskedasticity, non-normality, and autocorrelation. These features prompt further investigation using autoregressive and conditional variance equations. The specification we have chosen is EGARCH (1,1), which is widely used to examine the effect of macroeconomic announcements on volatility in asset pricing.

4.1. Conditional mean with macroeconomic news announcements

The estimates of the conditional mean model with macroeconomic announcements before the 2008 global financial crisis (2000-2007) are shown in Table 2.

● Table 2. **Estimates of the conditional mean model with macroeconomic announcements (2000-2007)**

Variable	Coefficient	Std. error	*t*-statistic	*p*-value
C	-0.001007	0.002932	-0.343421	0.7313
R_{t-1}	0.213733	0.022125	9.660225	0.0000
IFN	-0.000518	0.001044	-0.496045	0.6199
MPN	-0.000760	0.001524	-0.498805	0.6180
EXN	-0.000291	0.000489	-0.595896	0.5513
ON	0.002144	0.002927	0.732364	0.4640

As can be seen in Table 5, the coefficient of inflation news, monetary policy news, exchange news, and oil news on the announcement day are –0.00052, –0.00076, –0.00029 and –0.00214, respectively. It is somewhat surprising that all the parameters exhibit weakly negative signs. This indicates that macroeconomic news announcements influence stock market returns in Nigeria negatively and insignificantly between 2000 and 2007. This may be ascribed to the weak-form efficiency of the market, coupled with asymmetries and investors' passive response to macroeconomic news.

The coefficient of returns at lag 1 (R_{t-1}) is positive (0.2213733) and statistically significant at the one-percent level, implying that the behaviour of past returns is useful information for predicting current returns. A one-percent increase today has an impact of 0.22 perceptual points in tomorrow's returns. However, the *p*-values of all the macroeconomic news announcement coefficients indicate that the announcement of macroeconomic news, regardless of the type, does not have a significant, immediate impact on the returns. The results corresponding to the subperiod 2008-2015 are shown in Table 3.

● Table 3. **Estimates of the conditional mean model with macroeconomic announcements (2008-2015)**

Variable	Coefficient	Std. error	*t*-statistic	*p*-value
C	0.001793	0.001725	1.039714	0.2986
R_{t-1}	0.364742	0.020989	17.37770	0.0000
IFN	-0.001550	0.001106	-1.401513	0.1612
MPN	0.000371	0.001528	0.242505	0.8084
EXN	0.000466	0.000495	0.942281	0.3462
ON	-0.002180	0.001722	-1.266209	0.2056

Inflation and oil news coefficients maintained their negative sign between 2008 and 2015, while monetary policy and exchange news coefficients became positive as this period witnessed the government's use of monetary policy to cushion the effect of the global crisis. Also, the prices of crude oil fell in most of the years in this period, with

negative effect on returns. However, the important finding, which is common to both periods, is that the effect of the macroeconomic news announcements on returns is statistically non-significant.

The effect of macroeconomic announcements on stock returns for the period 2000-2015 is shown in Table 4.

● Table 4. **Estimates of the conditional mean model with macroeconomic announcements (2000-2015)**

Variable	Coefficient	Std. error	*t*-statistic	*p*-value
C	0.001046	0.001481	0.706128	0.4802
R_{t-1}	0.298759	0.015234	19.61102	0.0000
IFN	-0.000985	0.000762	-1.293630	0.1959
MPN	-0.000136	0.001082	-0.125319	0.9003
EXN	8.79E-05	0.000349	0.251909	0.8011
ON	-0.000732	0.001479	-0.495112	0.6205

As can be observed, Table 4 reveals again the non-significance of the impact of macroeconomic news announcements on the stock market returns in Nigeria.

As for the asymmetric effect of macroeconomic announcements on the volatility of stock returns for each of the periods, the results obtained are listed in Tables 5, 6 and 7.

● Table 5. **Macroeconomic news announcements and asymmetric volatility (2000-2007)**

G@RCH SPECIFICATIONS
Dependent variable: R^2. Mean Equation: ARMA (1, 0) model. 4 regressor(s) in the conditional mean.
Variance equation: EGARCH (1, 1) model. No regressor in the conditional variance.
GED distribution, with tail coefficient 1.70303. Strong convergence using numerical derivatives
Log-likelihood = 9517.01.

	Coefficient	Std. error	*t*-statistic	*p*-value
IFN (M)	-0.000326	0.00010165	-3.204	0.0014
MPN (M)	0.000323	0.00011957	2.697	0.0070
EXN (M)	0.000216	1.5539e-005	13.91	0.0000
ON (M)	0.000841	1.5322e-005	54.91	0.0000
AR(1)	0.443376	0.13752	3.224	0.0013
Cst(ω)	0.040000	1.5679e+006	0.00	1.0000
ARCH(α)	0.305806	0.084688	3.611	0.0003
GARCH(β)	1.027685	0.0034008	302.2	0.0000
EGARCH(γ)	-0.086524	0.014548	-5.947	0.0000
G.E.D.(DF)	1.703028	0.39291	4.334	0.0000

No. Observations: 1959. No. Parameters: 11. Mean (Y): 0.00012. Variance (Y): 0.00000. Skewness (Y): 19.17842
Kurtosis (Y): 394.14495. Log Likelihood: 9517.006. The sample mean of squared residuals was used to start the recursion.

Table 5 shows that all the macroeconomic announcements except inflation news have positive and significant effects on the volatility of stock returns at the one-percent level. The volatility is explosive and persistent (1.333491) as measured by the sum of $\alpha + \beta$ parameters, which implies that the mean reversion of volatility occurs over a longer period. Furthermore, the γ coefficient is negative (–0.086524) and statistically significant at one percent. This is evidence of an asymmetric or leverage effect in the Nigerian stock market, which further suggests that bad news has a more destabilizing effect on the volatility of stock returns than good news does. The total bad news impact on volatility from the asymmetric effect stood at 1.086524 compared with the total impact of good news of 0.913476. Thus, bad news had a greater effect on volatility than good news between 2000 and 2007 in the Nigerian stock market.

● Table 6. **Macroeconomic news announcements and asymmetric volatility (2008-2015)**

G@RCH SPECIFICATIONS
Dependent variable: R^2. Mean Equation: ARMA (1, 0) model. 4 regressor(s) in the conditional mean.
Variance equation: EGARCH (1, 1) model. No regressor in the conditional variance
GED distribution, with tail coefficient 2.43959. Strong convergence using numerical derivatives
Log-likelihood = 9215.32.

	Coefficient	Std. error	*t*-statistic	*p*-value
IFN (M)	-0.000368	0.00012983	-2.831	0.0047
MPN (M)	0.001626	0.00033019	4.923	0.0000
EXN (M)	-0.000137	4.5479e-005	-3.002	0.0027
ON (M)	-0.004757	0.00017922	-26.54	0.0000
AR(1)	0.577313	0.028346	20.37	0.0000
Cst(ω)	0.039996	0.11486	0.3482	0.7277
ARCH(α)	0.791205	0.29650	2.668	0.0077
GARCH(β)	1.011383	0.0065434	154.6	0.0000
EGARCH(γ)	-0.011026	0.10642	-0.1036	0.9175
G.E.D.(DF)	2.439587	0.40473	6.028	0.0000

No. Observations: 1981. No. Parameters: 11. Mean (Y): 0.00013. Variance (Y): 0.00000
Skewness (Y): 17.91695. Kurtosis (Y): 421.04692. Log Likelihood 9215.319.
The sample mean of squared residuals was used to start the recursion.

During the period 2008-2015, all the macroeconomic announcements have negative and significant effects on the volatility of stock returns except monetary policy news, which has a weakly positive and significant effect. It is evident that the volatility of stock returns marked by ($\alpha + \beta$ = 1.802588) is more explosive and persistent from 2008 to 2015. Coincidentally, this was the period when the global financial crisis hit, with severe effects on stock returns especially in NSE. Consequently, it takes a longer period of time for volatility persistence to attenuate in NSE, thereby accounting for investors' loss of confidence in the market. The asymmetric volatility coefficient is negative and insignificant (γ = –0.011026), which also implies that bad news is negatively correlated with volatility. Thus, there is evidence of an asymmetric effect in

the Nigerian stock market between 2008 and 2015, with the total impact of bad news on volatility (1.011026) being higher than the total effect of good news (0.988974).

● Table 7. **Macroeconomic news announcements and asymmetric volatility (2000-2015)**

G@RCH SPECIFICATIONS
Dependent variable: R^2. Mean Equation: ARMA (1, 0) model. 4 regressor(s) in the conditional mean.
Variance Equation: EGARCH (1, 1) model. No regressor in the conditional variance
GED distribution, with tail coefficient 2.00219. Strong convergence using numerical derivatives
Log-likelihood = 14622.7.

	Coefficient	Std. error	*t*-statistic	*p*-value
IFN (M)	-0.000832	0.00086289	-0.9637	0.3352
MPN (M)	-0.002569	0.0011393	-2.255	0.0242
EXN (M)	0.006829	0.0019533	3.496	0.0005
ON (M)	-0.004727	0.00025063	-18.86	0.0000
AR(1)	0.254421	0.19073	1.334	0.1823
Cst(ω)	0.040000	0.21365	0.1872	0.8515
ARCH(α)	0.282037	0.046604	6.052	0.0000
GARCH(β)	1.054476	0.0048104	219.2	0.0000
EGARCH(γ)	-0.042652	0.028570	-1.493	0.1355
G.E.D.(DF)	2.002188	1.0646	1.881	0.0601

No. Observations: 3940. No. Parameters: 11. Mean (Y): 0.00013. Variance (Y): 0.00000.
Skewness (Y): 20.19103. Kurtosis (Y): 469.00286. Log Likelihood: 14622.716.
The sample mean of squared residuals was used to start the recursion.

If the whole period 2000-2015 is considered, the following findings can be drawn from Table 7: only exchange news has a positive and significant impact on the volatility of returns, while monetary policy and oil news both have negative and significant effects on the volatility of stock returns. However, inflation news maintained its negative effect in all the periods, although said relationship was not significant in the period 2000-2015. The volatility is highly persistent ($\alpha + \beta = 1.336513$), with a long period of volatility attenuation. Finally, the asymmetric or leverage effect is –0.042652 and is statistically insignificant. This suggests that bad news had a more disruptive effect than good news on the volatility of stock returns in Nigeria from 2000 to 2015. More specifically, the impact of bad news on volatility is 1.042652, whereas that of good news is 0.957348.

5. Conclusion and discussion

The empirical results revealed that inflation announcements had negative and significant effects on stock returns in 2000-2007 and in 2008-2015, but were not significant in the period 2000-2015. The global financial crisis of 2008 generated more disturbances, resulting in a negative correlation between volatility and stock returns that persisted until 2015. The effect of oil news became negative between 2008 and

2015 due to the drop in oil prices in the international futures market. The effect of exchange rate news became negative during the same periods, due to the depletion of existing foreign reserves used by the Nigerian government to stabilize the shocks in the oil market. All macroeconomic announcements have a positive effect on the volatility of stock returns except oil news, in line with the findings of Olwenry and Omondi (2011) on the Nairobi Stock Exchange, but only exchange rate news has a positive and significant effect on volatility. In all cases, volatility is persistent and takes a long period of time to attenuate. The asymmetric volatility is negative, suggesting that bad news is positively correlated with volatility and negatively with stock returns, in the same vein as Atoi (2014) found in the NSE. The evidence of asymmetric volatility confirms that the Nigerian capital market is weakly efficient. This paper thus concludes that there is no significant effect of macroeconomic announcements on stock returns in Nigeria. However, the study also established a significant and positive effect of macroeconomic announcements on the volatility of stock returns, consistent with the findings of Yaya and Shittu (2001) in Nigeria. The implication is that macroeconomic news is a notable source of risk and volatility in Nigeria. The Nigerian stock market should be made deeper and more diversified to include trading in financial derivatives instruments. This would help to boost investors' confidence, which has already been weakened by the longer period it takes volatility persistence to attenuate. Therefore, when making important investment decisions, it is recommended that investors should adjust their portfolios to mitigate the pervasive effect of macroeconomic news announcements on stock returns and volatility in Nigeria.

References

- Adjasi, C., Harvey, S.K. and Agyapong, D.A. (2008). Effect of Exchange Rate Volatility on the Ghana Stock Exchange, *African Journal of Accounting, Economics, Finance and Banking Research*, **3**(3), pp. 28-47.
- Ajayi, R.A. and Mougoue, M. (1996). On the Dynamic Relation between Stock Prices and Exchange Rates, *Journal of Financial Research*, **19**(2), pp. 193-207.
- Alberg, D., Shalit, H. and Yosef, R. (2008). Estimating stock market volatility using asymmetric GARCH models, *Journal of Applied Financial Economics*, **18**, pp. 1201-1208.
- Alexander, C. and Lazar, E. (2009). Modelling Regime-Specific Stock Price Volatility. *Oxford Bulletin of Economics and Statistics*, **71**(6), pp. 761-797.
- Aliyu, S.R. (2010). Exchange Rate Volatility and Export Trade in Nigeria: An Empirical Investigation, *Applied Financial Economics*, **20**(13), pp. 1071-1084.
- Andritzky, J.R., Bannister, G.J. and Tamirisa, N.T. (2007). The Impact of Macroeconomic Announcements on Emerging Market Bonds, *Emerging Markets Review,* **8**, pp. 20-37.

- Atoi, N.V. (2014). Testing volatility in Nigeria stock market using GARCH models, *CBN Journal of Applied Statistics*, **5**(2), pp. 65-93.
- Bauwens, L., Laurent, S. and Rombouts, J.V.K. (2006), Multivariate GARCH Models: A Survey, *Journal of Applied Econometrics*, **21**, pp. 79-110.
- Bollerslev, T. (1986). Generalized Autoregressive Conditional Heteroscedasticity, *Journal of Econometrics,* **31**(3), pp. 307-327.
- Boyd, J.H., Jian, H. and Ravi, J. (2005). The Stock Market's Reaction to Unemployment News: Why Bad News Is Usually Good for Stocks, *Journal of Finance,* **60**(2), pp. 649-672.
- Brock, W.A., Dechert, W.D., Scheinkman, J.A. and LeBaron, B. (1996). A Test for Independence Based on the Correlation Dimension, *Econometric Reviews*, **15**, pp. 197-235.
- Brock, W.A., Hsieh, D.A. and LeBaron, B. (1991). *Nonlinear Dynamics, Chaos, and Instability: Statistical Theory and Economic Evidence*, MIT Press. Massachussetts.
- Cakan, E. (2012). The Business Cycle and Impacts on Economic News on Financial Markets, *Journal of Business and Economics Research*, **10**(6), pp. 385-390.
- Central Bank of Nigeria (2013). *Macroeconometric Model of the Nigerian Economy*, Central Bank of Nigeria (2010), Compendium of Monetary Policy Communiqués, No. 1-86, pp. 1-674.
- Chen, N., Roll, R. and Ross, S.A. (1986). Economic Forces and the Stock Market, *Journal of Business*, **59**, pp. 383-403.
- Dickey, D.A. and Fuller, W.A. (1979). Distribution of the Estimates for Autoregressive Time Series Unit Root, *Journal of American Statistical Association*, **74**, pp. 427-431.
- Dickey, D.A. and Fuller, W.A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root, *Econometrica*, **49**, pp. 1057-72.
- Ding, Z., Granger, C.W.J. and Engle, R.F. (1993). A Long-Memory Property of Stock Market Returns and a New Model, *Journal of Empirical Finance*, **1**, pp. 83-106.
- Emenike, K.O. and Aleke, S.F. (2012). Modeling Asymmetric Volatility in the Nigerian Stock Exchange, *European Journal of Business and Management*, **4**(12), pp. 1-29.
- Engle, R.F. (2001). GARCH 101: The Use of ARCH/GARCH Models in Applied Econometrics, *Journal of Economic Perspectives*, **15**(4), pp. 157-168.
- Engle, R.F. (1982). Autoregressive Conditional Heteroskedascity with Estimates of the Variances of U.K. Inflation, *Econometirica,* **50**(4), pp. 987-1007.
- Engle, R.F. and Ng, V.K. (1993). Measuring and Testing the Impact of News on Volatility, *Journal of Finance,* **48**(5), pp. 1749-1778.
- Fama, E.F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance*, **2**, pp. 383-417.
- Fedorova, E., Wallenius, L. and Collan, M. (2014). The Impact of Euro Area Macroeconomic Announcements on CIVETS Stock Markets, *Procedia Economics and Finance*, **15**, pp. 27-37.

- Glosten, L.R., Jaganathan, R. and Runkle, D. (1993). On the relationship between the expected value and the volatility of the nominal excess return on stocks, *Journal of Finance,* **48**(5), pp. 1779-1801.
- Montero, J.-M., Fernández-Avilés, G. and García, M.-C. (2010), Estimation of Asymmetric Stochastic Volatility Models: Application to Daily Average Prices of Energy Products, *International Statistical Review*, **78**, pp. 330-347.
- Nelson, D.B. (1991). Conditional Heteroskedasticity in Asset Returns: A New Approach, *Econometrica*, **59**(2), pp. 347-370.
- Nowak, S., Andritzky, J., Jobst, A. and Tamirisa, N. (2011). Macroeconomic Fundamentals, Price Discovery, and Volatility Dynamics in Emerging Bond Markets, *Journal of Banking & Finance*, **35**(10), pp. 2584-2597.
- Olowe, R.A. (2009). Stock return, volatility and the global financial crisis in an emerging market: The Nigerian case, *International Review of Business Research Papers*, **5**(4), pp. 426-447.
- Olweny, T. and Omondi, K. (2011). The Effect of Macro-Economic Factors on Stock Return Volatility in the Nairobi Stock Exchange, Kenya, *Economics and Finance Review*, **1**(10), pp. 34-48.
- Oseni I.O. and Nwosu P.I. (2011). Stock Market Volatility and Macroeconomic Variables Volatility in Nigeria: An Exponential GARCH Approach, *European Journal of Business & Management,* **3**(12), pp. 43-55.
- Rangel, J. (2011). Macroeconomic news, announcements, and stock market jump intensity dynamics, *Journal of Banking and Finance*, **35**(5), pp. 1263-1276.
- Rangel, J.G. (2004). *News, Announcements, and Stock Market Volatility Dynamics*, University of California, San Diego.
- Sentana, E. (1995). Quadratic ARCH models, *Review of Economic Studies,* **62**(4), pp. 639-661.
- Tsay, R.S. (2005). *Analysis of financial time series*, John Wiley & Sons, New York.
- Wdowinski, P. and Malecka, M. (2010). Asymmetries in Volatility: A Comparison of Developed and Transition Stock Markets. CESifo Working Paper Series No. 2974.
- Zakoian, J.M. (1994). Threshold Heteroskedastic Models, *Journal of Economic Dynamics and Control,* **18**(5), pp. 931-955.
- Zivot, E. (2009). Practical Issues in the Analysis of Univariate GARCH Models. In Andersen, T.G., Davies, R.A., Kreiss, J.P., and Mikosch, T. (Eds.): Handbook of Financial Times Series, pp. 113-153.