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# Modelling Nigerian stock market news using TGARCH model

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## Abstract

The stylized facts in the literatures show that in a volatile stock market, the forecast of the rate of return of a security is not enough information for decision making. The investor needs to examine the behaviour of the conditional variance of the return to estimate the riskiness of an asset to provide further guide in the decision making process. Against this backdrop, this paper investigates the hypothesized relationship between market news and volatility; that is, that bad news has larger impact on volatility than good news of the same magnitude. Using daily and monthly stock data of the Nigerian stock market over the period 1995 to 2011, the Threshold Generalized Autoregressive Conditional Heteroscedasticity, TGARCH (1 1) model was estimated. It was found that there are no asymmetries in the news and so the impact of bad news is not larger on volatility than good news. Also, the impulse-response function was quite high and is symptomatic of shocks dissipating very slowly. Implicitly, the market is such that old information wields more importance than recent information.

***Keywords:*** News asymmetries; Volatility; Impulse-response function; Market shocks



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## 1. Introduction

The need to understand the functioning of securities market has warranted investigations into information propagation process, market volatility, and information utilization process. The outcome of such investigations is the development of the Efficient Market Hypothesis (EMH) as an appropriate paradigm for examining stock market behaviour. An efficient market, though defined variously, is that in which prices always fully reflect all available information (Fama, 1970). In this context therefore, information is the basis for stock trade. Implicitly, in an efficient market condition, management of quoted firms would be motivated to take wise financial decisions, knowing full well that such will improve the net present value of their firms and hence their share prices. Thus, the allocation role of the stock market is enhanced if the market is efficient (Reilly and Brown, 2000).

However, empirical studies have shown that volatility of financial sector in general and stock market in particular can adversely affect the smooth functioning of the financial system, allocation of economic resources, and impair economic growth and development. It can drive down consumer spending and business investment as it precipitates a rise in risk of equity investment (Porteba, 2000; Arestis et al., 2001; Mala and Reddy, 2007). The empirical literatures have also, in terms of strand of study, either focused on the distributional properties of the returns data (where descriptive statistics are employed to describe the data in terms of measures of central tendencies, dispersions and symmetrical properties), volatility pooling (also called volatility clustering, indicating the tendency for a large change in returns to generate large shock and small change in return to generate small shock thus culminating into flanks of volatility and stability or stormy and tranquil periods), or "leverage effect" (Mandelbrot, 1963; Fama, 1965; Panagiotidis, 2002; Frimpong and Oteng-Abayie, 2006).

Be that as it may, this study observed that there is little of the issue of "leverage effect" in the extant literatures on Nigerian stock market in particular and emerging markets of Africa in general. Also observed is that it is more informative and therefore necessary, to model using simultaneous equation framework, investors' attitudes toward expected return and risk together. Knowledge of the behaviour of the conditional variance of the returns series over the holding period of an asset is of importance to any investor who is planning to buy an asset and then sell at a later date. Against this backdrop, the aim of this study is to examine the pattern of response to news in the Nigerian stock market. Put differently, it seeks to investigate the hypothesized pattern of response that bad news (negative shock) tends to increase volatility than good news (positive shock). It is hoped that the results of this study will contribute to building a body of literature on the subject from the perspective of emerging markets of Africa.

As part of the financial sector reforms in Nigeria, there have been renewed efforts geared towards strengthening the capacity of the stock market to accentuate economic growth and development. Though the market capitalization has been on the increase overtime in absolute terms, but its' ratio to the Gross Domestic Product (GDP) which indicates its' contribution to economic growth has not been encouraging. Stylized facts show that it ranges from 6.1% in 1970 to 16.7% in 2011. The stock traded turnover ratio in 2002 was 8.5% and in 2011, it was 9.21% (World Bank, 2012). The number of equity listing was 8 securities in 1970, but grew to 217 securities in 2010 (Nigerian Capital Market Statistical Bulletin, 2010). Sadly

however, only an average of less than 50% of these securities is actively traded on daily. The reasons for this poor performance have been identified by Osaze (2000), Donwa and Odia (2010) and others, to include but not limited to: inconsistent macroeconomic policies and turbulent environment, non-recognition of corporate governance practice as part of business ethics, dormant bond market, inefficient regulatory framework, and too few securities available for trading in the market. Notwithstanding, it is believed that if the recent policy reforms in the capital market and the financial sector (such as the internationalization of the Stock Exchange and cashless economy) are implemented, there will be a turn-around.

## 2. Materials and methods

The causes of volatility in stock markets have been explained from the general framework of internal theories of business cycle. Among these theories, the multiplier acceleration theory pioneered by Samuelson (1939) has gained popularity (for detailed articulation, see Lucas, 1981; Moore, 1983; Roll, 1984; Glosten and Milgrom, 1985; Engle and Ng, 1993; Verones, 1999; Shiller, 2000; Brennan and Xia, 2001; Mele, 2008). It has been observed that the expected value of the stochastic term ($u_t$) is time varying in a volatile stock market. Consequently, to model return series in such a market requires an analytical framework that can cope with deviations in the returns. To this end, this study adopts the Threshold Generalized Autoregressive Conditional Heteroscedasticity (TGARCH) model developed by Zakoian (1990) and Glosten, et al. (1993). This model is more potent than the ARCH (Autoregressive Conditional Heteroscedasticity) and GARCH (Generalized Autoregressive Conditional Heteroscedasticity) models. ARCH and GARCH specifications are symmetric in the sense that both positive and negative shocks of same magnitude are treated to have exact same effect by the square of the residuals. The TGARCH model on the other hand, is capable of checking for any statistical significant difference between when shock is positive and when it is negative. This it does by adding a multiplicative dummy variable into the variance equation (Demitros and Hall, 2007). This paper estimates the TGARCH (1 1) model of the form:

$$r_t = \mu_0 + \mu_1 r_{t-1} + u_t \quad (1a)$$

$$u_t/\Phi_t \cong \text{iid } N(0, h_t)$$

$$h_t = \gamma + \alpha u^2_{t-1} + \beta u^2_{t-1} \zeta_{t-1} + \delta h_{t-1} \quad (1b)$$

where $\zeta_t$ (the multiplicative dummy variable) takes the value of 1 for $u_t < 0$ and 0 when $u_t > 0$ so that "good news" and "bad news" have a different impact. Equation (1a) is an ordinary least square (OLS) model in the autoregressive form for returns and it depicts the mean equation in this context, while equation (1b) is the variance equation which captures the time varying behaviour of the $u_t$.The parameters of the variance equation to be estimated are $\gamma$, $\alpha$, $\beta$ and $\delta$. To test for asymmetries in the news, the parameter, $\beta$, must be positive and statistically significant. In which case, bad news has larger effect on the volatility of the series than good news. The model is estimated using Eviews 8.

The sample of data used in this exercise are the daily and monthly closing prices of the Nigerian Stock Exchange share index over the period January 2, 1995 to December 31, 2011. The data were sourced from Nigerian Stock Exchange (NSE) official list, Central Securities Clearing System (CSCS) Ltd official list and www.africanfinancialmarkets.com. The returns data are defined in the natural logarithms of the price indices, that is:

$$r_t = ln\left(\frac{Pt}{P_{t-1}}\right)$$

## 3. Empirical results and discussion

The results of the estimation of the model on daily returns data and monthly returns data are shown respectively in Tables 1 and 2.

**Table 1.** Results of TGARCH (1 1) Model on Daily Data

| Mean Equation | | | |
|---|---|---|---|
| Variables | Coefficient | Z-statistic | Probability |
| $\mu_0$ | - 2.14E-05 | -0.245216 | 0.8063 |
| $\mu_1$ | 0.139428 | 12.58947 | 0.0000*** |
| Variance Equation | | | |
| $\gamma$ | 6.35E-07 | 47.66156 | 0.0000*** |
| $\propto$ | 0.086689 | 41.38097 | 0.0000*** |
| β | - 0.052965 | - 22.33473 | 0.0000*** |
| δ | 0.943522 | 1117.698 | 0.0000*** |

*** 1% level (*Source: Authors' estimates)*

**Table 2.** Results of TGARCH (1.1) Model on Monthly Data

| Mean Equation | | | |
|---|---|---|---|
| Variables | Coefficient | Z-statistic | Probability |
| $\mu_0$ | -1.53E-05 | -0.105492 | 0.9160 |
| $\mu_1$ | 0.391743 | 4.259731 | 0.0000*** |
| Variance Equation | | | |
| $\gamma$ | 5.14E-07 | 2.939203 | 0.0000*** |
| $\propto$ | 0.812559 | 3.607136 | 0.0000*** |
| β | -0.061507 | -0.208729 | 0.8347 |
| δ | 0.391291 | 6.348317 | 0.0000*** |

*** 1% level (*Source: Authors' estimates*)

From Table 1, the conditional mean parameter, $\mu_0$ is not statistically significant. But the AR (1) parameter, $\mu_1$ is statistically significant at the 1% level implying that the behaviour of past returns is useful in understanding current returns. In the variance equation, all the parameters are statistically significant at the 1% level. However, the estimate of β is negative. In Table 2, the estimates for the monthly data, $\mu_0$ and β are not statistically significant but other parameters are statistically significant at the 1% level. Again, β is negative. The sum of the ARCH, α, and GARCH, δ, terms which is a measure of the impulse-response function is 1.0302 and 1.2039 respectively from daily data and monthly data. These values are quite high and it is symptomatic of persistence of volatility shocks which dissipates slowly. In which case, the market is such that old information is more important than recent information. This evidence is consistent with Ogum, et al. (2005).

To test the hypothesized pattern of response to news, the parameter of interest is β. The coefficient of this parameter must be positive and statistically significant for asymmetries in the news to be established. From the daily data, this parameter is negative and statistically significant. However, from the monthly data, the parameter is negative but not statistically significant. On the basis of these statistical evidence, and judging more from the daily data asymmetries in the news is not established. Thus, the hypothesized pattern of response that bad news has larger effect on volatility than good news is not sustained. Hereby, there are no asymmetries in the news and the market does not distinguish between bad news (negative shock) and good news (positive shock). This result supports Piesse and Hearn (2002) and partially supports Frimpong and Oteng-Abayie (2006) who found mixed evidence of leverage effect for Ghana stock market (another emerging African market).

Possible implications of this observed evidence are: firstly, it points to the fact that the Nigerian stock market is not informationally efficient, as it interprets all kinds of market news as if they are the same. An efficient stock market differentiates between bad news and good news, negative shock and positive shock. But this is not the case for the market under study. Secondly, because both good news and bad news generate

same magnitude of volatility, it is capable of discouraging sourcing of funds from the market. This perhaps corroborates Osaze (2000) and others who have found the money market more attractive than the capital market as a source of business finance in Nigeria.

## 4. Conclusion

Understanding how stock market reacts to news is of importance to investors in planning their asset portfolios. It throws light into the riskiness of equity investment and can be of help in guiding economic planners in their efforts towards financial sector reforms. In this paper, an attempt has been made to model how the Nigerian stock market reacts to bad news and good news. The estimated TGARCH (1 1) model did not establish the hypothesized pattern of reaction; that is, that bad news have a larger impact on volatility than good news of the same magnitude. The rate at which the response function decays on daily and monthly bases is also found to very high indicating that new shocks have implications on returns for a longer period. As this is capable of weakening investors' confidence, it is recommended that other securities other than equities be developed in the market. Also, stock market regulators should embark on investors' education and enlightenment in order to acquaint investors with the right knowledge needed to interpret market news.

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