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On the Reaction of Stock Market to Monetary Policy Innovations: New Evidence from Nigeria

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Abstract

The paper analysed the asymmetric effect of monetary policy to stock market in Nigeria. The study is conducted by using an EGARCH(X) model. The exogenous variable is a dummy variable which account for the monetary policy committee meetings of the central bank of Nigeria. All the parameters of the estimated model are statistically significant. The significance of the dummy variable in the mean and variance equation, couple with the significance of the asymmetric parameter provides empirical evidence that investors react to monetary policy innovation in Nigeria. The paper recommends for sound monetary policy that will develop and stabilize the stock market.

Key words

Monetary policy, Stock market, Aymmetric, EGARCH

JEL Codes: H54, R53

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1. Introduction

Monetary policy is one of the important tools used by the regulatory authorities to achieve stability of the macroeconomic variables such as inflation, interest rate, unemployment, foreign exchange and stock market. However, stock market is one of the most volatile and sensitive compared to most of the macroeconomic variables. According to Gordon (1959), when the central banks lower the interest rate, the return on investment declines and lead to a lower value of the required rate of investment returns. In this regard, investors are likely to accept a lower rate of return which will increase the current value of investment. This is not the case during most of the financial crisis as central banks flung to aggressive easing of monetary policy with drastic cut of interest rate to nearly zero in some countries to keep the crisis mild and increase the current value of investment. Despite the intervention, the stock value became weaker beyond the expectations of the central banks.

Although the relationship between monetary policy and stock market is theoretical established, the complexities of the monetary policy transmission channels has sometimes made the relationship spurious. In Nigeria, for example, it was evident during the global financial crises that monetary authorities keep cutting money policy rate (MPR) to augment investment and rise in asset prices. Nigeria stock exchange (NSE) market all share index (ASI) is 66,121.93 points in March 2008 while the MPR is 10 percent. In its effort to manage the crisis, the Central Bank of Nigeria (CBN) cut the MPR time upon time that by December 2009 the MPR is 6 percent. Despite this, monetary policy remained ineffective to stop the ASI from falling that by same time the ASI stood as 20,187.17. This invariably affects investors' confidence in the market.

Therefore, this paper analysed the asymmetric relationship between the CBN policies and Nigeria Stock Exchange (NSE) Market. The study used an Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) augmented with an exogenous variable to explain the asymmetric effects of monetary policy to stock market in Nigeria. The paper contributed by using a dummy variable that account for the periodic monetary policy meetings of the CBN. Our dummy variable is different from of Lyócsa *et al.* (2013) and Gregoriou *et al.* (2009) as it captured the monetary policy committee (MPC) meeting not the variables. The MPC meeting is a strategic meeting where all monetary policy variables such as MPR, Interest rate, and exchange rate are determined. Therefore, investors give close attention to the meetings.

2. Literature review

The relationship between monetary policy and the stock market has attracted great attention from both academicians and policy makers. An early study by Schwert (1989) found that the volatility of inflation, money growth, and industrial production all help to predict frequent fluctuations of the stock market. In essence, his results point to a positive link between monetary policy and stock market volatility, with more evidence showing stock market react to policy variables. The importance of monetary policy in controlling stock market volatility has also been discussed in studies such as

Bernanke, (1983) Dixit and Pindyck, (1994) Bloom (2009) and Mishikin (2009). Specifically, Bernake *et al.* (1999) pointed out that stock market is efficient and can automatically adjust prices as such monetary policy is only important if stock market volatility signal inflationary or deflationary pressures. This has been supported by studies such as Weise (1999), Garcia and Schaller (2002), Peersman and Smets (2002), Lo and Piger (2005) and Ioannidis and Kontonikas (2006) who found empirical evidences of the effectiveness of monetary policy on the stock market. They concluded that the relaxation of collateral laws and cut in interest rate argument firms liquidity and investors willingness for investment.

Although studies such as Tenreyro and Thwaites (2013) and Caggiano *et al.* (2014) has found the relationship between monetary policy and stock market. They argued that the relationship is only present during market bubble but failed in period of market burst. However, this contradicts Cecchetti *et al.* (2000), Filardo (2004), Gilchrist and Saito (2006) who believe that stock market volatility affects the financial stability which can cause adverse effect to economic growth. Therefore, monetary policy should constantly check stock market at both periods. Furthermore, literatures such as Lobo, (2002), Chen and Clements, (2007), Vahamaa and Aijo, (2011), Bissoon *et al.* (2016) among many others argued the susceptible of monetary policy in developing countries. In this regard, Aliyu (2011) study the reaction of stock market to innovations in major monetary variables of M1, M2 and MPR during the financial crisis in Nigeria. Empirical evidence from the result showed that unanticipated innovation in M2 and MPR influences stock market index, while anticipated innovations have no effect.

Moreover, Bomfim (2003), Bernanke and Kuttner, (2005) and Chulia *et al*., (2010) argued that the relationship between monetary policy and sock market volatility is asymmetric which can be negative or positive defending on the monetary policy shock. This has been proven in a recent study by Bui (2015) who found evidence of a positive asymmetric effect of monetary policy in the 5-ASEAN countries. Similarly, Li (2015) showed evidence of asymmetric effect between monetary policy and stock market prices. The study concluded that the responses of stock prices to the sentiment shocks present an immediate effect, while the responses of stock prices to the monetary policy shocks show one-period lag effect. In the same vein Yola (2016) found significant evidence of long run relationship between monetary policy and stock market in Nigeria. The study further showed evidence of causal relationship between the monetary policy and stock market.

Recently, Lawal *et al.* (2018) employed the autoregressive distributive lag (ARDL) model and EGARCH model to ascertain interactive impact of fiscal and monetary policies on stock market behavior in Nigeria. The study found significant evidence of long run relationship between monetary policy and stock market in Nigeria, further the study showed evidence of volatility in the ASI of Nigeria. Aladejere *et al.* (2018) used the Johansen cointegration and error correction method (ECM) and concluded that basic monetary policy variables such as Treasury bills, lending rate and deposit rate are not significant in explaining effect of monetary policy in the Nigerian stock exchange market. They argued that monetary policy authorities should employ further mechanisms that will be effective in reposition the stock market when the need arises.

The understanding of the asymmetric relationship between monetary policy and stock market is important for academicians, market participants and policy makers. This paper examined the persistence characteristics of the volatility of the Nigerian stock exchange market, and then investigates the relationship between monetary policy innovations and stock market volatility. By doing so, we add knowledge to the debate as to whether it is necessary for stock markets to react to the central bank innovations.

3. Methodology of research

Autoregressive conditional heteroskedasticity (ARCH) model was first developed by Engle (1982) which assumed that the variance of the present error term is related to the size of the previous periods error terms, giving rise to volatility clustering which is widely observable in financial markets. This make the model the most extensively used to analysed financial time series with time varying volatility such as stock market prices. In order to model in a parsimonious way the conditional heteroskedasticity, Bollerslev (1986) extended the ARCH model to GARCH model by assuming an autoregressive moving average model (ARMA) for the error variance. However, the GARCH model has several limitations. Firstly, the model is not able to explain the realized covariance between the conditional mean and conditional variance, this is possible only if the conditional variance is expressed as an asymmetric function of the conditional variance. Furthermore, the standard GARCH model shock may persist in one period and die out in another, so the conditional moments of the model may explode even when the process is strictly stationary and ergodic. The model essentially specifies the behavior of the data which lead to few large observations to dominate the sample.

In other to address the problems of the standard GARCH model, Nelson (1991) developed the Exponential GARCH (EGARCH) model which addresses the problems associated with the standard GARCH model that include positive definiteness, asymmetric and fat tails. Therefore, in line with the objective of this paper, we employed the EGARCH model for the analysis. The EGARCH model is specified in equation (1) below:

$$\text{Log } (h_t) = \omega + \sum_{i=1}^{2} \alpha_1 \left| \frac{U_{t-1}}{\sqrt{h_{t-j}}} \right| + \sum_{i=1}^{q} \lambda_1 \frac{U_{t-i}}{\sqrt{h_{t-1}}} + \sum_{j=1}^{p} \delta_j \log (h_{t-j}) \quad (1)$$

Such that we test the hypothesis that:

$\lambda_1 = \lambda_2 = \ldots \lambda_l = 0$ for symmetric model, $\lambda_1 \neq \lambda_2 \neq \ldots . \lambda_l \neq 0$ for asymmetric model.

From the EGARCH equation h_t is the conditional variance, α_1 is the ARCH parameter, λ_1 is the EGARCH and δ_j is the GARCH parameter. Moreover, the natural log of the conditional variance signifies that the asymmetric effect is exponential and non-quadratic.as such fulfilled the condition that the forecast of the conditional variance is non-negative. The λ is the parameter of interest in the EGARCH model which measure the asymmetric (leverage effect).

In this paper, we employed a variant of GARCH model that accommodates exogenous variables (EGARCH-X) to meet the objective of the study. The development of the model starts from the work of Sharma *et al.* (1996) and later Engle and Patton (2001) introduce interest rate levels in many GARCH models and Ashok et al. (2011) who improve the GARCH model by introducing stock's volume as a proxy for information flow and company specific announcements in the volatility equation. The model further finds place in the work of Han and Kristensen (2014) and Han and Park (2012). Nana et al. (2013) explained in detail the theoretical properties and application of the model that includes ergodicity, geometric ergodicity, existence of moments of the extended-GARCH, consistence and asymptotic normality of likelihood estimators.

Therefore, this paper uses EGARCH augmented with an exogenous variable which transformed the model to EGARCH (X) for the analysis. The EGARCH (X) model for the study is specified as Equation (2) below:

$$\text{Log } (h_t) = \omega + \sum_{i=1}^{2} \alpha_1 \left| \frac{U_{t-1}}{\sqrt{h_{t-j}}} \right| + \sum_{i=1}^{q} \lambda_1 \frac{U_{t-i}}{\sqrt{h_{t-1}}} + \sum_{j=1}^{p} \delta_j \log (h_{t-j}) + \theta x_t \quad (2)$$

Where θx_t is an exogenous variable in dummy form. The dummy is the variable that account for the MPC meeting and is given by

$\theta x_t = 1$ if $t = t\text{-}m \geq Y \leq t + m$, 0 if other wise

Where: Y is the MPC meeting, t-m is the 7 days before the MPC meeting and t + m is 7 days after the meeting.

4. Data and descriptive statistics

This paper used the NSE all-share index for the analysis. The paper used daily index which start from January 2005 and ends in December 2016 with 3130 observations. The data series was sourced from Datastream International. The series were transformed by taking the first difference natural log. Table 1 showed the descriptive statistics of the ASI of the NSE market computed by the Authors using Eviews. From the table, the mean value indicated that average return of the market is positive. However, there is wide range between the minimum and the maximum value of the series. This is justified by the extend of the dispersion shown in the standard deviation. The table also indicates a positive skewness which show that majority of the series are on the high side of the graph. It indicates positive asymmetry of the distribution of the market series around the average return. The result of the kurtosis showed a distribution that has a positive value and indicates that the distribution has heavier tails and a sharper peak than the normal distribution. Also, the kurtosis above 3.0 indicates a shock of either sign is more often to be presents. The Jarque-Bera test is significant which indicates that the series are not normally distributed. Finally, we find a significant ARCH effect which justifies the use of the GARCH family models. The significance of the ARCH effect implies assumption of stationarity of the variable.

Table 1. Descriptive Statistic of daily index series

	ASI(NSE)
Minimum	-1626.840
Mean	0.968
Maximum	2639.410
Std Deviation	332.539
Skewness	0.122
Kurtosis	8.019
Jarque-Bera	3293.031**
ARCH Effect	605.807**

Note: (**) Statistical significance at 5% Critical level.

5. Empirical results

In this section, the paper presented and analysed the result of the EGARCH (X) model estimated to meet the objective of the study. Table 2 tabulated summary of the model. The table is divided into two representing the mean and the variance equations. The result of the mean equation showed strong and statistically significant coefficients. The MPC (dummy) variable in the mean equation is significant which indicates the effectiveness of monetary policy on the return of the NSE market.

Table 2. Result of the EGARCH(X) model

Mean Equation	Coefficient	Probability
C	8.345	0.021
θx_t	13.636	0.031
Variance Equation		
ω	0.267	0.000
α	0.323	0.000
β	0.003	0.000
Y	0.955	0.000
θx_t	0.018	0.048

The second section of Table 2 presented the result of the variance equation. The intercept in the variance equation ω is statistically significant; this implied the stability of the long-term mean of the model. The coefficient of the ARCH parameter α is statistically significant, which signified that previous information influence present information in the NSE. Similarly, the coefficient of the GARCH parameter β is significant as such that the past conditional variance affects the presents conditional variance. Although the coefficient of the asymmetric parameter Y is statistically significant at 1% the sign of the coefficient is positive. This indicates that positive shocks led to more volatility than negative news in the NSE market. This result is in consistent with Aliyu (2011) study and Ndako (2010) who all found a positive and significant asymmetric coefficient in their EGARCH estimation using the all share index series of the NSE. The absence of leverage effect implied that sound macroeconomic policies that lead to stable price and exchange rate couple with strong institutions are better determinant of stock returns as against bad policies. The coefficient of the MPC dummy (exogenous) variable θx_t that account for monetary policy in Nigeria is positive and statistically significant. This showed that monetary policy innovations can increase or decrease the volatility of the NSE market. However, increase or decrease in volatility depends on how investors perceived the policy, time, economic condition and the type of the policy. The result is in consistence with the findings of Lyócsa *et al.* (2013) and Gregoriou *et al.* (2009).

6. Conclusions

This paper analysed whether there is asymmetric relationship between the monetary policy of the CBN and NSE market. The paper employed the daily index of the NSE market for the period of January 2005 to December 2016 and a dummy variable that the MPC meeting within the same period. We estimate an EGARCH (X) model. The MPC dummy is used as the exogenous variable in the model. Our result document a positive and significant coefficient of all the parameters of the mean and variance of the model. However, the positive sign of the asymmetric parameter indicated better macroeconomic policies are determinant of the stock return against bad macroeconomic policies. The significance of the dummy variable explained that a relationship existed between CBN monetary policy and the volatility of the NSE. The result supports the hypothesis of significant asymmetric relationship between monetary policy and stock market. The paper recommends for sound monetary policy which help in both developing and stabilizing the stock market.

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