

Predictive Impacts of Interest Rate Dynamics and Global Financial Crises on Stock Returns and Volatility: A Nigerian Context

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Abstract: *This paper examines the impacts of interest rate and its volatility on stock returns and stock returns volatility and the effect of interest rate during the global financial crises on stock returns and stock returns volatility using monthly All Shares Index prices of the NSE market and 3-month bank deposit rate covering the period of 1985M1-2010M12. GARCH (1, 1) specification with multivariate regressors was employed and the result shows that interest rate has significant negative impact on both stock returns and stock returns volatility; interest rate volatility has significant positive impact on both stock returns and stock returns volatility and during the global financial crises, interest rate has no significant impact both on stock returns and stock returns volatility. This result indicates that interest rate exerts strong predictive impact on stock market returns and there exist volatility spillover effect on stock market condition. It then becomes crucial for investors and policy makers to pay attention to interest rate changes when predicting stock market condition.*

Keywords: *interest rate, GARCH, global financial crises, stock returns, volatility.*

I. Introduction

The impact of interest rate on stock returns has been widely examined by researchers. Changes in the interest rates can cause reaction in value of stock returns. Stock market condition in any economy is a yard stick to measure the national economic conditions. A rise in stock returns increases risk appetite associated with investing and generally co-notes the overall growth of the economy and vice versa. For every average investor, stock return is an absolute and free measure of an investment opportunity. So, volatile stock returns can significantly weaken the performance of financial sector as risk appetite declines.

The monetary policy on interest rate of a country depends on its economic condition. The global economic crises propelled central banks to respond differently depending on how the crises affected their economies. Many central banks in advanced economy kept the main policy rate near zero, those in emerging economies raised policy rate, while a number of Central Banks in developing economies cut the policy rate in 2010; the Central Bank of Nigeria (CBN) raised their policy rate from 6.0 to 6.25 percent [1]. High interest rate propels investors to prefer their money deposited in saving bank account to get high interest to investing in risky stock market.

Due to the global financial crises which began in 2007, Nigeria economy faltered, the stock market collapsed by 70% in 2008-2009 and to rescue many Nigerian banks, the CBN injected N620 billion of liquidity into the banking sector [2].

The secondary market segment of Nigerian Stock Exchange (NSE) recorded a mixed performance in 2010. Volume of stocks traded (Turnover volume) declined from 193.1 billion shares in 2008 to 102.9 billion shares in 2009 and to 93.3 billion shares in 2010. The value of stocks/GDP was 10.0%, 10.0% and 2.7% in 2008, 2009 and 2010 respectively. Though, a turnover value of 797.6 billion naira was recorded, representing an increase of 16.3% over the level in 2009. The NSE ASI rose significantly by 18.9% to close at 24,770.5 in 2010 compared with 20.827.2 in preceding year. This reflected the rise in share prices of the listed stocks in the NSE [1]. What impact has monetary policy on interest rate played in this development? This is the trust of this paper.

[3] investigated the effects of interest rate volatility on stock returns and volatility using monthly returns of Karachi stock exchange and 90 days T-bill rate for the period of January 2002 to June 2006 applying GARCH (1, 1) models. The results revealed that conditional market return has a negatively significant relation with interest rates where as conditional variance of returns has a negative but insignificant relationship with interest rates.

[4] for Jordan and [5] for Ghana indicate the relationship between stock prices and interest rates is negative and statistically significant. [6] revealed that short- and long-term interest rates respectively have significant positive and negative relations with the Singapore's stock market. According to the results of [7], the responses of stock returns to interest rate is negative and significant in Brazil, Argentina, and Chile, but the response of returns in Mexico to interest rates appears to be insignificant in explaining the movement of returns.

[8] examined the relation between stock market capitalization rate and interest rate using regression. Their result showed that prevailing interest rate exerts positive influence on stock market capitalization rate and government stock rate exerts negative influence on stock market capitalization rate. As to Turkey case, the empirical results of [9] indicated that growth rates of interest rates negatively affect stock returns with a significant lag in short run dynamic model. [10] analyzed the reaction of equity markets to U.S. monetary policy with a special focus on the relative contributions of the credit and the interest rate channel for the period 1994 to 2003. Their results held that monetary policy affects individual stocks in a strongly diversified manner. Interest rate is not the only determinant of stock prices. [11] provided evidence that one-month interest rate is helpful in predicting the sign and the variance of the excess return on stocks. [12] analyzed changes in unconditional volatility across 50 financial markets for 50 year's daily data. While investigating determinants of unconditional volatility, macroeconomic factors such as GDP growth, inflation and short term interest rate were considered as important explanatory variables for increasing volatility.

[13] applied granger causality test on daily closing values of the Istanbul Stock Exchange 100 index and compounded interest rates to examine the impact of changes in interest rates on stock returns. His results proved interest rate as granger cause of ISE 100 index starting with 9 days time-scale effect. He also stated that affects of interest rates on stock return increases with higher time scales. [14] conducted a study to find out the effects of interest volatility on the stock returns and volatility in Korea. Their results revealed that market return is negatively and significantly related to interest rates whereas the conditional variance of returns has a positive and insignificant relationship with interest rates. These results showed that interest rates have a strong positive power for stock returns but a weak predictive power for volatility.

This study differs significantly from past studies on the related subject matter in many ways; firstly, it examines the impacts of interest rate and its volatility on stock returns and stock returns volatility. Here, volatility of interest rate is measured using the conditional variance from GARCH (1, 1) model instead of using mere changes in interest rate as assumed by some past researchers. There are two justifications for this; (i) volatility of any variable per say, cannot be negative unlike changes in the variable, since miss-specification of volatility could result to spurious, unreliable estimates and misleading interpretations and (ii) financial data exhibits nonstationary characteristics and to achieve stationarity, first log differencing in most cases is used, this should not in any way be interpreted as volatility of such variable. Secondly, the study will also look at the impact of interest rate on stock return during the period of global financial crises. Thirdly, the study will employ a multivariate regressor GARCH specification which will help in checking whether there exists volatility spillover effect.

The rest of the paper is organized as follows; section 2 deals with methodology and variable description. Section 3 describes data analysis and results and section 4 presents the conclusion and policy implication.

II. Methodology And Variable Definition

The data sets consist of monthly All Shares Index prices of the NSE market and 3-month bank deposit rate were all obtained through transcription from the published Central Bank of Nigeria Statistical Bulletins of 2010 and the data sets cover the period of 1985 M1-2010 M12. Stock returns and interest rate changes were defined as follows; stock returns is given as $sr_t = 100 \times (\log SPI_t - \log SPI_{t-1})$ and interest rate is given as $ir_t = 100 \times (\log ITR_t - \log ITR_{t-1})$. The simple Generalized Autoregressive Conditional Heteroscedasticity GARCH (1, 1) model introduced by [15], was used to measure the volatility of interest rate which of the form:

$$ir_t = \mu + \varepsilon_t \tag{1}$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{2}$$

Where $\varepsilon_t \sim \text{GED}(\nu, 0, \sigma_t^2)$, The tail parameter $\nu > 0$ and the Generalized Error Distribution (GED) is a normal distribution if $\nu = 2$ and fat-tailed if $\nu < 2$, $0 \leq \alpha, \beta \leq 1$ and $(\alpha + \beta) < 1$ shows that the model is covariance stationary. And ε_{t-1}^2 and σ_{t-1}^2 are the lagged squared error term and the lagged conditional variance respectively.

2.1 Model Specification

The model specified below represents the impact of interest rate and its volatility on stock returns and stock returns volatility and it is of the form:

$$sr_t = c_0 + c_1 sr_{t-1} + c_2 ir_t + c_3 \sigma_{ir,t}^2 + c_4 D_t + \varepsilon_t \tag{3}$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \tau_1 ir_t + \tau_2 \sigma_{ir,t}^2 + \tau_3 D_t \tag{4}$$

Where $c_0, c_1, c_2, c_3, \alpha, \beta, \tau_1, \tau_2$ and τ_3 are constant parameters. And $\sigma_{ir,t}^2$ is the interest rate volatility and D_t is the dummy variable representing the period of global financial crises and it takes value zeroes (0) before the global crises and ones' (1) from the period of global financial crises. Note that $\varepsilon_{it} \sim GED(0, \sigma^2)$. If the value of τ_2 is significant then, there exist volatility transmission from interest rate to the stock market returns.

III. Data Analysis And Results

The Table 1 below shows the descriptive statistics for stock returns and interest rate changes.

TABLE 1.

Statistics	sr_t	ir_t
Mean	0.017380	0.002267
Median	0.016919	0.000000
Maximum	0.323515	1.257771
Minimum	-0.365882	-0.608706
Std. Dev.	0.062041	0.108547
Skewness	-0.596348	4.433983
Kurtosis	11.38503	67.88605
Jarque-Bera	929.5176	55576.22
Probability	0.000000	0.000000
Observations	311	311

Descriptive Statistics

The monthly standard deviation from Table1 above shows that changes in interest rate (ir_t) is more volatile than stock returns (sr_t). The skewness is positive for ir_t and negative for sr_t . The Kurtosis exceeds the normal value of 3 indicating fat tails and sharper peaks than the normal distribution. This leptokurtic behaviour is not captured by an ARCH process with a normal distribution. The Jarque-Bera normality test confirms the non normality of the distributions of the two variables. Therefore, ARCH model with a fat tail distribution can be employed to address the excess kurtosis.

TABLE 2. Unit Root Test using Ng and Perron (NP) Test

Variable	Test	Deter- ministic Terms	Lags	Modified statistic	Test value	critical values		Result
						1%	5%	
sr_t	NP	C	4	MZa	-51.6481	-13.8000	-8.10000	Stationary
				MZt	-5.08124	-2.58000	-1.98000	
				MSB	0.09838	0.17400	0.23300	
				MPT	0.47565	1.78000	3.17000	
	C, t	4	MZa	-53.7285	-23.8000	-17.3000	Stationary	
			MZt	-5.18239	-3.42000	-2.91000		
			MSB	0.09646	0.14300	0.16800		
			MPT	1.69941	4.03000	5.48000		
ir_t	NP	C	0	MZa	-155.000	-13.8000	-8.10000	Stationary
				MZt	-8.80341	-1.98000	-1.98000	
				MSB	0.05680	0.17400	0.23300	
				MPT	0.15806	1.78000	3.17000	
	C, t	0	MZa	-155.000	-23.8000	-17.3000	Stationary	
			MZt	-8.80341	-3.42000	-2.91000		
			MSB	-0.05680	0.14300	0.16800		
			MPT	0.58790	4.03000	5.48000		

The unit root test by [16] was adopted to check the order of integration of the variables. The lag order used in the NP unit root test was suggested by the Schwarz information criterion (SIC). The two variables are stationary, that is, I(0) either with the inclusion of constant or constant and trend as deterministic terms.

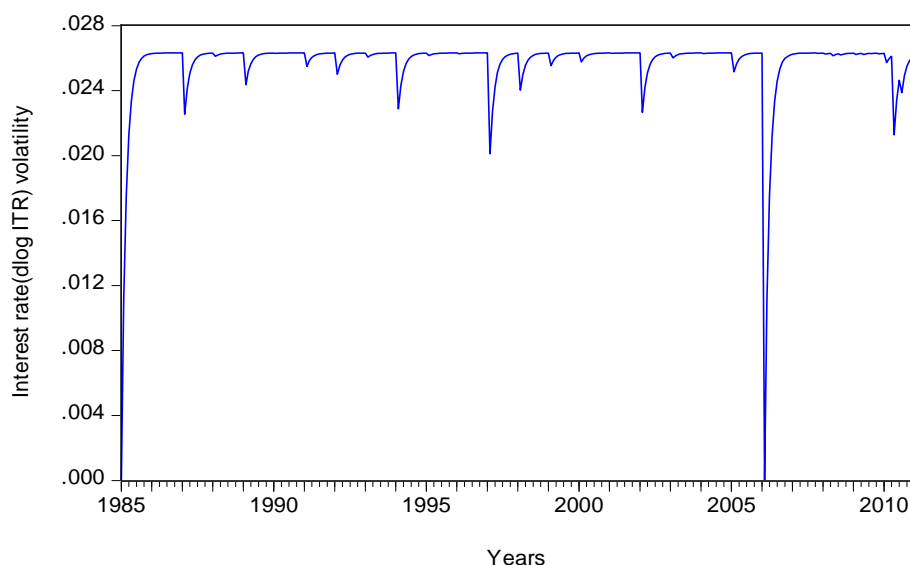


FIGURE 1. Plot interest rate volatility using the conditional variance from GARCH(1, 1) model

Fig.1 above shows that Interest rate volatility was at its lowest point in 2006,, followed by its value point in 1985. The variation of interest rate changes has depicted downward spikes, showing no evidence of volatility cluster.

TABLE 3. The impacts of interest rate, interest volatility and interest rate dummy during global financial crises on stock returns and volatility using GARCH(1, 1) model

Model	Statistics	Coefficients	z-value	Prob.	Remarks
1	Conditional mean equation				
	<i>C</i>	-0.0067	-2.1997	0.0278	Significant at 5%
	<i>ir_t</i>	-0.0312	-2.0653	0.0389	Significant at 5%
	$\sigma_{ir,t}^2$	2.0123	6.9181	0.0000	Significant at 1%
	<i>D_{ir}</i>	0.0367	0.2529	0.8004	Not Significant
	Conditional Variance Equation				
	<i>C</i>	-0.0004	-1.8122	0.0700	Significant at 10%
	ϵ_{t-1}^2	0.7103	4.6913	0.0000	Significant at 1%
	σ_{t-1}^2	0.4632	8.2145	0.0000	Significant at 1%
	<i>ir_t</i>	-0.0011	-1.7887	0.0737	Significant at 10%
	$\sigma_{ir,t}^2$	0.0408	2.3096	0.0209	Significant at 5%
	<i>D_{ir}</i>	0.0008	0.1018	0.9189	Not significant
	Diagnostic Test				
	ARCH(LM , 15 lag)	1.3174		0.1906	No ARCH in the squared residuals up to lag 15
	Ljung-Box Q-statistics	18.881		0.219	No serial correlation in the residuals up to Lag 15
LJB	39.5421		0.0000		
Skewness	0.3241				
Kurtosis	4.6221				
Wald test($\alpha+\beta$)<1	1.1735			persistent volatility	

The result in Table 3 shows that in the conditional mean equation, interest rate exerts significant negative impact on stock returns. This finding is consistent with the [3] for Karachi Pakistan, [7] for Brazil, Argentina and Chile, and [15] for Korea. Interest rate volatility has significant positive impact on stock returns but interest rate during the global financial crisis has insignificant positive impact on stock returns. In the conditional variance equation, interest rate has negative impact on the volatility of stock returns but it is significant at 10% level. Interest rate volatility has positive impact on stock returns volatility and it is significant

at 5% level. This result indicates the existence of direct volatility spillover effect. Again, interest rate during the global financial crisis has insignificant positive impact on stock returns volatility. The diagnostic test of ARCH LM result shows that there is no ARCH in the squared residuals up to 15th lag; Ljung-Box Q-statistics show that there is no serial correlation in the squared residuals up to 15th lag. Comparing the values of LJB, skewness and kurtosis (929.5176, -0.5963 and 11.3850) in Table1 with their values (39.5421, 0.3241 and 4.6221) in Table3 respectively, shows that the latter is smaller. This indicates that the model is fairly specified and adequate. The Wald test in Table 3 suggests that volatility is still persistent.

IV. Conclusion And Policy Implication

This paper investigates the impacts of interest rate, its volatility and interest rate during the global financial crises on stock returns and volatility. GARCH (1, 1) specification with multivariate regressors was employed and the result shows that interest rate has significant negative impact on both stock returns and stock returns volatility, interest rate volatility has significant positive impact on both stock returns and stock returns volatility and during the global financial crises interest rate has no significant effect on both stock returns and stock returns volatility. This result indicates that interest rate has strong predictive impact on stock market returns and volatility spillover effect on stock market condition. And during the global financial crises, interest rate exerts weak predictive impact on both stock market returns and volatility.

It then becomes crucial for investors and policy makers to pay attention on interest rate changes when predicting stock market condition.

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