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THE IMPACTS OF INFLATION DYNAMICS AND GLOBAL FINANCIAL CRISES ON STOCK MARKET RETURNS AND VOLATILITY: EVIDENCE FROM NIGERIA

C.G Amaefula

Department of Statistics, Federal University of Technology Owerri, Imo State, Nigeria

B.K Asare

Department of Mathematics, UsmanuDanfodiyo University Sokoto, Sokoto State, Nigeria

ABSTRACT

The paper investigates the impacts of inflation dynamics and global financial crises on Stock market returns and volatility in Nigeria. The data sets on monthly All Shares Index Prices of NSE, and consumers' price index (CPI) cover the period of January, 1985 to December, 2010. The GARCH (1, 1) model with multivariate regressors were adopted and the result shows that in the conditional mean equation; inflation exerts insignificant positive impact on stock market returns, inflation volatility exerts significant positive impact on stock market returns and during the global financial crises, inflation exerts significant negative effect on stock market returns. In the conditional variance equation, both inflation and its volatility have negative effects on the volatility of stock market returns, though significant for inflation and insignificant for inflation volatility. And during the global financial crises, inflation has significant positive impact on the conditional variance of stock market returns. The result implies that stock market returns can serve as a good hedge against volatile inflation, but this hedging propensity tends to be illusive if external shocks like the global financial crises affect the stock market condition negatively. However, it becomes imperative for investors to pay attention to variation of inflationary changes when predicting stock market returns and its vulnerability.

Keywords: Inflation, Global financial crises, Stock returns, Volatility, GARCH, Multivariate regressors.

1. INTRODUCTION

The relationship between macroeconomic indicators and stock market returns has been investigated for over two decades now. But the recent global financial crises that affected many financial institutions across the globe has surged the need for more intensive research for better macroeconomic policy that engenders economic and financial stability via empirical findings across the globe. According to Sanusi Lamido Sanusi (2010), "the world economy was hit by an

unprecedented financial and economic crisis in 2007-2009, tipped into recession by the sub-prime crisis in the US in August 2007. This crisis led to the collapse of many world renowned financial institutions and even caused an entire nation to be rendered bankrupt. In Nigeria, the economy faltered and the banking system experienced a crisis in 2009, triggered by global events. The stock market collapsed by 70% in 2008-2009 and many Nigerian banks had to be rescued. And there is no doubt that the global financial crises have necessitated sudden changes in macroeconomic policies of the government in the recent times in order to prevent economic recession.

This study differs significantly from past studies on the related subject matter in many ways; firstly, it examines the impacts of inflation rate and its volatility on stock returns and stock returns volatility. Here, volatility of inflation is measured using the conditional variance from GARCH (1, 1) model instead of using mere changes in inflation rate as assumed by some past researchers. There are two justifications for this; (i) volatility of any variable per say, cannot be negative unlike first log differencing 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 inflation 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 direct volatility spillover effect.

The rest of the paper is organized as follows; section 2 presents the literature review, section 3 deals with methodology and variable definition, section 4 describes data analysis and results and section 5 presents the conclusion and policy implications.

2. LITERATURE REVIEW

Many literature reviews have evolved on the relationship between inflation and stock returns. Some of these papers are theoretically based on classical economic hypotheses while others are based on empirical findings.Engle (2004), Engle and Rangel (2005), Rizwan (2007) established a strong predictive power of inflation on stock market volatility and returns. Habibullah *et al.* (2009) examined the impact of inflation and output growth on stock market returns and volatility in selected Asian countries, namely India, Japan, Korea, Malaysia and Philippines. Using monthly data from 1991 to 2004 and by employing GARCH (1, 1) model, they found that macroeconomic volatility, which is measured by movement in inflation and output growth; have a weak predictive power for stock market returns and volatility in these countries.

Fama (1981) hypothesized that the negative relation between real stocks returns and inflation observed during the post-1953 period were the consequence of proxy effects. Stock returns are determined by forecasts of more relevant real variables, and negative stock return-inflation relations are induced by negative relations between inflation and real activity.

However, Firth (1979) for UK and Adam and Tweneboah (2008) for Ghana reported a significant positive relationship between inflation (CPI) and stock returns. These results provide a

sharp contrast to empirical works that have found a significant negative relationship between stock returns and expected inflation. Kontonikas and Ioannidis (2005) show that an inflation targeting regime with strong interest rate reaction to inflation should lead to lower stock market volatility.

Gjerde and Sættem (1999) utilized multivariate VAR approach on the Norwegian monthly data from 1974-1994 their result showed that inflation has a negative effect on stock returns, a sentiment which was shared by Spyrou (2001) who examined the emerging economy of Greece, during the 1990s.

On the contrary, Choudhry (2001) in his study on four high inflation countries, Argentina, Chile, Mexico and Venezuela for the sample period from 1981:1 to 1998:6 provided evidence of a positive relationship between current stock market returns and current inflation. This result confirms that stock returns act as hedge against inflation. Saunders and Tress (1981) indicate that Australian nominal stock returns and inflation are related in a significantly negative fashion, implying that stocks are extremely poor inflationary hedges for the investor. In addition, the study indicates a mainly unidirectional relationship between inflation and stock returns, with price level charges leading the equity index in time.

Aliyu (2011) used GARCH model in assessing the impact of inflation on stock market returns and volatility using monthly time series data from the two West African countries, that is, Nigeria and Ghana. He also investigated the impact of asymmetric shocks using the QGARCH model developed by Sentana (1995), in both countries. His data covers the period of 1998M1 to 2010M5 for Nigeria and 1999M12 to 2010M5 for Ghana. Results for Nigeria show weak support for the hypothesis that bad news exert more adverse effect on stock market volatility than good news of the same magnitude, while a strong opposite case holds for Ghana. Furthermore, inflation rate and its three month average were found to have significant effect on stock market volatility in the two countries.

Douglason (2012) studied relationship between inflation and stock market returns in Nigeria using monthly and quarterly data from 1985-2009. Applying a simple regression model and testing for Fisher's effect, his findings seem to suggest that stock market returns may provide an effective hedge against inflation in Nigeria. Taofik and Omosola (2013) examined the long run relationship and dynamic interaction between stock returns and inflation in Nigeria using monthly All Shares Price Index from NSE and Consumer Price Index from 1997 – 2010. Applying the Autoregressive Distributed Lag (ARDL) model their result showed evidence of the existence of long-run relationship between stock returns and inflation. The short-run dynamic model also revealed that the speed of convergence to equilibrium is moderate, implying that there is a short-run relationship between stock returns and inflation.

3. METHODOLOGY AND VARIABLE DEFINITION

The data sets consist of monthly All Shares Index prices of the NSE market and consumers' price index (CPI) were all obtained through transcription from the published (Central Bank Nigerian, 2010) and the data sets cover the period of 1985 M1-2010 M12. Stock returns and

inflation rate changes were defined as follows; stock returns is given as $sr_t = 100 \times (\log SPI_t - \log SPI_{t-1})$ and inflation rate is given as $ifr_t = 100 \times (\log CPI_t - \log CPI_{t-1})$. The simple Generalized Autoregressive Conditional Heteroscedasticity GARCH (1, 1) model introduced by Bollerslev (1986) was used to measure the volatility of inflation rate which of the form:

$$ifr_t = \mu + \varepsilon_t \quad (1)$$

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

Where $\varepsilon_t \sim \text{GED}(v, 0, \sigma_t^2)$, The tail parameter v > 0 and the Generalized Error Distribution (GED) is a normal distribution if $v = 2$ and fat-tailed if v < 2, $0 \le \alpha, \beta \le 1$ 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.

3.1. Model Specification

This expresses the impact of inflation rate, its volatility and inflation rate dummy (which represents the impact of inflation rate during the period of global financial crisis) on stock returns and volatility and it is given as

$$sr_t = c_0 + c_1 ifr_t + c_2\sigma_{ifr,t}^2 + c_3 D_{ifr,t} + \varepsilon_t \quad (3)$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t_3-1}^2 + \beta\sigma_{t-1}^2 + \lambda_1 ifr_t + \lambda_2\sigma_{ifr,t}^2 + \lambda_3 D_{ifr,t} \quad (4)$$

where $c_0, c_1, c_2, c_3, \alpha, \beta, \lambda_1, \lambda_2$ and λ_3 are constant parameters. $\sigma_{ifr,t}^2$ is the inflation volatility. The constants λ_1, λ_2 and λ_3 are the impacts of inflation rate, inflation rate volatility and inflation dummy respectively on the stock returns volatility. Their values can be positive or negative. If the value of λ_2 is significant then, there exist volatility transmission from inflation to the stock returns. Note that $\varepsilon_t \sim GED(0, \sigma^2)$.

4. DATA ANALYSIS AND DISCUSSION OF RESULTS

In Figure 1, stock returns changes showed concentration around zero. It appears that more of this concentration occurs much more from 2000 to 2010 than from 1985 to 1999. Also more

outlying observations occur from 2000 to 2010 than any other time within the period under review. Specifically in 2009, stock returns changes occur most accounting for the largest outlying observation in the process. Figure 2 shows the plot of inflation rate changes. The plot exhibit an evidence of large changes clustered in between 1987 and 1995. This period shows largest outlying observations in the series. While moderate changes with concentration around zero is observable between the periods of 1996 to 2010.

An examination of the summary statistics in Table 1 clearly shows that the average monthly returns are positive. And from the monthly standard deviation, it is apparent that sr_t is more volatile than ifr_t. The statistics show excess kurtosis, since the kurtosis of all the variables exceeds the normal value of 3, and the skewness is positive for inflation rate and negative for stock returns. These show fat tails and sharper peaks than the normal distribution. This leptokurtic 645ehavior is not captured by an ARCH process with a normal distribution. The Jarque-Bera normality test confirms the non normality of the distributions of all the variables. Therefore the ARCH model with generalized error distribution can be employed to address the excess kurtosis.

Elliot Rothenberg, and Stock Point Optimal Elliott *et al.* (1996) Test was adopted to check the order of integration of the variables. The result of unit root test in Table 2, shows that the null hypotheses of the existence of a unit root in sr_t and ifr_t is rejected at 1%, 5% and 10% respectively. Hence, the variables are stationary. The lag orders used in the ERS Test were suggested by the model selection criteria.

Table 3 above gives the parameter estimates of inflation volatility. The volatility of inflation rate can be explained by approximately 10% and 85% of the news about inflation volatility in the past period and the previous period volatility of inflation respectively. Both values of lagged squared error term and lagged conditional variance are significant at 1% level.

The volatility of inflation is portrayed in Figure 3. The plot showed evidence of volatility clustering between 1988 and 1997. Within this period the volatility of inflation rate exhibited a highest peak in 1995. And from 1997 to 2010, the volatility of inflation rate has maintained a consistent low level with concentration around zero.

The result in Table 4 shows that in the conditional mean equation, inflation and its volatility all exert positive impacts on stock market volatility, significant for inflation volatility and insignificant for inflation rate. And during the global financial crises, inflation has significant negative impact on stock market returns. This result indicates that inflation has weak predictive impact on stock market returns but inflation volatility exerts strong predictive impact of stock market returns. This also implies that stock market returns can serve as a good hedge against volatile inflation. But this hedge tends to be illusive if external shock like the global financial crises affects the condition of the stock market. In the conditional variance equation, the result shows that both the lagged

squared error term and lagged conditional variance are positive and well specified though not significant. Inflation and its volatility all have negative impact on the conditional variance of stock returns, significant for inflation and insignificant for inflation volatility. Also, during the period of global financial crises, inflation exerts significant positive impact on the conditional variance of stock returns. This indicates that inflation has strong predictive impact on stock market returns. This result opines with that of Aliyu (2011) for Nigeria.

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 (628.5389, -0.5847 and 9.8656) 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 the model is covariance stationary.

5. CONCLUSION AND POLICY IMPLICATIONS

The paper examines the impacts of inflation dynamics and global financial crises on stock market returns and volatility in Nigeria. The simple GARCH (1, 1) model specification with multivariate regressors was adopted. And the result shows that in the conditional mean equation, inflation and its volatility all exert positive impacts on stock market volatility, and it is significant for inflation volatility and insignificant for inflation rate. And during the global financial crises, inflation has significant negative impact on stock market returns. This result indicates that inflation has weak predictive impact on stock market returns but inflation volatility exerts strong predictive impact of stock market returns. In the conditional variance equation, the result shows that inflation and its volatility all have negative impacts on the conditional variance of stock returns; it is significant for inflation and insignificant for inflation volatility. Also, during the period of global financial crises, inflation exerts significant positive impact on the conditional variance of stock returns. This indicates that inflation has strong predictive impact on stock market returns.

The result implies that stock market returns can serve as a good hedge against volatile inflation, but this hedging propensity tends to be illusive if external shocks like the global financial crises affect the condition of the stock market negatively. Also, the result implies that variation in inflationary pressure over a period of time increases the risk of investment and this forces stock return to decrease. And if external shocks increases, the average stock market returns tends to fall via inflationary changes.

However, it becomes imperative for investors to pay attention to variation of inflationary changes when predicting stock market returns and its vulnerability.

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Figure-1. Plot of monthly Stock returns (sr) in Nigeria from 1985-2010

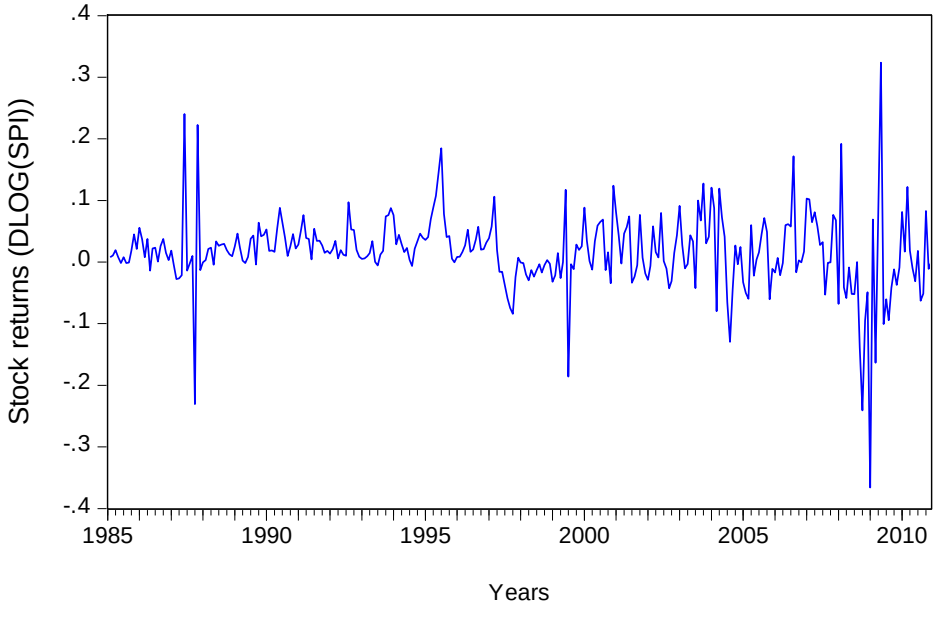

Figure-2. Plot of first difference of the natural log of inflation rate (ifr) in Nigeria

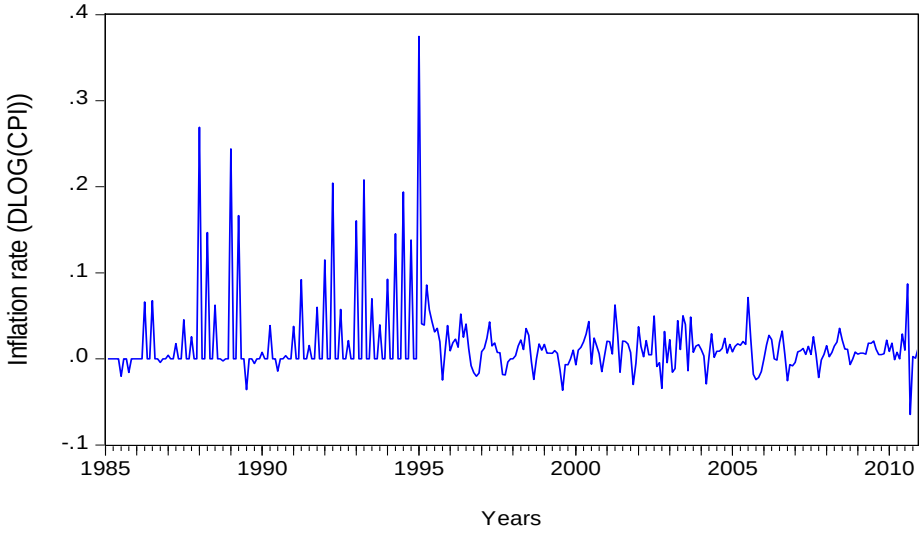

Table-1. Summary Statistics

Variables	Δ log SPI (sr_t)	Δ log CPI (ifr_t)
Mean	0.017380	0.016605
Std.Dev	0.062041	0.043727
Skewness	-0.596348	4.115697
Kurtosis	11.38503	25.53489
Jarque-Bera	929.5176	7458.520
Prob	0.000000	0.000000
Sum Sq. Dev	1.193206	0.592733
Observation	312	312

Table-2. Unit Root Test using Elliot Rothenberg, and Stock Point Optimal (ERS)

Variable	Deterministic Terms	Lags	Test value	critical values 1%	5%	10%	Remarks
sr_t	C	4	0.440351	1.954400	3.219950	4.413250	Stationary
	C, t	1	0.828020	4.000050	5.637800	6.876650	Stationary
ifr_t	C	2	0.870402	1.954400	3.219950	4.413250	Stationary
	C, t	2	2.966176	4.000050	5.637800	6.876650	Stationary

Table-3.GARCH (1, 1) estimates of inflation volatility and Diagnostic test

Statistics	Coefficient	z-Statistic	Prob.	Remarks
C	1.94E-08	0.004231	0.9966	Not significant
Variance Equation				
C	4.44E-05	1.884553	0.0595	5% significant
RESID(-1)^2	0.008483	1.323118	0.1858	Not significant
GARCH(-1)	0.952331	34.81428	0.0000	1% significant
Diagnostic test				
ARCH(LM 15lag)	0.868994		0.5997	No ARCH in the squared residuals up to 15^{th} lag
Ljung-Box Q-statistics	16.163		0.371	No serial correlation in the squared residuals up to 15^{th} lag
Wald test $(\alpha+\beta)<1$	0.9608			Covariance stationary

Method: ML - ARCH (Marquardt) - Generalized error distribution (GED). Sample (adjusted): 1985M02 2010M12, Included observations: 311 after adjustments. Convergence achieved after 40 1teration.

Figure-3. Plot inflation rate volatility using the conditional variance from GARCH (1, 1) model in Table 3.

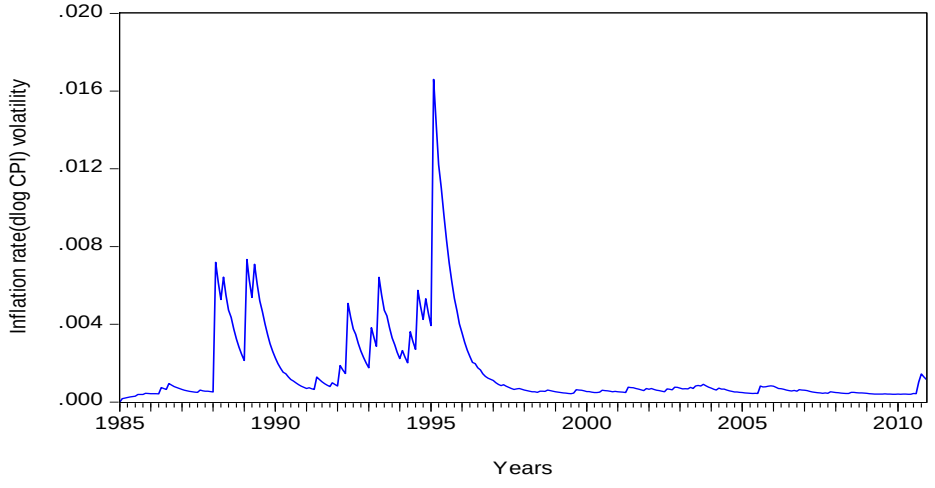

Table -4. Impacts analysis of inflation rate and inflation rate volatility on stock returns and stock returns volatility using GARCH (1, 1) specification and Diagnostic test.

Statistics	Coefficients	z-value	Prob.
Conditional mean equation			
C	0.009882	4.361774	0.0000*
ifr_t	0.026333	0.853057	0.3936
$\sigma^2_{ifr,t}$	4.097408	6.190643	0.0000*
$D_{ifr,t}$	-1.159008	-3.660823	0.0003*
Conditional Variance Equation			
ω	0.002275	2.512881	0.0120**
$\varepsilon^2_{t_3-1}$	0.486312	1.730429	0.0836
σ^2_{t-1}	0.166425	0.965362	0.3344
ifr_t	-0.006162	-4.068186	0.0000*
$\sigma^2_{ifr,t}$	-0.101575	-1.703995	0.0884
$D_{ifr,t}$	0.039832	2.016381	0.0438**
Diagnostic Test			
ARCH(LM , 15 lag)	0.113284		0.9523
Ljung-Box Q-statistics	0.3471		0.951
LJB	628.5389		0.0000
Skewness	-0.5847		
Kurtosis	9.8656		
Wald test(α+β)<1	0.6527		

Method: ML – ARCH (Marquardt) - Generalized error distribution (GED). Sample (adjusted): 1985M02 2010M12. Convergence achieved after 26 iterations and the symbols (*) and (**) indicate 1% and 5% significant.