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Does inflation has an Impact on Stock Returns and Volatility? Evidence from Nigeria and Ghana

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Abstract: This study seeks to apply the generalized autoregressive conditional heteroskedasticity (GARCH) model to assess the impact of inflation on stock market returns and volatility using monthly time series data from two West African countries, that is, Nigeria and Ghana. In addition, the impact of asymmetric shocks was investigated using the quadratic GARCH model developed by Sentana (1995), in both countries. Results for Nigeria show weak support for the hypothesis which states 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. Measures employed towards restraining inflation in the two countries, therefore, would certainly reduce stock market volatility, improve stock market returns and boost investor confidence.

Keywords: Stock Returns, Volatility, inflation

JEL Classification: E3, E31, E52, G15

I. INTRODUCTION

The strong connect between domestic and global financial market and developments there from continue to generate interest among researchers, practitioners, operators and regulators over how to evaluate models of financial risk. In recent years, inquiry into the link between nominal stock returns and their volatility has produced a number of stylized facts in the literature. For instance, alluding to the fact that the stock market performance depends on not only the overall fitness of the financial markets and macroeconomic stability, but, the external markets as well, burgeoning evidences suggest volatility clustering, that is, large (small) shocks tend to follow similar large (small) shocks. This is because real economic variables that derive from these relationships tend to display persistence; output, inflation, interest rate, exchange rate, oil prices, etc. This is particularly so for developing economies like Nigeria and Ghana, which are the main focus of the paper.

Stock market, especially in small economies, plays a very vital role in mobilizing economic resources within and from outside the economy to achieve greater and better economic potentials. The market, therefore, serves as an important conduit through which funds flow from individuals and corporate bodies across the globe to investors residing in a particular economy. Higher stock returns imply higher profitability by firms and other corporate bodies and thus overall growth/prosperity of an economy and vice versa. Volatility breads uncertainty, which impair effective performance of the financial sector as well as the entire economy at large. According to Pindyk (1984) an unexpected increase in volatility today leads to the upward revision of future expected volatility and risk premium which further leads to discounting of future expected cash flows (assuming cash flows remains the same) at an increased rate which results in lower stock prices or negative returns today. Stock return volatility, therefore, refers to variations in stock price changes during a period of time. This more often is perceived by investors and other agents as a measure of risk. On their part, policymakers and rational investors use market estimate of volatility as a tool to measure the vulnerability of the stock market. According to Karolyi (2001) strong asymmetric relationship exists between stock returns and stock returns volatility, and stock price volatility is higher when stock price decreases than when price increases.

Fama (1981) states that stock prices are the reflector of various variables such as inflation, exchange rate, interest rate and industrial production. Rigobon and Sacks (2004) show empirically that increase in the short-term interest rate negatively impact the stock prices, with the largest effect on the NASDAQ index. Their study further reveals that the short-term rate has a positive and significant impact on market interest rates. Generally, Engle and Rangel (2005) provide evidence of impact of overall health of the economy on unconditional market volatility. They concluded that countries with high rates of inflation experience larger expected volatilities than those with more stable prices. In a comparative study on the impact of inflation on conditional stock market volatility in Turkey and Canada, Saryal (2007), found evidence of a strong time varying volatility for stock market returns in Toronto stock exchange (TSE) and Istanbul stock exchange (ISE). The author further discovers inflation is one of the underlying determinants of conditional market volatility in Turkey which has higher inflation rate than Canada.

A recent study in the US show that high expected inflation has tended to coincide with periods of heightened uncertainty about real economic growth and unusually high risk aversion, both of which rationally raise equity yields, (Bekaert and Engstrom, 2009). According to them, countries with a high incidence of stagflation should have relatively high correlations between bond yields and equity yields. Other empirical studies in the area either established weak predictive power of inflation on stock market volatility and returns, for instance, Kaul (1987), Schwert (1989), Davis and Kutan (2003), while others like; Hamilton and Lin (1996), Engle (2004), Engle and Rangel (2005), Rizwan and Khan (2007), etc., established a strong predictive power of inflation on stock market volatility and returns.

Against this background, this paper seeks to investigate whether inflation has any impact on stock returns and volatility in Nigeria and Ghana from 1998M1 to 2010M5 and 1999M12 to 2010M5, respectively. The rest of the paper is structured as follows: section two, which follows this introduction, provides a brief background of the Nigerian Stock Exchange Market (NSE) and the Ghanaian Stock Exchange Market (GSE). Section three discusses the methodology of the paper while section four captures the empirical results and discussions. Lastly, section five summarizes and concludes the paper.

2.1 Background of the Nigeria and Ghana Stock Exchange Markets

The Nigerian Stock Exchange (NSE) was established in 1960. The market has passed through a number of stages and challenges in its development process; the indigenization policy of 1977, regime of control until July, 1986, the era deregulation and post-deregulation. Another major development in the market was the banking sector consolidation which spanned between 2005 and 2007. Currently, the NSE has a total of 283 listed securities in two market segments – first tier securities market and second tier securities market. In particular, the NSE has performed exceptionally well in recent years following successful recapitalization of the Nigerian banks. All Share Index, for instance, reached its peak in November, 2005 at N26,136.79, while total number of deals and market capitalization stood at 5,341 and N2.6 trillion, respectively. A record, which until then, was not attained in the market.

The spillover effect of the global financial crisis, however, sets in and this resulted in massive withdrawal of funds by foreign institutional investors and investment banks. The predicament further threw local investors into panic which exacerbates and compounds the crisis in the market. Empirical evidences, for instance, show that the NSE lost about 50.8 percent of its value even before the global financial crises when regulators placed a ban on loan-for-equity by the Nigerian commercial banks during the recapitalization exercise. Market capitalization, for instance, fell from N15.3 trillion in the first quarter of 2008 to N7.53 trillion in the first week of November, 2008 and further down to N6.25 trillion in the second week of December, 2008. Value of stocks traded in the market declined drastically from N387.3 billion in February, 2008 to N161.0 billion in September, 2008 and to only N38.1 billion by end of November, 2008. Meanwhile, the All S*hare Index* (ASI) fell from N66, 371.20 in the first quarter of 2008 to N27, 958.25 in the second week of December, 2008. This further fell down to an *All share index* of N18,897.54, and a total number of 4,677 deals. As of June, 2010, the All share index and number of deals in the market reached N25,422.79, and 7,473, respectively while the total market capitalization stood at N2,356,580,710.86.

The Ghanaian economy presents an example of a small open economy, which has trade relations with several countries and hence opens to foreign exchange rate and stock market volatility. Ghana's stock market (GSE) could therefore be described as one of the emerging markets, which was established in July 1989 and started trading in 1990. With around 30 listed companies currently, GSE could be said to have started on a strong footing where as at 1993, the exchange was ranked as the 6th best in all emerging economies and only a year later in 1994, it was ranked the best with a total gain of up to 124.3% in its index level. High inflation rate and interest rate were, however, blamed for the downward swings in 1995, which saw the plummeting of the index growth rate to as low as 6.3%.

As of October 2006, GSE's market capitalization was about ($11.5bil) 111,500 billion cedis, and by end of December, 2007, it stood at 131,633.22 billion cedis. Dominant players in the market are the manufacturing and brewing sectors and the lagging banking sector, while others include insurance, mining and petroleum sectors. Although most of the listed companies on the GSE are Ghanaian, but there are some multinationals as well. It is pertinent to note that despite the abolishment of restrictions by the Foreign Exchange Act, 2006 (Act 723), yet the market compared to the NSE could not be said to be fully integrated into the global arena.

3.1 Methodology of the Paper

The introduction of ARCH and GARCH models by Engle (1982) and Bollerslev (1986) saw an explosion of researches that seek to investigate the dynamics of stock market volatility in both developed and emerging stock markets alike. Although the standard GARCH (1,1) captures stylized fact of stock returns volatility in terms of volatility clustering, it, however, does not allow for assessment of asymmetric shocks in the conditional variance. Engle (2001) argues that market declines forecast higher volatility than comparable market increases do.

Since the distributions of series in this paper are stated as nonlinear (see Table 1), the paper employed a step-wise approach, where the standard linear GARCH (1,1) was first applied to capture the stock returns volatility and the Quadratic GARCH introduced by Engle and Ng (1993) and analyzed in detail by Sentana (1995) was then applied to test nonlinearities in the effect of asymmetric information – both negative and positive, on stock return volatility. The paper estimates these two models using monthly data from the Nigerian Stock Exchange Market (NSE) and the Ghanaian Stock Exchange Market (GSE). The standard GARCH (1,1) model introduced by Bollerslev (1986) defines information set Ω_t of monthly returns to be $\{r_t, r_{t-q},\ldots,r_1\}$, which is:

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

where: $\varepsilon_t = \sigma_t z_t$, and Z_t i.i.d (0,1)

$$\sigma^2 = \omega + \alpha\,\varepsilon^2_{t-1} + \beta\,\sigma^2_{t-1} \tag{2}$$

σ^2 is measurable with respect to Ω_t, which is the monthly returns. $\omega > 0$, $\alpha > 0$, $\beta \geq 0$, and $\alpha + \beta < 1$, such that the model is covariance-stationary, that is, first two moments of the unconditional distribution of the return series is time invariant. To further estimate the impact of asymmetric effect of shocks on volatility, the above specification is replaced with Sentana's Quadratic Generalized Autoregressive Conditional Heteroskedasticity, QGARCH (1,1) model as follows:

$$\sigma^2 = \omega + \alpha\,\varepsilon^2_{t-1} + \beta\,\sigma^2_{t-1} + \gamma\varepsilon_{t-1} \tag{3}$$

The presence of an additional term, $\gamma\varepsilon_{t-1}$ makes it possible for both positive and negative shocks to have different impact on the previous period inflation rate. The condition of covariance stationary stated in equation (2) above also applies here in (3) because of its semblance with the former. The appropriate model estimated to capture the effect of inflation on conditional variance nominal stock return volatility is:

$$\sigma^2 = \omega + \alpha\,\varepsilon^2_{t-1} + \beta\,\sigma^2_{t-1} + \lambda(inflation)_{t-1} \tag{4}$$

in line with evidences in the literature, the papers measures nominal stock returns , r_t, and inflation, π_t, as the first difference of the natural logarithm of the stock price index (SPI) and the consumer price index (CPI), respectively: $r_t = 100 * (\ln SPI_t - \ln SPI_{t-1})$, $\pi_t = 100 * (\ln CPI_t - \ln CPI_{t-1})$. The analysis covers the period of 1998M1 to 2010M5 for Nigeria and 1999M12 to 2010M5 for Ghana.

4.1 Results and Discussions

This section presents the results of empirical analysis. Monthly data from the Nigeria's and the Ghanaian stock markets and CPI were obtained from *DataStream International*. Table 1 reports the monthly mean returns, standard deviation, skewness, Kurtosis, and Jacque-Bera statistics for the entire sample for the two countries. An examination of these statistics shows that for the overall samples, the average monthly nominal returns are positive for both NSE and GSE markets. This translates to average monthly returns (in natural log) of 0.87% and 1.82%, respectively. Furthermore, from the monthly standard deviation, we see that nominal stock returns and inflation are more volatile in Nigeria than in Ghana. This suggests that the NSE is more open than GSE and or the Nigeria's Macroeconomy is more turbulent than the Ghanaian economy.

The markets, in addition, show evidence of fat tails, since the Kurtosis exceeds 3, which is the normal value, and evidence of negative skewness, for market returns in Nigeria and Ghana, and positive skewness for inflation in the two countries. These imply left and right fat tails, respectively. The Jarque-Berra normality tests refute the null hypothesis of normality of returns series and inflation in both Nigeria and Ghana. We can, therefore, employ the ARCH model to address the excess kurtosis.

Table 1: Summary Statistics for Nominal Stock Returns and Inflation in Nigeria and Ghana

Country/ Variable	Nigeria		Ghana	
	Nominal Stock Return	Inflation	Nominal Stock Return	Inflation
Sample Period	1998M1 - 2010M5		1999M12 - 2010M5	
Mean	0.00872	0.00942	0.01821	0.01401
Median	0.00158	0.00681	0.00948	0.01260
Standard Deviation	0.07519	0.01652	0.06510	0.01519
Skewness	-0.59946	0.04866	-0.90117	2.91213
Kurtosis	8.91679	4.97428	9.58365	21.4335
Jarque-Bera	218.675	28.8693	242.670	1864.59
Probability	0.00000	0.00000	0.00000	0.00000

4.1.1 Evidence of Time-varying Volatility

The basic GARCH (1,1) results are given in Table 2*a* and 2*b* for Nigeria and Ghana, respectively, with log of stock price index (LSPI) as the dependent variable. The results show that stock return volatility this month is explained by approximately 60% of the previous month's return volatility for Nigeria and only 31% in Ghana. This is significant for Nigeria while rather low for Ghana. The coefficient of return innovation are statistically significant for the two markets implying that new information arrival into the markets has significant impact on predicting next month's stock market volatility. However, only the constant term in the variance equation for GSE is significant whereas that of NSE is not.

Table 2*a*: GARCH (1,1) Volatility Coefficients for Return Series in Nigeria

	Coefficient	Robust Standard error
Mean Equation		
Constant (μ)	0.01895*	0.0053
AR(1)	0.90737*	0.0504
Variance Equation		
Constant (ω)	9.20E-05	6.61E-05
ARCH (1) (α)	0.5596*	0.1818
GARCH (1) (β)	0.5983*	0.0789
Diagnostic test		
ARCH LM (15 Lags)	-0.0557	0.4270
Q (15th Lags)	13.576	0.4040
Wald $\alpha + \beta = 1$	1.1579	

Notes: Dependent Variable: LSPI.
Sample (adjusted): March 23, 1990 to March 23, 2000.
Convergence achieved after 39 iterations.
Bollerslev-Woodridge robust standard errors and covariance.
* Significant at 1% level.

The persistence parameter for NSE $\alpha + \beta = 1.1579$, which is > 1. This show a very explosive volatility, but the same for GSE without constant parameter in the mean equation is 0.94841 – which implies mean revertion, that is, no matter how much time it takes, volatility process does return to its mean. Although all are statistically significant, the former is contrary to expectation. The latter demonstrates the capability of past volatility to explain current volatility (Engle and Bollerslev, 1986) and because it is very high, the rate at which it diminishes is rather very slowly.

Table 2*b*: GARCH (1,1) Volatility Coefficients for Return Series in Ghana

	Coefficient	Robust Standard error
Mean Equation		
Constant (μ)		
AR(1)	0.93927*	0.082630
Variance Equation		
Constant (ω)	0.00056**	0.000243
ARCH (1) (α)	0.63677*	0.241205
GARCH (1) (β)	0.31164**	0.138153
Diagnostic test	*Coefficient*	*Probability*
ARCH LM (15 Lags)	-0.0443	0.4860
Q (15th Lags)	5.2258	0.9700
Wald $\alpha + \beta = 1$	0.94841	

Notes: Dependent Variable: LSPI.
Sample (adjusted): March 23, 2000 to March 23, 2010.
Convergence achieved after 500 iterations.
Bollerslev-Woodridge robust standard errors and covariance.
* (**) Significant at the 1% and 5% level, respectively.

Thus, the GARCH coefficients from the two models are both statistically significant and conform to expectation. This implies that past variances exert significantly positive effect on stock return volatility in the two countries. On the basis of these results, it is evident that there is significant time varying volatility in both the Nigerian and Ghanaian stock market returns during the sample periods. Diagnostic test statistics, ARCH LM test and Ljung-Box suggest that the standardized squared residuals are serially uncorrelated and homoskedastic up the 15th lag period from both Table 2*a* and 2*b*. Further, the Wald test statistic for Ghana suggests that the model is mean reverting, that is, no matter how much time it takes, but volatility process does return to its mean.

As was stated earlier under section (3.1), the standard GARCH (1,1) model does not capture the asymmetric effect of shocks on stock market volatility and hence the choice of QGARCH as enunciated by Sentana (1995). This allows us to assess the impact of positive and negative innovations on stock return volatility. It was, for instance, discovered that negative returns increase future volatility by larger amount than positive returns of the same magnitude. For Nigeria, as can be seen from results in Table 3*a*, and in line with expectation, bad news has larger impact on stock volatility than good news. Although the coefficient is not statistically significant even at the 10% level, yet, this is a very important finding in the sense that it conforms with a number of empirical findings in the area. Saryal (2007), for instance, made similar discovery for Canada where the stock market index (TSE 300) records larger volatility in response to bad news than good news.

Table 3*a*: Asymmetric GARCH (1,1) Volatility Coefficients for Return Series in Nigeria

	Coefficient	*Robust Standard error*
Mean Equation		
Constant (μ)	0.01834*	0.00589
AR(1)	0.88691*	0.05552
Variance Equation		
Constant (ω)	0.00012	7.55E-05
ARCH (1) (α)	0.55045*	0.17763
GARCH (1) (β)	0.59399*	0.07501
QGARCH (γ)	-0.00015	0.00924
Diagnostic test	*Coefficient*	*Probability*
ARCH LM (15 lag)	-0.0437	0.5196
Ljung-Box Q - statistic (15^{th} Lags)	5.9097	0.9490
Wald ($\alpha + \beta$)	1.1444	
AIC	-2.6474	

Notes: Dependent Variable: LSPI.
Sample (adjusted): March 23, 2000 to March 23, 2010.
Convergence achieved after 500 iterations.
Bollerslev-Woodridge robust standard errors and covariance.
* Significant at 1% and 5% levels.

The ARCH and GARCH coefficients remain statistically significant and the persistence parameter exceeds 1.1444, which is highly explosive, like in the GARCH (1,1) model above. Diagnostic test statistics, the ARCH LM test and Ljung-Box show that the standardized squared residuals are serially uncorrelated and homoskedastic up the 15th lag period.

The QGARCH coefficient – γ, for Ghana is theoretically inconsistent although it is highly significant at the 1% level. Positive coefficient of the asymmetric effect implies that stock market volatility or market operators reacts more to good news than bad news. Also the ARCH and GARCH (1,1) coefficients are statistically significant and consistent like in symmetric GARCH results reported in Table 2*b* above, except that the persistence parameter here is: 1.1366, which is quite high.

Table 3*b*: Asymmetric GARCH (1,1) Volatility Coefficients for Return Series in Ghana

	Coefficient	*Robust Standard error*
Mean Equation		
Constant (μ)	0.02352	0.01472
AR(1)	0.84599*	0.09982
Variance Equation		
Constant (ω)	0.00057*	0.00021
ARCH (1) (α)	0.90142*	0.31047
GARCH (1) (β)	0.23515**	0.13166
QGARCH (γ)	3.40E-05*	9.91E-07
Diagnostic test	*Coefficient*	*Probability*
ARCH LM (15 lag)	-0.0674	0.2424
Ljung-Box Q - statistic (15^{th} Lags)	14.692	0.3270
Wald ($\alpha + \beta$)	1.1366	
AIC	-3.2378	

Notes: Dependent Variable: LSPI.
Sample (adjusted): March 23, 2000 to March 23, 2010.
Convergence achieved after 500 iterations.
Bollerslev-Woodridge robust standard errors and covariance.
* Significant at 1% and 10% levels.

Diagnostic test statistics, like the ARCH LM test and Ljung-Box suggest that the standardized squared residuals are serially uncorrelated and homoskedastic up the 15th lag period.

4.1.2 Impact of Inflation on Conditional Stock Market Volatility

The impact of inflation measured as rate of change in the log of CPI in the two countries on stock market returns volatility is investigated through the estimation of equation (4). The coefficient of lagged inflation λ in the GARCH (1,1) measures the predictive power of previous inflation rate on stock market volatility in the two markets, NSE and GSE. As can be seen from Table 4*a,* the coefficient is both negative and significant statistically, implying that inflation decreases conditional market volatility in the previous period in Nigeria. While for Ghana, the positive coefficient suggests an increase in conditional market volatility as inflation rate increases in the previous month. Although both coefficients for the NSE and GSE were statistically significant, only that of Ghana is consistent theoretically.

Furthermore, the models were re-estimated using an average of three month inflation rate and the coefficients turned out to be more robust, that is, in addition to being theoretically consistent they were equally significant at the 10% and 1% levels for both Nigeria and Ghana, respectively[1]. The latter findings are consistent with Erb *et al*. (1995), Kantonikas, *et al,* (2006), Saryal (2007) and Adjasi, Harvey and Agyapong (2008). Schwert (1989) opines that when prices in the domestic economy are uncertain, the volatility of nominal asset returns should reflect consumer price index volatility.

Table 4*a*: Asymmetric GARCH (1,1) Volatility Coefficients for Return Series with Inflation in Nigeria

	Coefficient	Robust Standard error
Mean Equation		
Constant (μ)	0.02387*	0.0049
AR(1)	0.27764	0.3966
Variance Equation		
Constant (ω)	0.00153*	0.0006
ARCH (1) (α)	0.36685*	0.1557
GARCH (1) (β)	0.49922*	0.1363
Inflation (-1) (λ)	-0.04924*	0.0115
Diagnostic test	*Coefficient*	*Probability*
ARCH LM (12 lag)	-0.0275	0.8032
Ljung-Box Q - statistic (10th Lags)	16.670	0.2150
Wald ($\alpha + \beta$)	0.8661	
AIC	-2.581	

Notes: Dependent Variable: LSPI.
Sample (adjusted): March 23, 2000 to March 23, 2010.
Convergence achieved after 500 iterations.
Bollerslev-Woodridge robust standard errors and covariance.
* Significant at 1% level.

The ARCH and GARCH coefficients are all statistically significant and consistent as shown in Table 4*a* for Nigeria's model. The result further shows a considerably high volatility persistence ($\alpha + \beta$) parameter of 0.86 as well, which is in line with expectation. Similarly, the GSE's ARCH and GARCH coefficients are also significant, statistically and conform to expectation, while the persistence parameter reveals that, although the model is mean reverting, it however, does so very slowly.

The ARCH LM test statistic from the two models indicates that there is no autoregressive conditional heteroskedasticity up to order 15 in the standardized residuals. Alternatively, the Ljung-Box Q-statistic of standardized squared residuals at 15th lag indicates that the residuals are serially uncorrelated. The Wald test indicates that two models are mean reverting with a persistence parameter each of ($\alpha + \beta$) < 1.

Table 4*b:* Asymmetric GARCH (1,1) Volatility Coefficients for Return Series with Inflation in Ghana

	Coefficient	Robust Standard error
Mean Equation		
Constant (μ)	0.01869	0.0004
AR(1)	-0.90213*	1.0380
Variance Equation		
Constant (ω)	-4.83E-05*	6.60E-08
ARCH (1) (α)	0.45524**	0.19015
GARCH (1) (β)	0.50709*	0.13708
Inflation (-1) (λ)	0.03371*	0.01215
Diagnostic test	*Coefficient*	*Probability*
ARCH LM (15 lag)	-0.0010	0.9871
Ljung-Box Q - statistic (15th Lags)	13.282	0.4260
Wald ($\alpha + \beta$) = 1	0.9623	
AIC	-3.320	

Notes: Dependent Variable: LSPI.
Sample (adjusted): March 23, 2000 to March 23, 2010.
Convergence achieved after 500 iterations.
Bollerslev-Woodridge robust standard errors and covariance.
* Significant at 1% and 5% levels.

5.1 Conclusions and Recommendations

In this paper, we have estimated a nonlinear GARCH model for monthly stock returns volatility and inflation in the two West African countries, Nigeria and Ghana. Data for the estimation of GARCH (1,1) and QGARCH (1,1) models was obtained from *Data-stream International* on stock market index and inflation rate. The asymmetric effect of inflation on stock returns and volatility was investigated using both inflation rate and an average of three month inflation rate in the two countries. Preliminary investigation into the nature of the data reveals that the data is characterized by a non normal distribution and average monthly returns (in natural log) of 0.87% and 1.82% for Nigeria and Ghana, respectively. With comparatively high standard deviation of monthly returns of 7.5% and 6.5% in the two markets, respectively, one would expect high conditional stock market returns volatility.

Firstly, results show evidence of time varying volatility in stock market returns across the two markets and from the asymmetric model, results reveal that bad news has larger impact on stock volatility than good news in the NSE, whereas the opposite, although counter intuitive, was established for GSE. The result for Nigeria should be treated with caution as the coefficient of the asymmetric effect is statistically insignificant. Besides, the investing public are unaware of developments in the stock market although some out choice, but other due to information asymmetry or due to poor brokerage. Secondly, results show that inflation is

[1] Appendix 1*a* and 1*b* present the estimated ARCH, GARCH and average of three month inflation rate coefficients and other diagnostic statistics.

one of the underlying determinants stock market volatility in the two markets. But, previous inflation rate was found to have less impact compared to average of three month inflation rate on stock returns volatility in the two markets. These results, therefore, would be useful to investors and other market operators in the two countries in making good portfolio decisions as a basis for detection of volatility in the stock markets. Policymakers could also design measure to stem inflation due to its adverse effect on stock market volatility in the two countries.

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NIGERIA

Dependent Variable: LSPI
Method: ML - ARCH (BHHH) - Normal distribution
Date: 07/04/10 Time: 15:36
Sample (adjusted): 1998M03 2010M01
Included observations: 143 after adjustments
Convergence achieved after 268 iterations
Bollerslev-Wooldrige robust standard errors & covariance
MA backcast: 1998M02, Variance backcast: ON
GARCH = C(4) + C(5)*RESID(-1)^2 + C(6)*GARCH(-1) + C(7)*ACPI(-1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.015227	0.004622	3.294179	0.0010
AR(1)	-0.024307	0.463169	-0.052479	0.9581
MA(1)	0.233859	0.444593	0.526008	0.5989
	Variance Equation			
C	-0.003647	0.002170	-1.680297	0.0929
RESID(-1)^2	0.437688	0.215227	2.033614	0.0420
GARCH(-1)	0.471354	0.156714	3.007734	0.0026
ACPI(-1)	0.002896	0.001633	1.773683	0.0761

R-squared	-0.016443	Mean dependent var	0.008793
Adjusted R-squared	-0.061286	S.D. dependent var	0.075452
S.E. of regression	0.077729	Akaike info criterion	-2.611807
Sum squared resid	0.821694	Schwarz criterion	-2.466772
Log likelihood	193.7442	Durbin-Watson stat	2.238509

Inverted AR Roots	-.02
Inverted MA Roots	-.23

GHANA

Dependent Variable: LSPI
Method: ML - ARCH (BHHH) - Normal distribution
Date: 07/04/10 Time: 15:30
Sample (adjusted): 2000M02 2009M12
Included observations: 119 after adjustments
Estimation settings: tol= 0.00010, derivs=accurate numeric (linear)
MA derivatives use accurate numeric methods
Initial Values: C(1)=0.01695, C(2)=0.00500, C(3)=0.00500,
C(4)=0.00429, C(5)=0.15000, C(6)=0.60000, C(7)=0.00000
Failure to improve Likelihood after 17 iterations
Bollerslev-Wooldrige robust standard errors & covariance
MA backcast: 2000M01, Variance backcast: ON

	Coefficient	Std. Error	z-Statistic	Prob.
C	0.018693	0.013431	1.391785	0.1640
AR(1)	0.902125	0.076622	11.77363	0.0000
MA(1)	-0.356241	0.131170	-2.715866	0.0066
	Variance Equation			
C	-4.83E-05	6.80E-08	-711.3353	0.0000
RESID(-1)^2	0.455240	0.190154	2.394055	0.0167
GARCH(-1)	0.507088	0.137088	3.698996	0.0002
ACPI(-1)	0.101139	0.036443	2.775238	0.0055

R-squared	0.239930	Mean dependent var	0.016947
Adjusted R-squared	0.199212	S.D. dependent var	0.065757
S.E. of regression	0.058844	Akaike info criterion	-3.323790
Sum squared resid	0.387808	Schwarz criterion	-3.160312
Log likelihood	204.7655	F-statistic	5.892489
Durbin-Watson stat	1.965098	Prob(F-statistic)	0.000023

Inverted AR Roots	.90
Inverted MA Roots	.36