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INFLATION RATES, FINANCIAL OPENNESS, EXCHANGE RATES AND STOCK MARKET RETURNS VOLATILITY IN NIGERIA

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ABSTRACT

Employing the Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models introduced by Engle (1982) and Bollerslev (1986) respectively, this study examines the relationship between inflation rates, financial openness, exchange rates and stock market volatility in Nigeria, for the periods 1985 to 2012. The results from this study reveals that previous periods inflation rates significantly but negatively impact volatility in market returns, while previous financial openness does not have significant impact on volatility in market returns. However, previous exchange rates were found to be significantly and positively associated with market return volatility. Another result of interest in this study is that changes in inflation rates, financial openness and exchange rates have no significant impact on market returns volatility. Based on these results, it is recommended that the government through her policy makers and relevant agencies (like the Central Bank of Nigeria - CBN) should ensure that appropriate measures (such as credit control, reduction in unnecessary government expenditure, increase production, anti-inflationary budgetary policy) are employed towards monitoring inflation in the country. This would certainly reduce stock market volatility, improve stock market returns and boost investors' confidence in the Nigerian stock market.

Keywords: inflation rate, financial openness, exchange rate, stock market volatility, Fisher's hypothesis

INTRODUCTION

Stock market is an important financial institution in a country and is of major concern to investors, business owners and the government. The stock market basically serves as a channel for resources mobilization as well as capital formation and allocation in an economy. Effective and efficient mobilization of resources in an economy foster sustainable growth and development, therefore, funds must be effectively mobilized and allocated to enable the economy realize optimal output (Osinubi, 2004). Investors have a great interest in discovering variables that may help forecast stock prices. They can more appropriately manage their portfolios (by increasing returns and/or lower risk) if they can use release news on major macroeconomic variables (inflation rate, financial openness, exchange rate) as reliable indicators for stock market activities. To the government, if the relationship between macroeconomic variables and stock returns has predictive power, policy makers can better control stock market volatility and invariably the direction and stability of the economy.

According to Zafar, Syeda, & Tahir (2008) volatility, the conditional standard deviation of the stock return and its determinants has been of concern over the years. The relationship between stock market volatility and exchange and inflation rates has recently preoccupied the minds of researchers (Vardar, Aksoy & Can, 2008; Chang, Cho & Hong, 2010; Yaya & Shittu, 2010; Oseni & Nwosu, 2011). This is because they both play an important role in influencing the development of a country's economy. Financial openness (globalization) has also advanced in the last two decades with increased cross-border capital flows, tighter links

among financial markets, and greater commercial presence of foreign financial firms in countries around the world. The effects of these macro economic variables (exchange rates, financial openness and inflation rates) on stock market volatility are particularly important for policy makers endeavouring to develop efficient financial systems and to manage risk.

The Nigerian economy has experienced significant changes in its macroeconomic aggregates in the recent past. This is evident from the inception of the Structural Adjustment Programme (SAP) to the transition from a military to civilian rule which have caused enormous movement in key macroeconomic variables (like inflation rates, exchange rates and money supply) (Osamwonyi & Evbayiro-Osagie, 2012). These changes in macroeconomic variables have implications for stock market volatility.

In extant literature, researchers (Kim, 2003; Chang, Cho & Hong, 2010; Yaya & Shittu, 2010; Wang 2010; Oseni & Nwosu, 2011) have shown that the relationship between macroeconomic variables and stock market volatility is mixed. For example, Kim (2003) showed that Standard and Poor's (S&P's) common stock price is negatively related to exchange rate. Yaya & Shittu (2010) found out that exchange rates and inflation rates have significant effects on conditional stock market volatility, while Oseni & Nwosu (2011) found that there is no relationship between stock market volatility and inflation and interest rate. The point is that, there is no consensus about these relationships and the empirical studies of the relationships are inconclusive.

Based on above submissions, the objective of the paper is to investigate the relationship between inflation rates, financial openness, exchange rates and stock market returns volatility, using quarterly data from Nigerian Stock Exchange for the period 1985 to 2012. The paper is organized as follows; the next section presents a review of relevant literature that examines the relationship between the exogenous variables (inflation rate, financial openness, exchange rate) and endogenous variable (stock market volatility). Section 3 describes the methodological framework for the study. Section 4 presents and discusses the empirical results and the last section is on concluding remarks, policy implications of findings and policy recommendations.

LITERATURE REVIEW

This section examines the theoretical underpinnings of the study and also reviews literature on macroeconomic variables (inflation rate, financial openness, exchange rate) and stock market volatility, alongside with the development of relevant hypotheses to guide the study.

Theoretical Framework

The financial economic theory suggests that the volatility of real economic activity should be related to stock market volatility, as in Hansen & Jagannathan (1991). They provide an inequality between the 'Sharpe ratios' for the equity market and the real fundamental and hence, implicitly link equity volatility and fundamental volatility, other things being equal. Studies carried out by Yaya & Shittu (2010) and Olweny & Omondi (2011) have variously found that macroeconomic factors such as foreign exchange rate, interest rate, inflation rate, gross domestic product and consumer price index for inflation rate are important explanatory variables in explaining volatility in stock market return. For example, a study by Olweny & Omondi (2011) on the effect of macro-economic factors on stock returns volatility in the Nairobi Stock Exchange, Kenya, showed that macro-economic factors such as foreign exchange rate, interest rate and inflation rate affect stock return volatility at the Nairobi Stock Exchange, Kenya. Using the financial economic theory we can systematically order the

relationship between inflation rate, financial openness, exchange rate and stock market volatility as follows:

Inflation and Stock Market Volatility

Schwert (1989) studied the relationship between stock market volatility and volatility of real and nominal macroeconomic variables. The study concluded that macroeconomic volatility as measured by movements in inflation and real output have weak predictive power on volatility of stock market and return. This study was done in developed economy where inflation rates and real output are relatively stable. In particular, inflation volatility predicts stock market volatility for the period 1953-1987. Gruen (1995) found that lower inflation variability leads to less volatility of the stock market especially the bond yields.

A similar study carried out by Saryal (2007) used GARCH (1,1) model (Generalized Auto Regressive Conditional Heteroskedasticity) for conditional stock market volatility using data from Turkey and Canada. The study found that the rate of inflation has high predictive power for stock market volatility in Turkey, whereas it is weaker, but still significant for Canada. This difference may be attributable to the fact that Turkey is an emerging market with a high inflation rate and Canada a developed market with a low inflation rate.

Diebold & Yilmaz (2008) carried a similar study but with a wider scope titled 'macroeconomic volatility and stock market volatility, world-wide'. Forty (40) countries were studied consisting of both developed and developing economies using macroeconomic data (such as GDP, consumer price index for inflation amongst others) and stock market data. The study found a clear link between macroeconomic fundamentals and stock market volatilities, with volatile fundamentals translating into volatile stock market. It also found that developing countries often have unusually high volatility. Engle, Ghysels & Sohn (2013) study reveals long-run and short-run relationship between stock market volatility and macroeconomic variables.

Some similar studies have been done in Nigeria. Omotor (2008) investigates the relationship between inflation and stock market returns using Nigerian data and found a significant and positive relationship between inflation and stock prices as the Fisher (1930) hypothesis postulates. It suggests that the higher the rate of inflation, the greater the stock market volatility. Yaya & Shittu (2010), carried out a study 'on the impact of inflation and exchange rate on conditional stock market volatility: a re-assessment'. Using data sources from the Nigerian Stock Exchange, the study found that previous exchange rates and inflation rates have significant effects on conditional stock market volatility. It also showed that changes in exchange rates and inflation rates, as measured by changes in these rates have greater impact in predicting the stock market volatility in Nigeria.

Oseni & Nwosu (2011) also studied stock market volatility and macroeconomic volatility in Nigeria using monthly and quarterly data with the Exponential GARCH model, and found that there is no relationship between stock market volatility and inflation and interest rate in Nigeria. Aliyu (2011) expanded on the initial studies by applying 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. The study reported that inflation rate and its three month average have significant effect on stock market volatility in the two countries.

Financial Openness and Stock Market Volatility

There have been previous studies which have examined the effect of liberalization on stock market volatility (Reinhart, 1998; Bekaert, Harvey & Lundblad, 2009). Reinhart (1998) models the effect of capital controls on domestic stock markets, and concludes that such restrictions should raise the volatility of prices. The rationale is that when investors are constrained in adjusting the quantity of asset holdings in response to a shock, more of the response falls on price, raising the latter's variability. Conversely, it would, thus, be expected that the removal of controls on foreign investment in local equity should lower volatility in prices. This theory has intuitive appeal in light of most standard asset pricing models.

Bekaert, Harvey and Lundblad (2009) examine the effect of financial liberalization on future financial development. The study found that financial openness enhances the development and efficiency of the stock market. Researchers have devised both *de jure* and *de facto* quantitative measures of a country's integration with global capital market. Huang (2008) investigated stock market effects of liberalization in emerging markets financial systems and found significant evidence to suggest that financial openness is positively associated with a decrease in the aggregate cost of equity and an increase in the stock market volatility.

Exchange Rate and Stock Market Volatility

Adler & Dumas (1984) reported that firms whose operations are widely domestic may be influenced by the fluctuations in the foreign exchange rates as their input and output prices may be affected by currency movements. The study of Vardar, Aksoy & Can (2008) on effect of interest and exchange rate on volatility and return of sector price indices at Istanbul stock exchange showed that exchange rate significantly affect market volatility.

Chang, Cho & Hong (2010) in their study on stock volatility, foreign exchange rate volatility and the global financial crisis, found that stock volatility and Korea's won/dollar exchange rate has been the highest during the global financial crisis. Rasool and Hussain (2014) investigation reveals that exchange rate has a negative and significant relationship with stock market volatility in the Islamabad stock exchange. Using data sources from the Nigerian Stock Exchange, Yaya & Shittu (2010) carried out a study on the impact of inflation and exchange rate on conditional stock market volatility'. The study showed that previous exchange rates and inflation rates have significant effects on conditional stock market volatility. Also, changes in exchange rates and inflation rates, as measured by changes in these rates also have greater impact in predicting the stock market volatility in Nigeria.

Olweny & Omondi (2011) investigated the effect of macro-economic factors on stock return volatility in the Nairobi Stock Exchange, Kenya. The study concluded that macro-economic factors such as foreign exchange rate, interest rate and inflation rate affect stock return volatility at the Nairobi Stock Exchange, Kenya. Specifically, it found that the impact of foreign exchange rate on stock return is relatively low though significant.

From the empirical review, the changes in the results might be explained by each country's differences in economic stage, government policy, expectation pattern, financial sector activities, etc. To summarize, even though the theoretical explanation may seem obvious at times, empirical results have always been mixed and existing literature is inconclusive.

Hypotheses Development

Inflation Rate and Stock Market Volatility: The foundation of the discourse on the linkage between stock market returns and inflation is the Fisher (1930) equity stocks proclamation. According to the generalized Fisher (1930) hypothesis, equity stocks represent claims against

real assets of a business; and as such, may serve as a hedge against inflation. If this holds, then investors could sell their financial assets in exchange for real assets when expected inflation is pronounced (Olweny & Omondi, 2011). Again, the Fisher theory of interest rate relates the nominal interest rate (i) to the rate of inflation (π) and the "real" interest rate (r). The real interest rate (r) is the interest rate after adjustment for inflation.

It is the interest rate that influences lenders willingness to loan out their funds. This means that real interest rates were equal to nominal interest rates minus expected inflation. Inflation rate is the rate of increase of a price index. It is the percentage rate of change in price level over time. In theory, there is a case to support the view that since the rate of inflation means an increase in the general level of prices, and since common stocks can be considered as capital goods, then the stock prices should move with the general level of prices. Therefore, when the general inflation rate increases, common stocks should also increase to compensate investors for the decrease in the value of money (Omotor, 2008). With this it is expected that there should be a positive and significant relationship between inflation rates and stock prices. This generates the hypothesis that:

H1: There is no significant and positive relationship between inflation rate and stock market volatility.

Financial Openness and Stock Market Volatility: The past three decades have witnessed a rather unprecedented process of deregulation of financial markets and of liberalization of cross-border capital flows (Huang, B.N. & Yang, C. W (2000). Financial liberalization usually involves the domestic banking sector, stock market, and national capital account (Huang, 2008). The recent opening in emerging financial markets has generated a large literature, with many commentators predicting that such liberalization will increase the inflow of foreign capital, leading to greater financial development and economic growth.

Conceptually, financial openness is defined as allowing foreign ownership of equity, and the facilitation and encouragement of international capital flows (Reinhart, 1998). In principle, some models maintain that a market opening should decrease the variability of asset prices. The more able investors are to adjust the quantity of their portfolios in response to shocks, the less impact there should be on prices, and hence the volatility of returns should fall (Reinhart, 1998). However, the turmoil in emerging markets has led policy makers and investors to wonder whether greater financial openness may actually increase the volatility of stock returns. Theory on the effects of market opening on volatility has been ambiguous, and empirical work has yielded conflicting results (Miles, 2002). It is, therefore, hypothesised in this study that:

H2: There is no significant and positive relationship between financial openness and stock market volatility.

Exchange Rate and Stock Market Volatility: Financial economy theory explain that a change in the exchange rates would affect a firm's foreign operation and overall profits which would, in turn, affect its stock prices, depending on the multinational characteristics of the firm. Basically, foreign exchange rate volatility influences the value of the firm since the future cash flows of the firm change with the fluctuations in the foreign exchange rate. When the exchange rate appreciates, since exporters will lose their competitiveness in the international market, the sales and profits of exporters will shrink and the stock prices will decline. On the other hand, importers will increase their competitiveness in the domestic markets. Therefore, their profit and stock prices will increase.

The depreciation of exchange rate will have adverse effects on exporters and importers. Exporters will have advantage against other countries' exporters and increase their sales and invariably their stock prices will be higher (Yau & Nieh, 2006). It means, currency appreciation has both positive and negative effects on the domestic stock market for both export-dominant and import-dominant countries, respectively. Exchange rates can affect stock prices not only for multinational and export-oriented firms but also for domestic firms. For a multinational company, changes in exchange rates will result in change in value of its foreign operations as well as a continuing change in the profitability of its foreign operations. These changes in economic value of firm's foreign operations may influence stock prices. It is therefore hypothesized in this study that:

H3: There is no significant and positive relationship between exchange rate and stock market volatility.

MATERIALS AND METHOD

We used average quarterly data for the period for all the variables and data on All share price index was obtained from the Nigerian stock exchange, while data on balance of payments capital account data (capital account balance), real GDP index, exchange rate index and inflation rate were collected from the Central Bank of Nigeria (CBN) and Federal Bureau of Statistic (FBS). The paper made use of quarterly data from 1985 to 2012 consisting of one hundred and four (104) observations for all the variables of concern in the study. The statistical software used for the study was Eview 7.0 as an aid for the analysis.

Measurement of Research Variables:

Endogenous variable: Nominal Stock Market return (r_t) volatility is given by,

$$r_t = \log(ASIt/ASIt-1) * 100, \text{ where, } ASIt \text{ is the Nigerian all share index.}$$

Exogenous variables: In this work, we use data on inflation, All share price index (ASPI), balance of payments capital account data, real GDP index, exchange rate index, inflation rate, and others not mentioned but reflected in the work from 1985-2012, a time frame of twenty-eight (28) years; to test this theoretical prediction. Real GDP is the value of nominal GDP deflated by Nigeria CPI. The inflation rates are stated as quarterly inflation rate, exchange rates are stated in Nigeria/US dollar exchange rate and financial openness measured by capital account balance to GDP. The variables are used to demonstrate the impact of inflation rates (infl), financial openness (opn) and exchange rates (exrt) changes on the underlying market return volatility.

Model Specification

Most economic and financial time series and especially stock market volatility has always been studied using the ARCH and GARCH models introduced by Engle (1982) and Bollerslev (1986) respectively. These models help to study volatility clustering. Assuming linearity, the first and second conditional moments of return series (given its past behaviours) can be jointly estimated by GARCH (p, q) in order to characterize the dependence of future observations on past values.

For a linear model, define a univariate stochastic process for stock market returns where the information set $t \in \Omega$ of quarterly returns is defined to be $\{r_t, r_{t-1}, \dots, r_{t-q}, \dots, 1\}$. The jointly estimated GARCH (1,1) model introduced by Bollerslev (1986) is given by,

$$r_t = \mu + \varepsilon_t, \quad \varepsilon_t = \sigma_t z_t \quad \text{and} \quad z_t : N(0, 1) \quad (1)$$

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

where σ_t^2 is measurable with respect to Ω_{t-1} and $\omega > 0$, $\alpha > 0$, $\beta \geq 0$ and $\alpha + \beta < 1$ such that the model first two moments of the unconditional distribution of the series is time invariant. (Sentana, 1995, Saryal, 2007).

In this work, the impact of volatility on the market return series will be measured using the GARCH model,

$$r_t = \mu + c\sigma_{t-1}^2 + \varepsilon_t \varepsilon_t = \sigma_t z_t \quad \text{and } z_t : N(0, 1) \quad (3)$$

$$\sigma_t^2 = \omega + \alpha \sigma_{t-1}^2 + \beta \sigma_{t-1}^2 \quad (4)$$

where c is the risk premium parameter which indicates that the market return is related to its volatility (Saryal, 2007). Again, following Saryal (2007), the impact of asymmetric effect of shocks on volatility will be estimated using Sentana's QGARCH (1,1) model,

$$r_t = \mu + \sigma_t z_t, \quad \sigma_t = \sigma_t z_t \quad \text{and } z_t : N(0, 1) \quad (5)$$

$$\sigma_t^2 = \omega + \alpha \sigma_{t-1}^2 + \beta \sigma_{t-1}^2 + \gamma \varepsilon_{t-1} \quad (6)$$

where the term $\gamma \varepsilon_{t-1}$ makes it possible for positive and negative shocks to have different effects on volatility.

Now that we have determined the appropriate ARCH AND GARCH AND QGARCH model, then the estimation of the impact of inflation, financial openness and exchange rate on stock market volatility can be investigated by specifying three appropriate models.

Model I

$$r_t = \mu + \text{Infl}_t + \text{Opn}_t + \text{Exrt}_t + \varepsilon_t, \quad (7)$$

$$\sigma_t = \sigma_t z_t \quad \text{and } z_t : N(0, 1)$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_t^2 + \beta \sigma_{t-1}^2 + \theta \text{Infl}_t + \pi \text{Opn}_t + \varphi \text{Exrt}_t \quad (8)$$

The above model estimates the relationship and impact of the current inflation rate, financial openness and exchange rate on stock market volatility in the mean and variance equations.

Model I1

$$r_t = \mu + \lambda^1(\text{Infl})_t + \lambda^2(\text{Opn})_t + \lambda^3(\text{Exrt})_t + \varepsilon_t, \quad (9)$$

$$\sigma_t = \sigma_t z_t \quad \text{and } z_t : N(0, 1)$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \theta \text{Infl}_{t-1} + \pi \text{Opn}_{t-1} + \varphi \text{Exrt}_{t-1} \quad (10)$$

The above model estimates the impact of the previous period inflation rate, financial openness and exchange rate on stock market volatility in order to capture time-variation in the mean and variance equations.

Model II1

$$r_t = \mu + \lambda_1 \Delta (\text{Infl})_{t-1} + \lambda_2 \Delta (\text{Opn})_{t-1} + \lambda_3 \Delta (\text{Exrt})_{t-1} + \varepsilon_t, \quad (11)$$

$$\sigma_t = \sigma_t z_t \quad \text{and } z_t : N(0, 1)$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 + \theta \Delta \text{Infl}_{t-1} + \pi \Delta \text{Opn}_{t-1} + \varphi \Delta \text{Exrt}_{t-1} \quad (12)$$

Here, the standard GARCH (1,1) model is extended by including the impact of changing inflation rate, financial openness and exchange rate on stock market volatility in both the mean and variance. The GARCH (1,1) was adopted in this study.

RESULTS AND DISCUSSION

Using model 1 the effect of current inflation rates, financial openness and exchange rates on market return volatility using the ARCH (1) is investigated and results reported in table 2 below:

Table 1: Regression Result on Model 1

| <u>Mean Equation</u> | | |
|--------------------------|---------------------------------|----------------------------------|
| <u>Variables</u> | <u>Coefficient (Std. Error)</u> | <u>z-Statistic (Probability)</u> |
| Inflation rate | 0.1938 (1.6610) | 0.1166 (0.9071) |
| Financial openness | -8.2302 (5.2247) | 1.5752 (0.1152) |
| Exchange rate | 0.5348 (0.7757) | 0.6895 (0.4905) |
| <u>Variance Equation</u> | | |
| <u>Variables</u> | <u>Coefficient (Std. Error)</u> | <u>z-Statistic (Probability)</u> |
| Inflation rate | -306.0106 (88.6197) | 3.4530 (0.0006) |
| Financial openness | -255.5619 (108.7396) | 2.3502 (0.0188) |
| Exchange rate | -158.7335 (42.7935) | 3.7092 (0.0002) |
| ω | 26696.61 (8019.808) | 3.3288 (0.0009) |
| α | 0.1150 (0.0252) | 4.5599 (0.0000) |
| β | -0.4515 (0.1048) | -4.3084 (0.0000) |
| R = 0.2520 | | |
| R ² = 0.2235 | | |
| D. W. = 1.5737 | | |

The mean equation of model 1 shows that current inflation rate, financial openness and exchange rate have impact on stock return volatility. This impact is not significant as seen from the z-statistic probabilities. As seen from the results the estimated coefficients of inflation rate, financial openness and exchange rate are +0.1938, -8.2302 and +0.5348 respectively, meaning a 1% increase in inflation rate, financial openness and exchange rate will cause 0.19%, 8.23% and 0.53% increase and decrease in stock market returns volatility respectively. That is, a 1 percent increase in inflation rates equals 0.19 percent increase in stock market returns volatility. And a 1 percent increase in exchange rates equals 0.53 percent increase in stock market returns volatility. Finally, a 1 percent increase in financial openness equals 8.23 percent decrease in stock market returns volatility.

The variance equation for model 1 shows that the square residuals of inflation rate, financial openness and exchange rate significantly and negatively impact volatility in market returns in Nigeria. The constant term for the return series is significant, too. Using the results we can conclude that there is significant impact of current inflation rate, financial openness and exchange rate on stock return volatility in Nigeria. Also in our variance equation, the sum of $\alpha + \beta$ is 0.5665 which is less than 1. This implies that the volatility of returns is quite persistent in the model. The estimated sample variance ($\omega/(1-\alpha)$) is 30165.66, which indicates a higher persistent volatility of stock returns. It shows that returns volatility is mean reverting.

Table 2 is on model 2 and it shows the predictive power of previous inflation rates, financial openness and exchange rates on market return volatility using the ARCH (1).

Table 2: Regression Result on Model 2

| <u>Mean Equation</u> | | |
|-----------------------------|---------------------------------|----------------------------------|
| <u>Variables</u> | <u>Coefficient (Std. Error)</u> | <u>z-Statistic (Probability)</u> |
| Previous Inflation rate | 0.1819 (1.2065) | 0.1507 (0.8801) |
| Previous Financial openness | -10.0654 (6.8723) | 1.4646 (0.1430) |
| Previous Exchange rate | 0.7214 (0.9290) | 0.7765 (0.4374) |
| <u>Variance Equation</u> | | |
| <u>Variables</u> | <u>Coefficient (Std. Error)</u> | <u>z-Statistic (Probability)</u> |
| Previous Inflation rate | -328.3066 (108.9698) | 3.0128 (0.0026) |
| Previous Financial openness | -175.6729 (920.8295) | 0.1907 (0.8487) |
| Previous Exchange rate | -127.0803 (62.6075) | 1.8796 (0.0602) |
| ω | 26172.06 (9459.66) | 2.7667 (0.0057) |
| α | 0.058952 (0.0181) | 3.2434 (0.0012) |
| β | -0.2894 (0.1993) | -1.4522 (0.1464) |
| R = 0.3062 | | |
| R ² = 0.2798 | | |
| D. W. = 2.0413 | | |

The mean equation for model 2 shows that lagged or previous inflation rate, financial openness and exchange rate have no significant impact on stock return volatility. The variance equation for model 2 shows that past square residuals of inflation rate and exchange rate significantly and negatively impact volatility in market returns. While previous financial openness does not show significant impact on market returns. From the model the estimated coefficients are all significant but with different levels of confidence as seen from the z-statistic probabilities. Also in our variance equation, the sum of $\alpha + \beta$ is 0.3484 which is less than 1.

This implies that the volatility of returns is quite persistent in the model. The estimated sample variance ($\omega/(1-\alpha)$) indicates a higher persistent volatility of stock returns. It shows that returns volatility is mean reverting. This result is consistent with Yaya and Shittu (2010) using Nigerian data on inflation rates and exchange rates. Also in line with Saryal (2007), we can say that rate of inflation is one of the determinants of market return volatility in Nigeria. This could be as a result of the high inflation rates in the country. This is same for financial openness and exchange rate in Nigeria as a determinant of market return volatility.

Table 3 is on model 3 which investigate the impact of changing inflation rates, financial openness and exchange rates on market return volatility.

Table 3: Regression Result on Model 3

| <u>Mean Equation</u> | | |
|-----------------------------|---------------------------------|----------------------------------|
| <u>Variables</u> | <u>Coefficient (Std. Error)</u> | <u>z-Statistic (Probability)</u> |
| Changing Inflation rate | -1.6465 (3.3104) | -0.4973 (0.6189) |
| Changing Financial openness | 8.5291 (8.5806) | 0.9939 (0.3202) |
| Changing Exchange rate | 3.7374 (1.8515) | 2.0185 (0.0435) |
| <u>Variance Equation</u> | | |
| <u>Variables</u> | <u>Coefficient (Std. Error)</u> | <u>z-Statistic (Probability)</u> |
| Changing Inflation rate | -8.2357 (550.5617) | -0.0149 (0.9881) |
| Changing Financial openness | -8.2672 (2218.443) | -0.0037 (0.9970) |
| Previous Exchange rate | 55.2559 (512.4392) | 0.1078 (0.9141) |
| ω | 27791.37 (16708.61) | 1.6632 (0.0963) |
| α | 0.1036 (0.0102) | 10.1339 (0.0000) |
| β | -0.5631 (0.5581) | -1.0089 (0.3130) |
| R = 0.2787 | | |
| R ² = 0.2512 | | |
| D. W. = 2.1414 | | |

The mean equation of model 3 shows that changing inflation rate and financial openness have no significant impact on stock return volatility. Changing exchange rates has significant and positive impact on market return volatility in Nigeria. The variance equation for model 3 shows that the changing square residuals of inflation rate, financial openness and exchange rate do not significantly impact volatility in market returns. The adjusted R squared is lower than 31% in the three models; this shows that other macro economic variables apart from inflation rate, financial openness and exchange rate impact on stock market volatility. Also in our variance equation, the sum of $\alpha + \beta$ is 0.6676 is less than 1. This implies that the volatility of returns is quite persistent in the model. The estimated sample variance ($\omega/(1 - \alpha)$) indicates a higher persistent volatility of stock returns. It shows that returns volatility is mean reverting.

Discussion of Findings

Under model I, we found that there is no significant relationship between the explanatory variables in this study and stock market volatility. Though, only financial openness was found to be negatively associated with stock market volatility. However, under the variance equation in current period, a significant relationship was established. This result is in consonance with that of Saryal (2007), who used GARCH (1,1) model for conditional stock market volatility using data from Turkey and Canada. He found that the rate of inflation has high predictive power for stock market volatility in Turkey, whereas it is weaker, but still significant for Canada. This difference may be attributable to the fact that Turkey is an emerging market with a high inflation rate like Nigeria and Canada a developed market with a low inflation rate.

Under Model II, it was found out that in previous inflation rates and exchange rates are significantly associated with stock market volatility, but with a negative relationship. This result is in consonance with that of Yaya & Shittu (2010) and Aliyu (2011), that previous exchange rate and inflation rates have significant effects on conditional stock market volatility. Also, changes in exchange rates and inflation rates, as measured by changes in these rates also have greater impact in predicting the stock market volatility in Nigeria. These results are also in consonance with that of Olweny & Omondi (2011) that investigated the effect of macro-economic factors on stock return volatility in the Nairobi Stock Exchange, Kenya, and concluded that macro-economic factors such as foreign exchange rate, interest rate and inflation rate affect stock return volatility at the Nairobi Stock Exchange, Kenya. Specifically,

they found that the impact of foreign exchange rate on stock return is relatively low though significant.

However, these results are not in consonance with that of Oseni & Nwosu (2011) who used monthly and quarterly data with the Exponential GARCH model, and found that there is no relationship between stock market volatility and inflation and interest rate in Nigeria. This difference may be attributable to difference in scope of data coverage in these studies. From the empirical review, the differences in these results might be explained by each country's differences in economic stage, government policy, expectation pattern and financial sector activities amongst others.

In this study, we found that under changes in both the mean and variance (model III) there was no significant relationship between inflation rates, financial openness, exchange rates and stock market volatility. Though, inflation rate was found to be negative. This result is in tandem with that of Schwert (1989) who found that macroeconomic volatility as measured by movements in inflation and real output have weak predictive power on volatility of stock market and return. Also in consonance with the result of this study is that of Gruen (1995) where in his paper on the relationship between asset prices volatility and the volatility of a key macroeconomic variable: inflation, found that lower inflation variability leads to less volatility of the stock market especially the bond yields.

It was also discovered in this study that current period relationship between macroeconomic variables and stock market volatility in Nigeria is significant but negative. This is in tandem with the findings of Vardar, Aksoy & Can (2008) on effect of interest and exchange rate on volatility and return of sector price indices at Istanbul stock exchange, which shows that exchange rate significantly affect market volatility. Likewise, Chang, Cho & Hong (2010) in their study on stock volatility, foreign exchange rate volatility and the global financial crisis, found that stock volatility and Korea's dollar exchange rate has been the highest during the global financial crisis.

In previous periods it was found that there is no significant relationship between financial openness and stock market volatility and the relationship is negative. This result is not in tandem with that of Bekaert, Harvey and Lundblad (2009) that examined the effect of financial liberalization on future financial development and found that financial openness enhances the development and efficiency of the stock market. Likewise, result from Huang (2008) who investigated stock market effects of liberalizations in emerging markets financial systems shows significant evidence to suggest that financial openness is positively associated with a decrease in the aggregate cost of equity and an increase in the stock market volatility.

CONCLUSION

This paper studies the impact of inflation rates, financial openness and exchange rates on stock market return volatility in Nigeria. It has shown that inflation rate, financial openness and exchange rate significantly and negatively impact volatility in stock market returns. Again it demonstrated that past square residuals of inflation rate and exchange rate significantly and negatively impact volatility in market returns, while previous financial openness does not show significant impact on market returns. While changes in inflation rates and financial openness and exchange rates have no significant impact on market returns volatility. It was observed that there is a bi-directional relationship between financial openness and market returns volatility in Nigeria. In the same vein, there is also a bi-directional relationship between financial openness and exchange rate. Measures should be employed towards monitoring

inflation in the country; this would certainly reduce stock market volatility, improve stock market returns and boost investors' confidence in the market.

Policy Implication

The result of this research would yield important implications for policy makers, investors, stock brokers and economic forecasters. Firstly, that rate of inflation is one of the determinants of market return volatility in Nigeria. For the period of consideration in this study, it could be observed that inflation rate in the country was very high and one should expect higher nominal stock return/volatility in line with the simple Fisher effect.

Secondly, exchange rate in Nigeria is a determinant of market return volatility. Exchange rate relationship with market return volatility is negative. Changes in exchange rates would affect a firm's foreign operation and overall profits which would, in turn, affect its stock prices. Nigeria as a country is import denominated, with a high exchange rate. This implies a weak currency that may have a negative impact on the country in general, and stock market returns in particular due to the increase in the cost of imported goods for production. Financial openness on the other hand had negative impact on stock market volatility in Nigeria. This relationship was only significant with current financial openness and insignificant with previous and changing financial openness. The opening of our border and foreign activities (significant dependence on international trade) has not increased stock market return volatility or risk in Nigeria.

Policy Recommendations

The government through her policy makers and relevant agencies (like CBN) should ensure that appropriate measures are employed towards monitoring inflation in the country. One of these appropriate measures is that the CBN should control the quantity and quality of credit either by raising the bank rates or by selling securities in the open market. Another appropriate measure is that the Nigerian government should reduce unnecessary government expenditure on non-developmental activities. When these measures are in place, it would certainly reduce stock market volatility, improve stock market returns and boost investors' confidence in the market.

Macroeconomic policies aimed at keeping inflation rate at a manageable level should be designed by government. A useful macroeconomic policy here is the adoption of anti-inflationary budgetary policy – surplus budget approach and not deficit financing. Another policy is to increase production in order to increase aggregate supply. These policies ensure price stability, stable and market determined exchange rate and enhance balance of payment equilibrium. This stabilization policy and a stable economy environment will reduce stock market volatility and provide the impetus for investors to invest in the Nigerian stock market.

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Figure 1: exchange rate, inflation rate, market return volatility and financial openness computed by standard GARCH (1,1) model

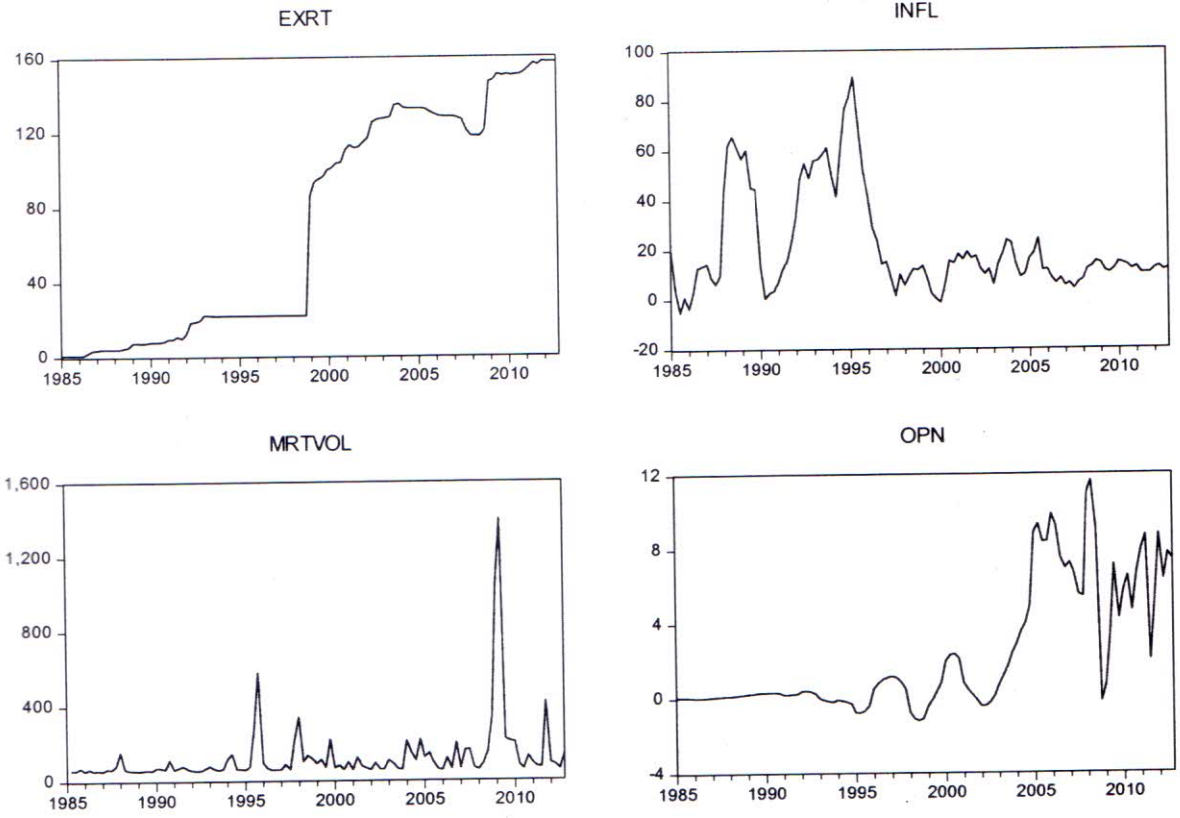


Figure 2: Market return volatility and inflation rate in Nigeria

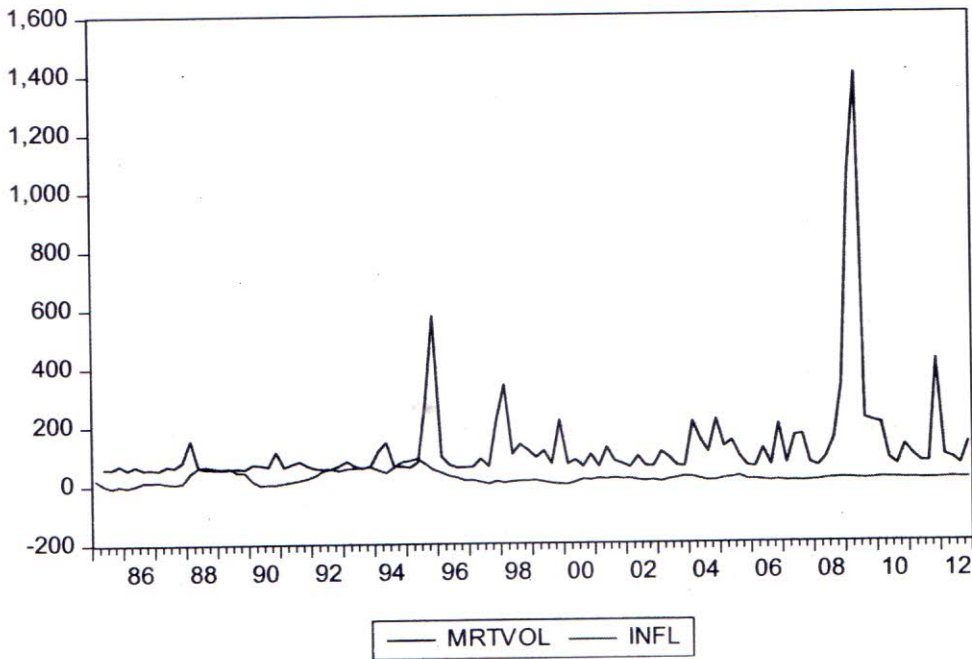


Figure 3: Market return volatility and financial openness in Nigeria

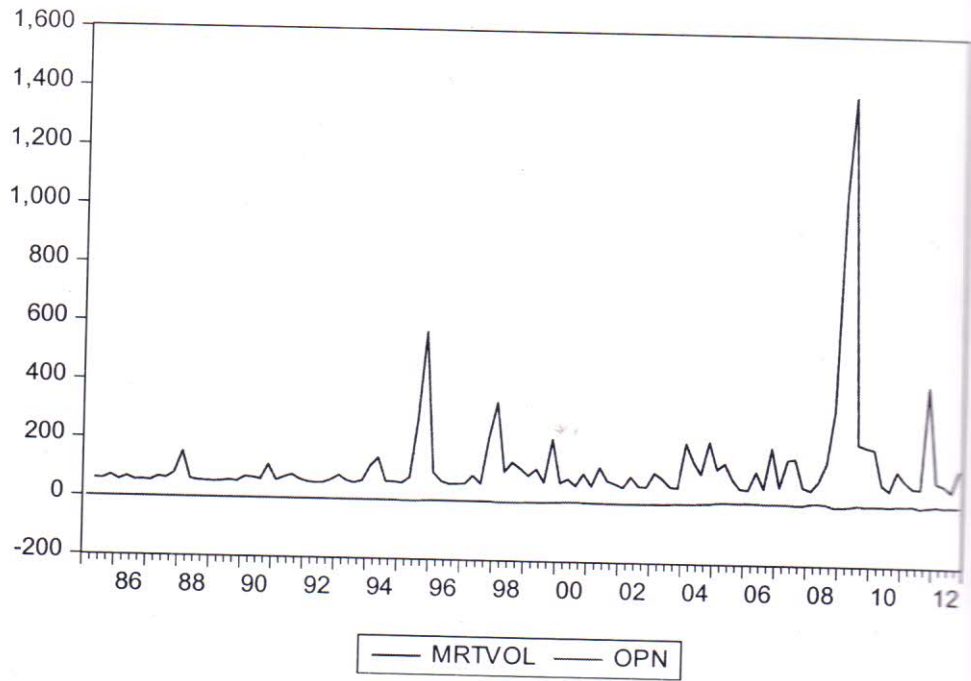


Figure 4: Market return volatility and exchange rate in Nigeria

