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Sensitivity of Stock Returns Volatility and Money Market Rates: Insight from Nigeria

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ABSTRACT

The study focused on how money market factors affected the stock return fluctuations in the Nigerian setting. The study specifically looked at the impact of Treasury bill rates and monetary policy rates on the return fluctuations in Nigeria from 2002 - 2016 over the study period. Financial econometrics study was performed using descriptive statistics, unit root test, heteroscedasticity, autocorrelation, GARCH (1.1), and GARCH-X (1.1) models. The series' stationarity was confirmed using the PP test and the Equally Augmented Dickey-Fuller (ADF) test. Additionally, a Benchmark GARCH (1.1) model was estimated to study the volatility. A diagnostic test was run using the Ljung-Box Q-Statistics to determine the robustness of the calculated GARCH model. The overall finding indicated that there was significant volatility clustering that was still present in the Nigerian exchange group, suggesting that it would take some time for the market's reaction to volatility shocks from the prior period to be completely eliminated. The study also discovered that changes in treasury bill rates and monetary policy rates significantly reduce the volatility of returns on the stock in Nigeria, supporting the idea that there is an inverse link between the value of money and the value of capital markets.

Kata Kunci:
Indikator Harga Pasar Uang, Pengembalian Pasar Saham, Volatilitas, Model GARCH 1-1

ABSTRAK

Sensitivitas Volatilitas Pengembalian Saham (Return Saham) dan Harga Pasar Uang: Pandangan/Persepsi dari Nigeria. *Penelitian ini berfokus pada bagaimana faktor pasar uang mempengaruhi fluktuasi return saham di Nigeria. Penelitian ini secara khusus melihat dampak dari tingkat tagihan Treasury dan tingkat kebijakan moneter pada fluktuasi pengembalian di Nigeria dari tahun 2002 - 2016 selama masa penelitian. Penelitian ekonometrik keuangan dilakukan dengan menggunakan statistik deskriptif, uji akar unit, heteroskedastisitas, autokorelasi, model GARCH (1.1), dan GARCH-X (1.1). Stasioneritas seri dikonfirmasi menggunakan uji PP dan uji Equally Augmented Dickey-Fuller (ADF). Selain itu, model Benchmark GARCH (1.1) diperkirakan untuk mempelajari volatilitas. Tes diagnostik dijalankan menggunakan Ljung-Box Q-Statistics untuk menentukan kekuatan model GARCH yang dihitung. Temuan keseluruhan menunjukkan bahwa ada pengelompokan volatilitas yang signifikan yang masih ada di kelompok pertukaran Nigeria, menunjukkan bahwa perlu beberapa waktu agar reaksi pasar terhadap guncangan volatilitas dari periode sebelumnya benar-benar dihilangkan. penelitian ini juga menemukan bahwa perubahan dalam tingkat tagihan treasury dan tingkat kebijakan moneter secara signifikan mengurangi volatilitas pengembalian saham di Nigeria, Hal tersebut mendukung gagasan bahwa ada hubungan terbalik antara nilai uang dan nilai pasar modal.*

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INTRODUCTION

An unresolved attribute of the behavior of the financial market in recent years has remained asset price volatility. The growing benefit of stock markets has prompted economists and policymakers to forecast stock prices and financial returns (Türkyılmaz and Balıbey 2014) Stock market behavior and effective macroeconomics policies have a very strong link; since asset prices to Xu (2007) are the essential tools people use to convey their confidence about the situation of the economy and a less volatile stock market in this regard, is critical for the country's economic transformation process.

The unpredictability of stock returns is used to describe the irregularity of stock price variations in a specific period in the developed and/or emerging market economy. Extreme unpredictability to investors will erode the value of stock prices which will lead to an increasing in financial risk, and this can destabilize investors' assets and wealth (Blitz, Falkenstein, and Van Vliet 2014). Furthermore, he stated that regardless of whether it is used to evaluate risk; extreme stock return volatility undermines the worth of the stock prices which demonstrates the essential worth of the firm. Further macroeconomic fluctuations increase the unpredictability of stock returns, gives rise to risk and investors might consider switching their investment to a portfolio with a reduced amount of risk. Experience has shown that each time the stock market shows excess volatility, investors are likely to lose their trust and possibly will exit the market (Owidi and Mugo-Waweru 2016). Similarly, volatility is believed to be reasonably high for the period of economic recession, and increase volatility tends to be connected with fragile economic conditions thus affecting macroeconomic variables. Equally, economic volatility is linked to fluctuations in risk aversion since investors tend to avoid risk more during economic decline.

The Monetary Policy of countries is constantly monitored carefully by stock market investors. This is because; when government monetary policy changes, it could produce damaging or favorable effects based on the actual course of such change. For instance,(Thorbecke and Alami 1994) observes that when the change is contractionary, it will boost the Policy Rate, thus reducing the money supply by reducing the non-borrowed reserve. Similarly, when the change is expansionary, it lowers the Policy Rate and expands the money supply by increasing in the non-borrowed reserve (Hameed 2011). (Crowder 2006) using the future cash flow theory of stock price valuation argues that when monetary policy is contractionary, it then lowers stock prices and vice versa.

Furthermore, he argues that this will help to offset a negative relationship associated with changes in money demand since improved earnings of firms are associated with increased interest rates showing a strong link. Similarly, when policy changes are not anticipated it will affect the stock market due to the market's forward-looking nature. (Saeed, Chowdhury, and Akhter 2006) using the future cash flow theory of stock price valuation argues that when monetary policy is contractionary, it lowers stock prices and vice versa. Further, he argues that this will help to offset a negative relationship associated with changes in money demand since improved earnings of firms are associated with increased interest rates showing a strong link. Similarly, when policy changes are not anticipated it will affect the stock market due to the market-forward looking nature.

Similarly, Fisher (1930) asserts that anticipated interest rate on monetary resources should go in line with inflation rate. He argued further that increased interest rate poses a threat to the financial system, because the variation of inflation reacts completely toward the unpredictability of interest rate; such development to Fisher could pose a grave challenge to monetary policy administration. Fluctuations in the worth of stock tend to have an equivalent effect primarily through the Money Market (Ngozi 2014). This is because any upward

adjustment in stock prices increases demand for investment fund which is believed to capitulate high interest rates in the financial system (Spiro, 1990). This is consistent with Fisher (1930) who observed that high interest rate may likely endanger any financial system, given that the variation of price increase reacts absolutely to the unpredictability of interest rates. Such development could create a grave danger to Monetary Policy Management.

The Treasury bill rates serve as substitute for interest rate because they represent an alternative to investing in shares as well as a standard for interest rate measurement (Kuwornu 2012). Mukherjee and Naka (1995) argues that any change in both short and long- term rates are likely to influence the rate of discount in the same manner considering their effect on risk - free rates. Interest rates plays a vital role in investment practice as a risk-free rate also because it is perceived as a rate of return on asset that has a certain pay-off. Investor use treasury bills rate as one of the risk-free interest rates in investment decisions and stock valuation (Under and Of 1964). Supporting the above assertion, they claim that thigh Treasury bills rate ought to transform into a corresponding rise in the required rate of return which gives rise to investment returns. They further argue that high treasury bills are supposed to translate into a corresponding increase in the expected rate of investment return and comprise a risk-free rate and/or premium. In the view of Otieno *et al.,* (2017) argued that treasury bills usually struggle with stocks, and investors are expected to shift most of their funds to treasury bills and less to stocks due to increased treasury bills rates and since treasury bills to them are relatively safer as they have the promise of government.

On the relationship between treasury bill rates and stock market returns, (Patel 2019) discovered that high Treasury bill rates lead to an increase in the charge on borrowing which reduces economic activity. This equally will affect corporate earnings, future cash flow of business, and dividends. When government borrowing increases due to the issuance of more treasury bills, investors will rebalance their portfolios as such affecting the stock market. Conversely, when Treasury bills rate is reduced it is believed to promote the movement of domestic fund across the markets. Equally, increased Treasury bill rate, tend to encourage more investment on government instruments. This triggers off competition between the markets, thereby bringing down the interest on stock market instruments and thus reducing stock prices (Pilbeam, 1992).

Nigeria aspires to be ranked among the world's greatest economies, the role of a less volatile stock market in this regard is critical for the country's economic transformation process. This is because extreme unpredictability to investors will weakens the value of stock prices which will leads to increase in financial risk, and this potentially destabilizing investor's assets and wealth. Experience has shown that each time the stock market shows excess volatility, investors are likely to lose their trust and possibly will tend to exit the market (Bhowmik 2013). It is reasonable to state that changes in the level of uncertainty of any of these variables could equally alter stock market returns.

The development of the money market is vital as it is used to transmit the instruments of Monetary Policy (Ghosh and Bhattacharyya 2009). A well performing money market therefore is vital as it used to carry out Monetary Policy Operations and ensure the provision of required liquidity to the market using government and/or corporate bond (Becker et al. 2015). Chen *et al.,* (1986) used particular macroeconomic factors to substitute for the vague variables in Asset Pricing Theory. The authors observed that returns on equity are the function of macroeconomic variables given that those macroeconomic factors influence the expected dividend. (Pathan and Masih 2015) collaborated with the study and conclude that macroeconomic indicators affect the value of stock systematically.

The majority of the empirical research on money market indicators' effect on return volatility comes from industrialized and developing nations; there is relatively little data showing how money market indicators affect stock return volatility in Nigeria. (OLOWE 2011) invesigated the volatility of the inter-bank call rate, (Yaya and Shittu 2010) estimated "the impact of inflation and exchange rate on stock market return volatility," and (Aliyu 2011) calculated "the effect of inflation on the volatility of stock market returns volatility," (Decker and Decker, n.d.) examined "stock market volatility and macroeconomic variables in Nigeria," and (Yaya and Shittu 2010) estimated "the impact of inflation and exchange rate on stock market return volatility." The diverse views on the relationship between money and the stock market must therefore be reconciled because this research has produced varied results depending on the macroeconomic conditions and/or variables used. Using money market indicators, such as the Treasury bill rate and the monetary policy rate, it was determined how money market indicators affected stock return volatility in Nigeria. The study expands on earlier research on their impact on market returns for stock and boosts the body of existing information. The precise goals of the study are to establish the relationship between the Treasury Bill Rate and the Nigerian All-Share Index as well as the links between the MPR and the Nigerian ASI.

LITERATURE REVIEW

Numerous scholars from around the world have focused a lot of emphasis on the connection between the volatility of stock returns and the money market rate. Falianty & Budimanta (2020) examined the financial, currency rate, and contagion volatility brought on by the Argentina-Turkey conflict and global unrest in 2018. The regression approach, simple correlation, DCC, and VAR were all employed. The study also investigated the possibility of contagion in the stock and rate of exchange markets as well as in the determination of the rupiah rate of exchange from contagion and fundamental issues surrounding the balance of payment (BOP) condition. The empirical finding demonstrates the possibility for the economic crisis in Argentina and Turkey to spread to Indonesia, particularly to the stock market and rate of exchange. The results of the regression and correlation analysis further demonstrate that Turkey has a greater financial contagion effect on the Indonesian financial market than Argentina. An important factor in explaining the depreciation of the rupiah's currency rate is the balance of payments situation. Erdogan, Grediki, & Cevik (2020) examined the volatility spillover impact that exists between forex markets and Islamic stock markets for the major three emerging nations of India, Malaysia, and Turkey using daily data from 2013 to 2019. They applied Hafner and Co's Causality-in-Variance Test (2006). The Time-Varying Test Statistics were also computed by the authors using rolling samples to assess the nature of the association between the variables and determine whether it fluctuates over time. Volatility spillovers from the Turkish foreign exchange market to the Islamic stock market were supported by the author's arguments. Their time-varying experiments also show that there is at times a one-way volatility spillover between currency rates and the Islamic stock market.

In their study of the Association of Southeast Asian Nations-5 (ASEAN-5) countries from January 1995 to December 2018 (covering three regimes), (Thampanya et al. 2020) analyze the influence of fundamental and behavioral determinants in stock return volatility (before Asian, between and after Global financial crises). They discover that in Malaysia, Thailand, and Singapore, fundamental variables are key in determining stock market volatility,

whereas in other countries, such as Indonesia and the Philippines, behavioral factors have a greater impact on stock market volatility than fundamental ones.

Using OLS and GARCH (1.1), (Marozva 2020) looked at how closely stock returns were correlated with interest rates and currency rates from 1995 to 2019. Finally, the author noticed several surprising findings that added to the body of literature and showed how various markets react to various inputs. The study's most important discovery was a considerable positive correlation between stock returns and interest rates, which the Keynesian hypothesis, which was supported by the use of a sticky-price model, explains. The findings showed that exchange rates and stock market price returns had a negative and significant association. The study also found a strong and positive correlation between interest rates and stock return volatility. Additionally, only a highly significant positive correlation was found between exchange rates and the OLS method used to calculate the return volatility of the JSE All-Share Index.

(Worlanyo et al. 2019) investigated the short-run and long-run dynamics of the link between interest rates and stock market returns in Ghana using time series analytic models with Johansen's co-integration process and the vector error correction model. Their findings demonstrated that, contrary to widely held beliefs based on prior research, interest rate adjustments have a positive and significant impact on stock market returns over the long term, and that, following a short-term stock market shock, the long-run equilibrium is restored period after period. The relative strength of banking stocks on the Ghana Stock Exchange explains this. Equally demonstrates that the short-term variances dramatically reduce as the long-run equilibrium is reached.

The impact of the money supply, exchange rate, and interest spread on the performance of the Malaysian stock market was examined by Qing & Kusairi in 2019. According to the results, the money supply, real effective rate of exchange, and interest spread all had a long-term impact on the stock market's performance. The real effectiveness of the rate of exchange and the money supply both have a favorable short-term impact on stock market interactions. On the other hand, the interest spread had a short-term negative impact on the performance of the stock market. The volatility revealed strong correlations among the money supply, real effective exchange rate, interest spread, and stock market (KLCI). The study's conclusion is that before making stock investments or policies to stabilize the performance of the stock market, affected persons should consider interest rates and exchange rate fluctuations.

(Okechukwu et al. 2019) examined the occurrence of high market returns fluctuation and the impact of the exchange rate, interest rate, and inflation on stock market returns using monthly financial data from 1995 to 2014. According to the authors, excessive volatility prevents the stock market from performing its function of financial intermediation, which could result in a financial crisis. They also discovered that whereas inflation and exchange rates have a positive association with stock market returns, interest rates have a negative relationship with stock market returns. However, they draw the conclusion that the returns on the Nigerian stock market exhibit considerable and ongoing volatility. Additionally, the volatility of the Nigerian stock market return is substantially influenced by the exchange rate, interest rate, and inflation.

The return and volatility spillovers in the Nigerian financial market are examined by (Fasanya and Akinde 2019). Specifically, they used financial data from 2002 to June 2017 to

investigate the spillovers in the stock market, money market, and foreign currency market. The authors initially calculated the total spillover, directional spillover, and net spillover indices using the Diebold and Yilmaz (DY) (2009, 2012) technique. To capture the secular and cyclical movement in the financial markets over the period under examination, they also used rolling window analyses into consideration. The article discovers a low level of financial instrument interdependence as well as cross-market spillovers. The report also showed that the stock market is both the biggest net recipient and sender of return spillovers to other markets, while the money market is both the biggest net donor and receiver of volatility spillovers, followed by the foreign currency market. Return researchers found that whereas volatility spillovers reveal huge bursts but no patterns, spillovers from spillovers reveal only small trends and bursts.

Using data from 1986 to 2018, Umezulike, Nwaolisa, & Ananwude (2019) used the Autoregressive Distribute Lag (ARDL) model to examine whether or not monetary policy affects stock market return on the Nigerian Stock Exchange (NSE). Based on the data examined, they draw the conclusion that changes to the Central Bank of Nigeria's monetary policy tools have little to no impact on the return on the Nigerian stock market (CBN).

(Pproach 2019) investigated the effects of currency, money supply, and interest rate shocks on stock returns. Their findings support asymmetric co-integration in Turkey between stock returns, real effective exchange rates, rate of interest, and money supply. Their findings also show that prices of stock respond asymmetrically to changes in the real effective exchange in the short- and long-term, while interest rate fluctuations affect stock returns predominantly in the short term. Furthermore, the Turkish money supply is symmetrically linked to stock returns.

(Khan, Teng, and Khan 2019) employed an asymmetric ARDL model to examine the effect of oil prices on Shanghai stock returns from 2000 to 2018. The asymmetric autoregressive distributed lag model shows oil prices and stock returns co-integrate. Rising oil prices have a detrimental long- and short-term influence on Shanghai Stock Exchange stock returns, whereas declining oil prices have the reverse effect.

Dogo & Uzonwanne (2018) studied the volatility spillovers in stock returns and the exchange rate due to foreign investors in the Nigerian stock market. The authors modeled mean return, return spillover, and shock spillover between stocks and currencies using their return series and a VARMA-AGARCH model. Their data reveal an Intermarket transmission mechanism. Shock spillovers showed a higher, unidirectional propagation of stock market shocks to the forex market. They considered breakpoints and discovered bi-directional spillover in both marketplaces.

The relationships between prices of stock, rate of inflation, and interest rates were evaluated by (Uddin et al. 2018) and are still present. evidence-based on the stock duration model. According to the panel Johansen cointegration analysis's findings, there is cointegration between stock prices, changes in stock prices brought on by inflation rates, and changes in stock prices brought on by real interest rates. According to the results of cointegration regression, real interest rates and stock prices are positively correlated, but changes in real interest rates and inflation rates are inversely correlated with stock prices. Granger caused significant changes in stock prices, a significant increase in the rate of adjustment to the long-term equilibrium between observed stock prices and real interest rates, as well as a significant decrease in the rate

of adjustment to the equilibrium between changes in stock prices brought on by real interest rate changes and changes in inflation rates.

Using monthly data from 1998 to 2014, (Setiawan 2020) examined the effect of macroeconomic volatility on stock market return for the fifty listed on the Karachi Stock Exchange. Macroeconomic variables employed in the inquiry include market return, industrial production, interbank call money rate, term structure, money supply, rate of exchange, and inflation rate. The study adopted the Rational Valuation Formula (RVM). Significant auto regression's outcome raises the possibility of volatility persistence. The industrial output demonstrates a negative impact on Pakistan's stock market returns volatility. Equally, the volatility of the exchange rate catches the volatility of the external sector and exhibits beneficial effects on the volatility of returns. Stock return volatility is negatively impacted by unanticipated changes in call money and the term structure of interest rates, while it is positively impacted by the increasing variance in the money supply and inflation. They came to the conclusion that the unpredictability of financial and economic variables influences stock price swings in Pakistan.

For a time frame between November 2004 - November 2017, Kamal (2018) adopted econometric models to study the relationship between TBR, interest rate, and the Egyptian Stock Market. According to the study's findings, there is no positive correlation between Treasury bill rates, interest rates, and returns on the Egyptian stock market. Additionally, the co-integration between these three variables was revealed by the econometric study, indicating a long-term association. However, the author comes to the conclusion that, over time, South Africa's profits on the Egyptian stock market are affected jointly by both interest rates and Treasury bill rates.

In their study, (Otieno, Ngugi, and Wawire 2017) investigated Granger causality involving the two measures of interest rate and stock market returns in Kenya. They used an ARFIMA model and looked at the stochastic properties of the macroeconomic variables, and stock market returns with their co-integrating residuals in Kenya. The authors' monthly data ranges from January 1, 1993, to December 31, 2015. Their findings show that the 3-month Treasury Bill rate, loan rate, and stock market returns are partially integrated, implying that shocks to the variables persist but eventually fade. Furthermore, their findings show that the co-integrating residuals are only partially taken into account, which suggests that when each of the interest rate measures is diverted from stock market returns, a new and harmful long-run equilibrium may be established. Additionally, their research demonstrates, among other things, that the long-term effects of the 3-month Treasury Bill rate and lending rate negatively affect stock market returns, indicating that stocks and Treasury Bills are competing for investment assets.

Oladapo, Adeyeye, Seyingbo, & Owoeye (2017) looked into how exchange rates affect stock market performance by utilizing MCAP monthly data as stock market performance indicators and monthly exchange rate data as a parameter for quantifying exchange rate volatility. The outcome demonstrated that the four models' residual volatility of variance differed from one another. It was found that whereas the GARCH model has both GARCH and ARCH effects, the ARCH model does not have any ARCH effect. According to the report, the government should enforce laws that forbid the importing of non-necessary, less-productive

goods and services and foster favorable conditions that would boost the creation and export of goods and services.

Using a sample of five open nations—Mauritius, London, Australia, Japan, and Trinidad each with a developing stock market from 2004 to 2014, Bissoon, Bhattu-Babajee, & Sectah (2016) evaluated the effects of monetary policy on stock markets. The panel regression and panel vector error correction models were employed by the authors to analyze the short- and long-term relationships between the variables. Their research shows a clear correlation between money supply and stock return as well as a negative relationship between interest rates and stock return. The study's findings support the idea that both short-run and long-run financial factors influence variations in stock performance.

(Bhat and SZA Shah 2015) looked at the relationship between stock return volatility and changes in the currency rate. The study made use of estimation parameters such ARCH, GARH models, Unit root test, Johannsen Co-integration test, and Granger causality test. ARCH, GARCH, EGARCH, and T-GARCH were used to test the volatility. The unit root test demonstrated that both series are level and stationary. Both variables are co-integrated into one another, according to a cointegration test. Additionally, the Ganger causality test demonstrates a two-way causal relationship between the two variables.

From 2000 to 2009, the co-movement of stock market volatility between China and the ASEAN-5 nations was examined by Jakpar, Vejayon, Johari, & Myint. The findings show that China and the ASEAN-5 have a reasonably similar stock market volatility trend. The findings demonstrate that there are two-way causal relationships between China and Singapore, Thailand, and Indonesia. China and Malaysia, as well as China and the Philippines, have no causal connection. However, it can be said that there is a correlation between geographical areas and stock market volatility.

METHODOLOGY

Using the Generalized Autoregressive Conditional Heteroscedasticity (GARCH 1.1)-X Model to study the impact of money market variables on stock market return volatility in Nigeria. The GARCH 1.1 model is appropriate because financial time series, such as stock prices, have been stylized to indicate the trend of volatility clustering, or times when their prices display large swings for a long time followed by calmer intervals (Chali and Ashe 2016) .Because it enables the addition of an explanatory variable to the GARCH equation, the GARCH-X (1,1) model is a suitable model. In line with (Lee, 1994; Hwang and Satchell, 2005; Emenike & Odili, 2014), this involved approximating the equation shown below:

$$R_t = \theta + \mu_t \quad (1)$$

$$\mu_t \sim (0, \sigma^2_t)$$

$$\sigma^2_t = \alpha_0 + \alpha_1\mu^2_{t-1} + \beta_1\sigma^2_{t-1} + \lambda\,(\text{Money Market Indicators})_{t-} \quad (2)$$

Where:

R_t in equation (1) = the stock market return,

μ_t = the error term,

σ^2_t = the conditional variance,

α_0 = the constant variance that corresponds to the long-run average,

α_1 = the first order ARCH term that transmits volatility news from the previous period, and

β_1 = the first order GARCH term is the new information that was not available when the previous forecast was made (Engle, 2003; Emenike, 2010).

λ = the variable that measures the effect of money market indicators on stock market returns volatility.

To calculate the effect of money market indicators (Treasury Bills and Monetary Policy Rate) on the volatility of stock market returns in Nigeria, Equation 2 is an appendix to the conventional GARCH (1.1) model. The estimate of λ estimates how much the volatility of Nigeria's stock market returns is impacted by various money market indicators. For instance, a positive and statistically significant lambda coefficient would suggest that money market indicators have a favorable impact on the volatility of Nigerian stock market returns. A statistically negligible lambda coefficient, on the other hand, would mean there was no impact. However, the linear function of the above information is hereby modified and estimated in line with the variables of the study as follows;

$$ASI_t = F(TBR, MPR,)$$
$$ASI_t = \beta_o + \beta_1 TBR_t + \beta_2 MPR_t + \mu_t \ldots \quad (3)$$

Where,

ASI = All Share Index (dependent variable)

TBR = Treasury Bill Rate

MPR = Monetary Policy Rate

T = Time series (Monthly) values.

B_0 = Represents the constant or intercept

$B_1 .. \beta_2$ = Represents the regression coefficients to be estimated

μ_t = Error or disturbance term.

The assumption of the GARCH-X (1,1) is that the error term is serially uncorrected with an absence of heteroscedasticity.

We looked at how well the GARCH-X (1,1) model fit the data in order to assess its suitability. The computed standardized residuals should not only provide a satisfactory fit but also be serially uncorrelated and show no signs of persisting conditional volatility (Engle and Paton, 2001). By checking the standardized residuals for independence, The GARCH-X model's suitability for fitting to the return series of the Nigerian financial markets will be evaluated. If the mean model is adequate, the standardized residuals will be uncorrelated. Another quality of a good variance model is uncorrelated squared standardized residuals (Emenike, 2015).

Sources of Data

The study used time-series data. The data consists of the monthly All Share Index of the Nigerian Stock Exchange (ASI), Treasury Bills Rate (TBR), and Monetary Policy Rate (MPR) for the period from January 2002 to December 2016. The data for this study were sourced from

the Central Bank of Nigeria Statistical Bulletin and the Nigerian Securities and Exchange Commission (NSEC)

Data Analysis - Descriptive Statistics of Money Market Indicators and Stock Market in Nigeria

Tables 1 Show the descriptive statistics of the level series of the monthly All-share index, treasury bills rate, and monetary policy rates, in Nigeria. Notice from Table 2 that the average bill rate for the study period is 10% while the mean monetary policy rate is 11.9%.

Table 1: Descriptive Statistics for Money Market Indicators and Stock Market Level Series

	SMR	TBR	MPR
Mean	28680.73	10.13	11.97
Min.	10581.90	1.04	6.00
Max.	65652.38	24.50	20.50
Std. Dev	11340.06	4.55	3.40
Skewness	1.01(0.00)	0.34 (0.06)	0.18 (0.32)
Kurtosis	0.98 (0.00)	0.19 (0.69)	0.10 (0.77)
J-B Stat.	38.07 (0.000)	3.81 (0.14)	1.09 (0.57)

Note: *P*-values are displayed as (.). All the tests are conducted at 5% significant level

Source: Author's Computation, 2018 using RATS Version 9.0

Table 2 presents the descriptive statistics of the return series of the monthly All-share index, treasury bills rate, and monetary policy rates in Nigeria. Observe that the monthly mean returns of the All-share index, treasury bills rate, interbank call rate, monetary policy rates, and prime lending rate in Nigeria are 0.5%, -0.2%, -0.2%, respectively. The null hypothesis of a normal skewness distribution is 0. The value of skewness for Treasury Bills rates, Inter-bank rates, monetary policy rates, and prime lending rates in Nigeria are -0.563, 0.914, and -2.034, respectively. These show that the All-share index and monetary policy rates are negatively skewed, and treasury bills rates are positively skewed. In a properly distributed series, skewness is typically 0 and kurtosis is 3. The time series under examination has positive and/or negative skewness, which indicates asymmetry. Kurtosis coefficients larger or less than 3 indicate peaks or flat data, respectively (Emenike, 2015). Excess kurtosis in a naturally distributed series is 0. Excess kurtosis with a positive or negative value denotes a peak or flatness in the data. Leptokurtosis is evident in all of the series' kurtosis coefficients. Leptokurtosis implies that extreme observations are significantly more likely to occur for a significant portion of the time. Leptokurtic stock returns, for instance, imply that investors may receive extremely high returns while also suffering significant losses on their capital (see, Emenike, 2015).

Jarque-Bera statistics also show absence of non-normal distribution in all the series.

Table 2: Descriptive Statistics for Money Market Indicators and Stock Market Return Series

	SMR	TBR	MPR
Mean	0.005	-0.002	-0.002
Min.	-0.365	-0.806	-0.336
Max.	0.323	1.178	0.260
Std. Dev	0.072	0.199	0.054
Skewness	-0.563 (0.002)	0.914 (0.000)	-2.034 (0.006)
Kurtosis	5.376 (0.000)	10.772 (0.000)	16.520 (0.000)
J-B Stat.	225.037 (0.000)	890.493 (0.000)	2159.033 (0.000)

Note: *P*-values are displayed as (.). All the tests are conducted at 5% significant level
Source: Author's computation, 2018 using RATS Version 9.0.

Time Series Graphs of Money Market Indicators and Stock Market series in Nigeria

Figures 1 to 3 present plots of log-level and return series of the All-share index, treasury bills rate, interbank call rate, monetary policy rates, and prime lending rate in Nigeria for the study period.

Figure 1: Time Graph of Level and Returns for Stock Market Index in Nigeria January 2002 to December 2016 (Source: Nigeria Journal of Securities and Finance, 2016)

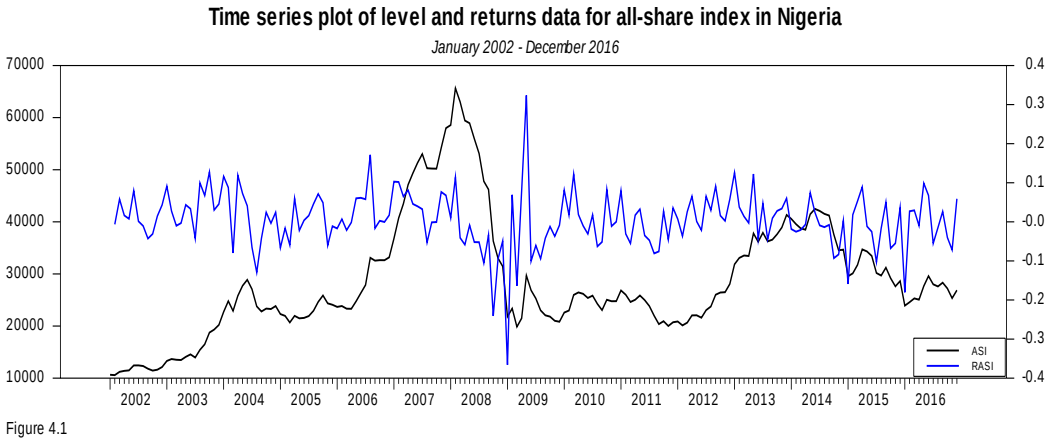


Figure 4.1

Notice from Figure 1, that the log-level series was trending upward till the first quarter of 2008, when it started a downward trend as a results global financial crisis. This implies that the log-level series may not be stationary. Towards the first quarter of 2012, the series regained its upward movement. This is an indication that Nigeria stock may have regained investors' confidence. The return series, on the other hand, appear to be mean reverting, which is an indication that the series appear stationary. Be sure to pay attention to the significant downward and upward spikes in the years 2008 and 2009, which coincide with the time of the global financial crisis.

Figure 2: Time Graph of Level and Returns Data for Treasury-Bill Rate in Nigeria January 2000 to December 2016

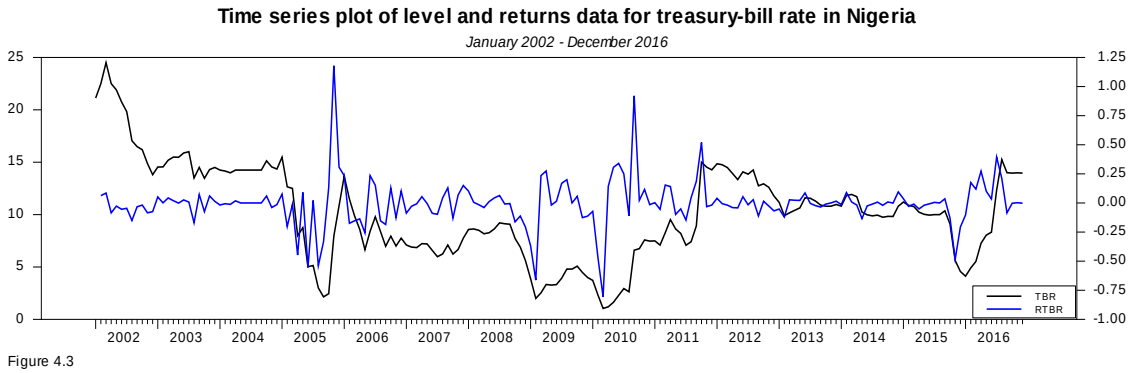
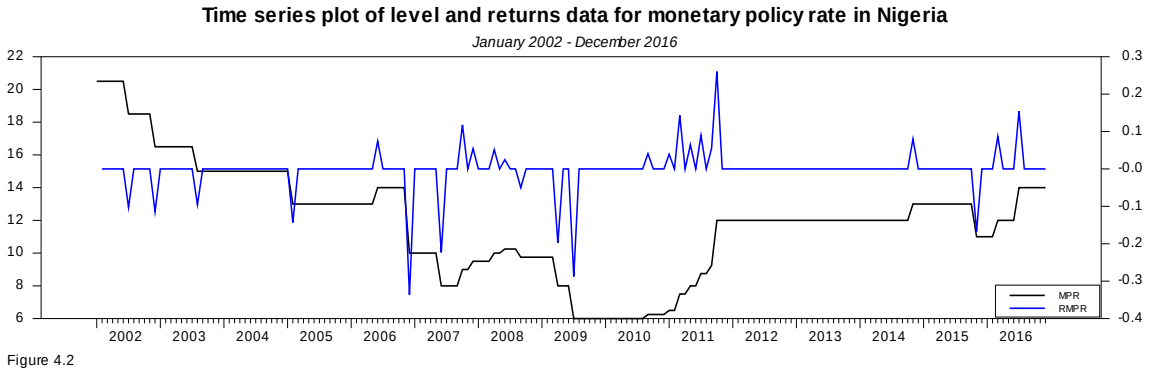


Figure 2 present the line graph of the log-level and return series of the Treasury bill rates for the sample period. Notice from the graph that the level series started declining from the second quarter of 2002 till the last quarter of 2005 before picking up in the first quarter of 2006. Notice also that the level series do not appear stationary whereas the return series are stationary. Another major trend is that the treasury bills rates did not decline immediately affected by the global financial crisis in the first quarter of 2008.

Figure 3: Time Graph of Level and Returns Data for Monetary Policy Rate in Nigeria January 2002 to December 2016.



The figure, presents the line relationship between the log-level and return series of the monetary policy rates in Nigeria. Figure 3, presents the line relationship between log-level and return series of the monetary policy rates in Nigeria for the study period. Observe from the graph that the log-level series appear flat in most cases followed by step-like movement. This is not surprising given that the Monetary Policy Committee usually retains the MPR until a change in expectation is envisaged. Notice also the wide fluctuations in the return series (Emenike, 2015). The return series also seems to be coming back to the mean value.

Unit Root Tests for Money Market Indicators and Stock Market Series in Nigeria

Tables 4 and 5 present the results of unit root tests conducted on the log-level and first difference series of the stock market indices, treasury bills rate and monetary policy rates. The unit root tests were conducted using augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The

ADF and PP tests were conducted at 5% level of significance in order not to accept a false null hypothesis.

Table 3: Results of Unit Root Test for Money Market Indicators and Stock Market Level Series in Nigeria

	Augmented Dickey Fuller results		Phillip-Perron results	
	5% critical value	computed value	5% critical value	computed value
SMR	-3.435	-1.823	-3.435	-2.036
TBR	-3.435	-3.252	-3.435	-2.920
MPR	-3.435	-1.319	-3.435	-1.408

Note: ** refers to 5% statistical significance levels.
Source: Author's computation, using RATS Version 9.0.

As we can see from Table 4, the money market indicators and stock market series are not stationary at their levels, except for interbank call rate series. This is evidenced in the computed ADF coefficients being less than theoretical values in absolute terms. Similar results were obtained from PP tests except.

Table 4: Results of Unit Root Test for Money Market Indicators and Stock Market Return Series in Nigeria

	Augmented Dickey Fuller results		Phillip-Perron results	
	5% critical value	computed value	5% critical value	computed value
SMR	-3.435	-11.560**	-3.435	-11.815**
TBR	-3.435	-10.334**	-3.435	-10.394**
MPR	-3.435	-13.1513**	-3.435	-13.283**

Source: Author's computation, using RATS Version 9.0

The absolute values of the calculated ADF coefficients, however, exceed the critical values at the 5% significance level in their initial differences. Table 5 demonstrates that, at the 5% level of significance, the estimated ADF coefficients for the stock market, treasury bills, and monetary policy rates, respectively, are more than the theoretical value (-3.435). These imply that for money market indicators and stock market series to become stationary, they must first difference. The PP test backs up these findings. The absolute values of the calculated ADF coefficients, however, exceed the critical values at the 5% significance level in their initial differences.

GARCH-X Results of the Effect of Money Market Indicators and Stock Market Return Volatility in Nigeria

In this section we present results of the GARCH models estimated to evaluate the effect of money market indicators on stock market returns volatility indicators in Nigeria. The GARCH-X (1,1) model is appropriate model because it allows explanatory variable to be added to the GARCH equation (Lee, 1994; Emenike & Odili, 2014). Notice from the GARCH (1,1) benchmark model estimates presented in Table 4.5, that there is volatility clustering in the Nigeria stock market returns. This is evident in the statistical significance (0.00) of the GARCH

parameter (β_1). Notice also that the volatility of the Nigeria stock market is persistent, as shown by the sum $\alpha_1 + \beta_1$ (0.89) being close to 1.

Table 5: Estimates of GARCH (1,1) Benchmark Model for Stock Return Volatility in Nigeria

Parameters	Coefficient	T-Statistics	Significance
Constant	0.012	2.341	0.019
α_0	0.0005	2.376	0.017
α_1	0.204	2.609	0.009
β_1	0.690	9.205	0.000
$\alpha_1 + \beta_1$	0.894		
Q(6)	11.332	0.078	
ARCH-LM (6)	13.612	0.074	

Source: Author's computation, using RATS Version 9.0

Table 6 illustrates that the results of the GARCH-X (1,1) model show that money market indicators have effect on stock market returns volatility in Nigeria at the 5% significance level. Specifically, the treasury bills rate and monetary policy rates have negative and statistically significant effect on stock market volatility in Nigeria. The p-value of the coefficient of Treasury bill rate (0.001) is less than the 5% significance level (0.05). Similarly, the p-value of the coefficient of the monetary policy rate (0.017) is less than the 5% significance level (0.05).

Table 6: Results for GARCH-X Model for Effect of Money Market Indicators on Stock Return Volatility

Parameters	Coefficient	T-Statistics	Significance
Constant	0.014	23.792	0.000
α_0	0.002	30.840	0.000
α_1	0.042	12.995	0.000
β_1	0.468	72.461	0.000
$\alpha_1 + \beta_1$	0.610		
Λ_{TBR}	-0.068	-3.165	0.001
Λ_{MPR}	-0.025	-2.553	0.017

Source: Author's computation, using RATS Version 9.0

Table 7 shows the outcomes of diagnostic tests performed to determine the robustness of the estimated ARDL model. Observe from the Table that the model residuals' Ljung-Box Q-statistic is not significant. This suggests that the residuals do not exhibit autocorrelation. Similar to this, the results of the ARCH-LM diagnostic test indicate that there is no heteroscedasticity in the residuals at the 5% level of significance. As a result, the results are homoscedastic and serially uncorrelated. As a result, the presented results are reliable in their interpretation.

Table 7: Diagnostic Test Results for GARCH-X model for Effect of Money Market Indicators on Stock Return Volatility

Parameter	Statistic	Significance level (χ^2)
Q(6)	11.066	0.086
$Q^2(6)$	9.215	0.161
ARCH-LM (6)	10.107	0.120

Source: Author's computation, using RATS Version 9.0

GARCH-X Results of the Effect of Treasury Bill Rate on All Share Index in Nigeria

Section 4.5 The GARCH-X model was calculated to analyze the long-run effect of Treasury Bills rates on the All Share Index in Nigeria. Table 9 shows that Treasury Bills rates have a negative and significant impact on the All Share Index in Nigeria at the 5% significance level. This is demonstrated by the t-significance statistic's (-3.165) being more than the theoretical t-statistic (-1.96), and the p-value (0.001) being smaller than the significance level (0.05). This negative effect of Treasury Bills rate of stock market returns is agreement with the theoretical postulation and apriori expectation of a negative linkage between the TBR and returns. Theoretically, an increase in Treasury Bills rates reduces transfer of financial resources to stock market as investors try to benefit from the increased rate, vice versa. Since this is the case, as results show, it thus suggests that the capital and monetary authorities need to formulate policies to reduce the negative effect of changes in Treasury Bills on stock market returns.

GARCH-X Results of the Effect of Monetary Policy Rate on All Share Index in Nigeria

Section 3.7 The GARCH-X model estimates of the impact of monetary policy rates on Nigeria's All Share Index are shown here. Table 9 shows that monetary policy rates have a significant effect in Nigeria at the 5% level of significance. This is demonstrated by the fact that the significance of the t-statistic of the coefficient of monetary policy call rate (-2.553) is more than the theoretical t-statistic (-1.96) and the p-value (0.017) is less than the significance level (0.05).

Table 8: Effect of Monetary Policy Rate on All Share Index in Nigeria

Parameter	Coefficient	T-Statistics	Significance
λ_{MPR}	-0.025	-2.553	0.017

Source: Author's computation, derived from table 6 above

RESULT AND DISCUSSION

Money market issues were examined as a possible cause of Nigeria's stock market volatility. As a starting point for assessing the impact of money market indicators, which served as research variables, a benchmark GARCH -X (1, 1) model was estimated. To determine whether an observed sequence has a GARCH feature or not, the GARCH-x (1,1) model was developed as a parametric test by Engle in 1982 as the Autoregressive Conditional Heteroscedasticity (ARCH) and generalized as the Generalized Autoregressive Conditional heteroscedasticity (GARCH) model by Bollerslev in 1986.

However, the GARCH-x (1,1) Model estimates indicated that the Nigerian stock market's results were clustered in terms of volatility. This result also offered evidence that the factors of the money market have a substantial impact on the volatile stock returns in Nigeria. The study also found that changes in Treasury bill rates and monetary policy rates have a big effect on making stock returns in Nigeria less volatile. The consequence is that a rise in government borrowing through the sale of treasury notes would also result in a rise in interest rates. As a result, the stock market will be impacted as investors change their portfolios to

benefit from the rise. Additionally, since the change in monetary policy rate may result in a decrease in the amount of non-borrowed reserves, it has an impact on stock market returns. Equally, raising interest rates by policymakers diminishes returns since stock returns are more volatile when there is little expectation of change and when there is a lot of uncertainty.

The study suggested the following:

1. Monetary authorities and policymakers need to develop and put into place measures that will lessen the impact of changing Treasury bill rates on stock market returns; and
2. Monetary authorities should exercise discretion when using monetary policy tools arbitrarily to prevent a detrimental impact of rising interest rates on stock returns in Nigeria.

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