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# RESPONSE OF STOCK MARKET VOLATILITY TO FOREIGN EQUITY INVESTMENTS

Kalu O. Emenike<sup>1</sup>  
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## Abstract

*This study evaluates the response of stock market volatility to foreign equity investments. Specifically, the study examines how foreign portfolio investment and foreign direct equity investment influence stock market volatility in Nigeria, using monthly data from January 2007 to July 2017. Results of preliminary analyses of stock market returns series show evidence of negative skewness, leptokurtosis, non-normal distribution, and average positive monthly return. Estimates from the GARCH-X (1,1) model show evidence of volatility clustering in the stock market returns. The estimates also show that stock market volatility responds to changes in foreign portfolio investment. On the other hand, changes in foreign direct equity investment do not influence stock market volatility. The key implication is for investors to adjust their portfolio to changes in the foreign portfolio investment, in order to mitigate stock market volatility, and for stock market regulators to encourage more inflow of foreign direct equity investment as a more stable source of foreign equity investment.*

**Keywords:** equity investment, stock market volatility, foreign direct equity investment, foreign portfolio investment

**JEL Classification:** G11, G32, F21

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## 1. Introduction

An important feature of stock market liberalisation are foreign equity investments. Foreign equity investments are of two major forms: foreign portfolio investment (FPI) and foreign direct investment (FDI). While FPI is investment by non-residents in equity, FDI, in the context of this study, is the investment by a company in equity of a foreign country different from the investor's home country (Feenstra, 2016). There are two competing opinions concerning the impact of foreign equity investment. One is that foreign investors are return-chasing speculators whose decisions can create excess volatility in the domestic stock market (see, Nguyen & Le, 2013; Halale, 2014). This speculative behaviour has a negative impact on the domestic stock market. In

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particular, the excess volatility caused by speculative foreign equity investor could destabilize the domestic stock market, which affects the cost of capital. The mechanism through which this can work is that the excess volatility requires domestic investors to demand a higher return for holding stocks to compensate them for the increased volatility that foreign equity speculators cause. A greater risk premium results in a higher cost of equity capital, makes future investment opportunities unprofitable, and reduces private physical investment (Emenike, 2010; Joo & Mir, 2014). The counter argument, on the other hand, is based on the notion that foreign equity investment provides real economic benefits to the domestic market through risk sharing between domestic and foreign investors (see, Blonigen, 1997; De & Chahkraborty, 2015). This risk sharing leads to acquisition of the knowledge assets of foreign firms and a reduction in the equity cost of capital of domestic firms, since foreign investors are willing to pay a premium in order to obtain the diversification benefit. Another potential benefit of foreign investors is improved liquidity.

Stock market volatility has an adverse impact on the investors' decisions pertaining to the effective allocation of resources and thereby on investment in stock markets. It is perceived as indicating a rise in financial risk, which can adversely affect investors' assets and wealth. The foreign equity investments inflow and outflow depend on, amongst other factors, the return and sentiment of the market. The inflow of foreign private investments increases the stock market indices and outflows reduce it, thus creating volatile behaviour in the host country's stock market (Joo & Mir, 2014). Consequently, it is important to understand the response of stock market return and volatility to changes in foreign private equity investment.

A good number of studies have evaluated the impact of foreign equity investment on stock market returns and volatility both in developed and developing economies (see for example, Choe, Kho & Stulz, 1999; Nguyen & Le, 2013; Joo & Mir, 2014; Waqas, Hashmi, & Nazir, 2015). Most of the studies were conducted for developed countries and other developing countries. The available studies in the context of Nigeria concentrated on the determinants of FDI, and impact of FDI on stock market performance (see, Idenyi, Ifeyinwa, Obinna & Promise, 2016; Omodero & Ekwe, 2017). The evidence of foreign equity investments on volatility of stock return returns is very important for policy formulation, because of the ease of exit foreign equity investors. There is therefore the need for empirical evidence on the response of stock market volatility to changes in foreign equity investment in Nigeria.

The objective of this study was to evaluate the response of stock market returns and volatility to changes in foreign portfolio and direct equity investments in Nigeria. Understanding the effect of foreign equity investment to stock market returns volatility is important for stock market regulation and policy-making. Investors, both domestic and international, will also understand the likely effect of foreign investment flow on the riskiness of their portfolios, and adjust accordingly to mitigate any negative effect on their wealth. This paper, in addition, contributes to enriching the existing literature on foreign equity investment and stock market returns volatility. The remainder of the paper is organised as follows. Section 2 presents brief review of empirical literature. Section 3 embodies methodology and data. Section 4 presents the empirical results and discussions, and Section 5 provides the conclusions and policy implications.

## 2. Brief Review of Empirical Literature

Numerous empirical studies have been conducted to evaluate the impact of foreign equity investment on stock market returns and volatility. Nguyen and Le (2013) evaluate the impacts of daily foreign flows on Vietnamese stock market volatility using a dataset ranging from October 26, 2005 to March 16, 2011. The study finds, *inter alia*, that relationships between foreign flows and market volatility are short-lived; past foreign flows relate to volatility being stronger in the bull market as compared with the bear one; market volatility responds positively to a random shock to bull market; and an increase in foreign net purchases reduces market volatility in the bear market. In a similar study, Hsu (2013) evaluates how foreign investment portfolios affect the domestic stock market of host countries by comparing the performance of favoured and unfavoured stocks of foreign investors. Specifically, he tested whether investors herded into each group and whether the favoured group outperforms the unfavoured group during both expansion and recession periods using daily closing prices of stocks listed on the TWSE. The findings, *inter alia*, show that market participants did herd in the foreign investor favoured stock group, but herded in the unfavoured group only in bear markets. The foreign investor favoured group outperformed the other only during economic expansion. During recession, the foreign investor unfavoured group performed better. In a latter study, Halale (2014) investigates the role of FPI and its degree of relationship with stock market indicators (price earnings multiple, dividend yield, book value of NIFTY) in India using Pearson linear correlation analysis on the Indian stock market during January 2003 to December 2013. The findings show moderate positive correlation between foreign institutional inflow (FII) and stock market movement in India. However, he finds no significant relationship between FII inflows and Price Earnings multiple. He further reports that there is moderate and inverse relationship between the FII flows and of the NIFTY dividend yield. On the other hand, De and Chahkraborty (2015) found no significant causal relationship between foreign portfolio investment and stock market volatility in India using VAR framework on firm-level panel data from 2003 to 2013.

Joo and Mir (2014) examine the impact of foreign institutional investors' (FIIs) investment on volatility of Indian stock market from January, 1999 to December, 2013. The study reports, *inter alia*, that there is a significant relationship between FIIs capital flows and stock market volatility, and that FIIs investment has statistically significant influence on volatility of Indian stock market. In another volatility study, Waqas, Hashmi, and Nazir (2015) examine the relationship between macroeconomic factors and foreign portfolio investment volatility in South Asian countries. The monthly data was collected for the period ranging from 2000 to 2012 for four Asian countries i.e. China, India, Pakistan and Sri Lanka. The results reveal that there exists significant relationship between macroeconomic factors and foreign portfolio investment volatility. The study concludes that less volatility in international portfolio flows is associated with high interest rate, currency depreciation, foreign direct investment, lower inflation, and higher GDP growth rate of the host country.

In an African study, Koskei (2017) investigates the effect of foreign portfolio equity outflows on stock returns of listed financial institutions in Kenya for the period from January 2008 to December 2014. The results indicate that foreign portfolio equity outflows have no effect on stock returns of listed financial institutions in Kenya.

Most of the literature on FDI concentrates on its linkage with stock market returns. Choe, Kho and Stulz (1999) examine the impact of foreign investors on stock returns in Korea from November 30, 1996 to the end of 1997, using order and trade data. The study finds strong evidence of positive feedback trading and herding by foreign investors before the period of Korea's economic crisis. During the crisis period, herding falls, and positive feedback trading by foreign investors mostly disappears. Using event study methodology, the study also reports no evidence that trades by foreign investors had a destabilizing effect on Korea's stock market over our sample period. In particular, the market adjusted quickly and efficiently to large sales by foreign investors, and these sales were not followed by negative abnormal returns. In an another related study, Idenyi, Ifeyinwa, Obinna and Promise (2016) examine the impact of foreign direct investment on the growth of the Nigeria stock market from 1984 to 2015. The results show, inter alia, that FDI has a negative relationship with the stock market growth both in the long and short run, and no causality between FDI and stock market growth. The study concludes that foreign direct investment has no significant impact on the stock market growth in Nigeria. In contrast to studies that document positive linkage between FDI and stock market, Omodero and Ekwe (2017) examine the impact of FDI on the stock market performances in Nigeria for the period from 1985 to 2014. The results indicate, inter alia, that FDI does not significantly impact stock market performances in Nigeria.

From the brief literature reviewed in this study, it is clear that scholars have not examined the impact of FDI on stock market volatility. This could be as a result of unavailability of data on FDI equity investment. This study includes FDI equity variable, because the Central Bank of Nigeria (CBN) decomposed foreign equity investment into two types: FPI and FDI equity investments.

### 3. Methodology and Description of Data

#### 3.1. Methodology

The GARCH-X model was employed in this study to evaluate the response of stock market volatility to changes in foreign equity investment in Nigeria. The GARCH-X model involves inclusion of explanatory variable(s) to the conditional variance equation. It is an extension of the ARCH model developed by Engle (1982) and generalised by Bollerslev (1986), and has been widely used to examine the effect of exogenous variables on volatility. It was first used by Lee (1994) to examine how the short-run disequilibrium affects uncertainty in predicting co-integrated series. Other studies, such as Brenner, Harjes and Kroner (1996), Hwang and Satchell (2005), and Emenike and Odili (2014), and Waqas, Hashmi, and Nazir (2015) also applied GARCH-X by including variables as explanatory variable in the GARCH model. The GARCH-X(1,1) model is specified in the following form:

$$SR_t = \mu + \Phi SR_{t-1} + \varepsilon_t \quad (1)$$

$$\sigma_t^2 = \omega + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 + \gamma F_t \quad (2)$$

Where  $SR_t$  is as define as stock market return,  $\Phi$  is the autoregressive term in the mean equation that account for the time dependence in the stock returns,  $\varepsilon_t$

is the residual term in the mean equation. In the volatility equation (2),  $\sigma_t^2$  is stock market return volatility,  $\omega$  is the constant variance that corresponds to the long run average,  $\alpha_1$  refers to a first order ARCH term,  $\beta_1$  is the first order GARCH term, and  $F_t$  represents the foreign equity investments (i.e., foreign portfolio investment and foreign direct equity investment for a month  $t$ ). The GARCH-X specification in equation (2) involves a direct test of the response of stock market returns volatility to changes in foreign investments. The response is assessed by the statistical significance of the coefficients of individual foreign investment ( $\lambda_1$ ).

### 3.2. Description of Data

The data for this study are a monthly series of the All-share Index (ASI) of the Nigeria Stock Exchange (NSE), Foreign Portfolio Investment in equity (FPI), and Foreign Direct Investment in equity (FDI). The series was obtained from the Central Bank of Nigeria (CBN) statistical database: <http://statistics.cbn.gov.ng/cbn-onlinestats>. The period under consideration for the variables ranges from January 2007 to July 2017. The choice of the period was based on availability; as the CBN started publishing the monthly foreign investment series on the statistical database from January 2007. The dataset was converted monthly returns series by taking the first difference of the natural log series as follows:

$$R_t = Ln \left( \frac{I_t}{I_{t-1}} \right) \quad (3)$$

where  $R_t$  is a vector of the variables returns series,  $I_t$  is the monthly closing value of the variables at time  $t$ ,  $I_{t-1}$  is the previous month closing value of the ASI, FPI and FDI, and  $Ln$  is natural logarithm.

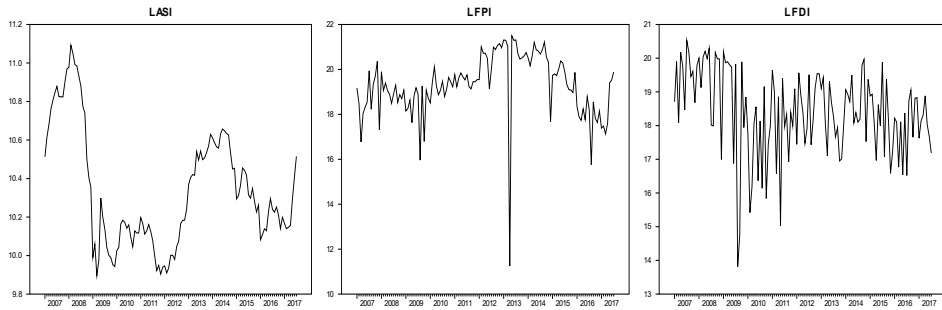
## 4. Empirical Results and Discussions

### 4.1 Descriptive Statistics

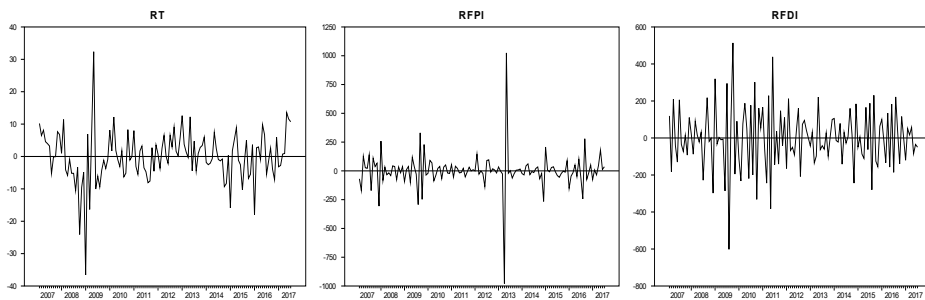
Figure 1 and 2 present the time series plot of stock market, foreign portfolio investment, and foreign direct equity investment level and return series, respectively. The foreign portfolio investment, and foreign direct equity investment returns are conceptualised as the rate of change in the series. Notice from this figure that the Nigeria stock market series was trending upward from the beginning of the sample period to the first quarter of 2008, when it started declining as a result of the global financial crisis (GFC). Although there is more fluctuation in the FPI and FDI series, the effect of GFC is glaring. Another noticeable trend in the plots of the level series is that the stock market and FPI series has regained an upward movement, whereas the FDI is moving downward. The upward movement in stock and FPI series may indicate renewed foreign investors' confidence in the Nigeria stock market after the devastating effect of GFC, when foreign portfolio investors hurriedly exited the market. Notice also that the level of the FDI, and all the return series appear mean reverting. Mean reversion is a characteristic of stationary series, which is required in econometric analysis. The spike in all the return series corresponds to the period of the GFC, and may indicate its effect on the series. This is also the case on the estimated volatility of the Nigeria stock market presented in *Figure 2* in the appendix. Notice from the *Figure 2* that

stock market volatility is very high during the GFC. But it moderated after the GFC, suggesting the financial crisis can exacerbate volatility.

**Figure 1. Stock Market and Foreign Equity Investments Level Series**



**Figure 2. Stock Market and Foreign Equity Investments Return Series**



Descriptive statistics of the stock market, foreign portfolio investment, and foreign direct equity investment series are presented in *Panel A* of *Table 1* below. Notice that the mean rate of return for the Nigeria stock market and FPI are positive, whereas FDI is zero. The standard deviations of returns are 7.87, 158.59, and 162.95 for the stock market, FPI and FDI, respectively. The standard deviation shows that the FDI has the highest standard deviation, whereas the stock market has the lowest for the study period. The skewness and excess kurtosis coefficients under normality assumption are 0. However, the skewness coefficient for the stock market is negative, whereas FPI and FDI are zero at the 5% significance level. The excess kurtosis coefficients for all the series are nonzero, and are significant at 5% level, suggesting that the stock market, FPI and FDI series are leptokurtic. In the same vein, the Jarque-Bera statistics for all the series suggests that they are not normally distributed at any conventional significance level.

*Panel A* of *Table 1* also displays the Ljung-Box Q (LBQ) statistics and the  $p$ -value of the LBQ, estimated to examine stock returns series for serial correlation. The  $p$ -value of the Ljung-Box Q coefficient is more than the 5% significance level. Therefore, the null hypothesis of no autocorrelation in the stock returns series is accepted at the



5% level of significance. The absence of serial dependence in the stock returns is an indication of serial independence, and evidence against autoregressive model estimation.

Panel B of Table 1 reports the Bayesian information criterion (BIC) lag analysis for the Nigeria stock return series. Estimates from lags 0 to 5 of the BIC conducted to select the appropriate autoregressive lag length, show that the stock return series does not require any lag. This result reinforces the Ljung-Box Q statistics, which shows evidence against the autoregressive model.

Panel C of Table 1 presents the results of unit root tests performed on log-levels and return series of the stock market, FPI and FDI using Augmented Dickey-Fuller (ADF) and Kwiatkowski, Phillips, Schmidt & Shin (1992) (KPSS) tests. The ADF test shows that the level series has unit root, except for FDI; but rejects the null hypotheses of unit root in the returns series at 1% level of significance. This is evident in the absolute values of the ADF statistics for stock return (-5.257), FPI (-8.920), and FDI (-9.639) exceeding the 5% critical value of -3.446. Similarly, the results of the (KPSS) tests show that the level series is nonstationary, whereas its returns are stationary.

**Table 1. Preliminary Statistics for Stock, FPI and FDI Series**

Variable	Mean	Std. Dev.	Skewness	Kurtosis	J-B Stat.	LB-Q
<b>Panel A: Descriptive Statistics</b>						
Stock	0.001 (0.002)	7.872	-0.523 (0.017)	5.202 (0.000)	147.816 (0.000)	2.022 [0.155]
FPI	0.568 (0.040)	158.591	0.262 (0.2351)	24.511 (0.000)	3155.625 (0.000)	
FDI	1.208 (0.083)	162.950	-0.099 (0.652)	1.402 (0.001)	10.528 (0.005)	
<b>Panel B: Bayesian information criterion (BIC) lag analysis for stock returns</b>						
Lags	0	1	2	3	4	5
Stock	-5.053*	-5.030	-5.012	-5.002	-5.026	-4.997
<b>Panel D: Unit root tests for NSE monthly series</b>						
		<b>ADF</b>			<b>KPSS</b>	
	5% critical value	Level	Returns	5% critical value	Level	Returns
Stock	-3.446	-2.296	-5.257**	0.146	0.390**	0.070
FPI	-3.446	-3.153	-8.920**	0.146	0.442**	0.024
FDI	-3.446	-4.140**	-9.639**	0.146	0.2242**	0.019

**Note:** Mean is stated in percentage. LB-Q is the Ljung-Box Q statistics for the autocorrelation functions, and are displayed as [.] and *p*-values are displayed as (.). Std. Dev. and J-B Stat are the standard deviation and Jarque-Bera statistics for the monthly series. \*\* indicates significance at the 1% level.

### 4.3 Results of Response of Stock Market Volatility to Foreign Equity Investments

The summary of results for the GARCH-X (1,1) model specified in equation (2) are presented in *Table 2* below. Observe from *Table 2* that all the conditional variance parameters  $\omega$ ,  $\alpha_1$ , and  $\beta_1$  are significant. This suggests evidence of volatility clustering in the Nigeria stock market. Evidence of stock market volatility in Nigeria is numerous in finance literature (see for example, Ogum, Beer & Nouyrigat, 2005; Emenike & Aleke, 2012). Notice also that all the three parameters in the conditional variance equation ( $\omega$ ,  $\alpha_1$ , and  $\beta_1$ ) satisfy the non-negativity restrictions of the GARCH model.

The estimates of GARCH-X model also indicate that stock market returns volatility responds significantly to changes in foreign portfolio investment, but does not respond to changes in foreign direct equity investment in Nigeria. That is evident in the statistical significance of foreign portfolio investment coefficient (0.008) at the 5% significance level (0.090), and absence of statistical significance of foreign direct equity investment coefficient (0.002) at any conventional significance level (0.538). It is thus glaring that FPI contributes to volatility of stock market returns in Nigeria. This result is in accord with some of the earlier studies that investigated the impact of foreign equity investment on stock market return volatility. For instance, Joo and Mir (2014) examine the impact of foreign institutional investors' (FIIs) investment on volatility of Indian stock market for the period from January 1999 to December 2013, and report, inter alia, that FIIs investment has statistically significant influence on the volatility of the Indian stock market. The results are also similar to Nguyen and Le (2013) and Hsu (2013) who report that stock market volatility responds positively to a random shock from foreign portfolio investment during economic expansion.

The response of stock market volatility to changes in foreign portfolio investment is also not a surprise, because of the domineering influence of foreign portfolio investors on the Nigeria stock market. In March 2014, for example, the foreign portfolio investors accounted for 78.25% of the transactions in the Nigeria stock market, whereas domestic investors contributed in 21.75% of the transactions. By April of 2014, the foreign portfolio investors still accounted for a very large chunk of the transactions (75.25%) (Nigeria Stock Exchange, 2014). In January 2016, the foreign portfolio investors still dominated market transaction with 51.57%, while domestic investors transacted 48.43%. The domestic investors, however, dominated market transactions in January 2017 with 53.83% of the transactions (Nigeria Stock Exchange, 2017). The large volume of transaction recorded by foreign portfolio investors may account for significant response of Nigeria stock market volatility of changes in foreign portfolio investment.

The diagnostic tests results presented in the *Panel B* of *Table 2* were computed to evaluate the adequacy of the GARCH-X (1,1) model. Notice that the West-Cho modified Q-statistics for residuals of the stock market return is not significant, indicating that there is no serial correlation in the standardized residuals. The ARCH-LM and McLeod-Li results indicate that the null hypotheses of no ARCH effect and no serial correlation in squared residuals are accepted at the 5% significance level. The GARCH-X model is therefore adequate for policy-making as there appear to be no specification error.

**Table 2.** Estimates of GARCH-X (1,1) Model for Stock and Foreign Equity Investment

Variable	GARCH-X parameters				
	$\omega$	$\alpha_1$	$\beta_1$	$\gamma_{FPI}$	$\gamma_{FDI}$
Stock return	0.0006	0.206	0.685	0.008	0.002
volatility ( $\sigma^2_t$ )	[1.965]	[2.166]	[6.727]	[2.585]	[0.614]
	(0.049)	(0.030)	(0.000)	(0.009)	(0.538)

**Panel B: Diagnostic Tests Results**

	Test Applied	Statistic	Signif. Lvl.
Heteroscedasticity	LM (6)	6.186	0.090
	McLoed-Li(22)	15.322	0.848
Serial Correlation	West-Cho Q(22)	7.527 2.764	0.080
	Ljung-Box Q(12)		0.060

**Note:** LM is ARCH Lagrange multiplier test at lag 6. *P*-values are displayed as (.) and *t*-statistics is displayed as [.]. The LM tests are conducted under null hypothesis of no ARCH effect in the standardized residuals, whereas the Ljung-Box Q and McLoed-Li tests are conducted under the null hypotheses of no serial correlation in the standardized residual and squared standardized residual respectively. West-Cho is a modified Q-statistics conducted under the null hypothesis of no serial correlation in the standardized residual. All the tests are conducted at 5% significant level.

## 5. Conclusions and policy Implications

The study evaluates the response stock market returns volatility to changes in foreign portfolio investment and foreign direct equity investment by applying the GARCH-X (1,1) model on monthly data from January 2007 to July 2017. Results of preliminary analyses of stock market return series show evidence of negative skewness, leptokurtosis, and non-normal distribution with an average positive monthly return. Estimates from the GARCH-X (1,1) model show evidence of volatility clustering in the stock market returns. The estimates also show that the stock market returns volatility respond to changes in foreign portfolio investment. On the other hand, changes in foreign direct equity investment do not influence stock market returns volatility. Although the results of this study show that foreign portfolio investment influences stock market volatility, it also highlights the importance of foreign direct equity investment in a developing market. Foreign equity investment provides real economic benefits to the local stock market through risk sharing between domestic and foreign investors, leading to acquisition of the knowledge assets of foreign firms and a reduction in cost of capital.

These findings have two major implications. The first is that regulators of the stock market should encourage more inflow of foreign direct equity investment as a more stable source of foreign equity investment than the foreign portfolio investment. The speculative behaviour of foreign portfolio investment influences volatility in the

domestic stock market thereby raising the cost of capital. More so, foreign direct equity investment could lead to acquisition of the knowledge assets of foreign firms. The second major implication of these findings is that investors should adjust their portfolio to changes in the foreign portfolio investment, in order to mitigate the impact of stock market returns volatility on their portfolio.

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## Appendix

### Figure 2. Estimated Volatility of the Nigeria Stock Market

