“How financial liberalization impacts stock market volatility in Africa: evidence from Nigeria”

AUTHORS

Patrick Olufemi Adeyeye
Olufemi Adewale Aluko
Oladapo Fapetu
Stephen Oseko Migiro

ARTICLE INFO

Patrick Olufemi Adeyeye, Olufemi Adewale Aluko, Oladapo Fapetu and Stephen Oseko Migiro (2017). How financial liberalization impacts stock market volatility in Africa: evidence from Nigeria. *Investment Management and Financial Innovations*, *14*(3), 291-301. doi:10.21511/imfi.14(3-1).2017.13

DOI http://dx.doi.org/10.21511/imfi.14(3-1).2017.13

RELEASED ON Monday, 13 November 2017

RECEIVED ON Wednesday, 02 August 2017

ACCEPTED ON Wednesday, 27 September 2017

JOURNAL "Investment Management and Financial Innovations"

ISSN PRINT 1810-4967

ISSN ONLINE 1812-9358

PUBLISHER LLC “Consulting Publishing Company “Business Perspectives”

FOUNDER LLC “Consulting Publishing Company “Business Perspectives”

NUMBER OF REFERENCES **30**

NUMBER OF FIGURES **4**

NUMBER OF TABLES **3**

BUSINESS PERSPECTIVES

LLC "CPC "Business Perspectives"
Hryhorii Skovoroda lane, 10, Sumy, 40022, Ukraine

www.businessperspectives.org

Patrick Olufemi Adeyeye (South Africa), **Olufemi Adewale Aluko** (Nigeria), **Oladapo Fapetu** (Nigeria), **Stephen Oseko Migiro** (South Africa)

HOW FINANCIAL LIBERALIZATION IMPACTS STOCK MARKET VOLATILITY IN AFRICA: EVIDENCE FROM NIGERIA

Abstract

Understanding the impact of financial liberalization on stock market is important for decision making by investors. The neo-classical economists believe that financial liberalization reduces stock market volatility while the post-Keynesian economists argue that financial liberalization increases volatility of the stock market. This study investigates the effect of financial liberalization on the volatility of an emerging stock market in Africa, with particular focus on the Nigerian stock market. The estimation results reveal that financial liberalization has a significant positive impact on return volatility, thus indicating that it increases stock market volatility. Also, the study finds no evidence of asymmetry in the stock market.

Keywords financial liberalization, emerging stock market, market returns, volatility, GARCH model, Nigerian Stock Exchange

JEL Classification C22, C58, G01, G12, G14

Received on: 2nd of August, 2017
Accepted on: 27th of September, 2017

Patrick Olufemi Adeyeye, Graduate School of Business, University of KwaZulu-Natal, Westville, Durban, South Africa.

Olufemi Adewale Aluko, University of Ilorin, Ilorin, Kwara State, Nigeria.

Oladapo Fapetu, Department of Banking & Finance, College of Management Sciences, Federal University of Agriculture, Ogun State, Nigeria.

Stephen Oseko Migiro, Graduate School of Business, University of KwaZulu-Natal, Westville, Durban, South Africa.

INTRODUCTION

Stock market volatility is the rate at which prices of stocks/assets drift in the stock market. Bekaert and Harvey (1997) argue that understanding of volatility in emerging stock markets is crucial for deciding on the cost of capital, evaluating direct investment and making decisions related to allocation of assets. Financial liberalization policy paved way for the influx of foreign investors into the domestic financial market. Foreign investors have shown great interest in emerging stock markets due to the desire for higher returns and international diversification. The activities of foreign investors in the stock market increase the market liquidity. Spyrou and Kassimatis (1999) note that financial liberalization will cause volatility to increase through increased market liquidity. Kaminsky, Lyons, and Schmukler (2000) found that stock markets that were highly liquid suffered more than markets with less liquid during the Asian and Russian crises. Volatility in the stock market tends to rise due to financial liberalization (Aggarwal, Inclan, & Leal, 1999; Miles, 2002; Haung, 2008).

The liberalization of the stock market refers to the elimination or removal of repressive policies existing in the market. Stock market liberalization creates a paradigm shift from administratively controlled system to a market-based system. In a liberalised stock market, the interaction of market forces of demand and supply acts as the mechanism for determination of stock prices. Hence, there is a tendency for stock prices to be more volatile when determined by these market forces. Financial liberalization is likely to attract short-term investors into an economy, thereby leading to bubbles in asset price and instability in the financial system (Arestis & Demetriades, 1999; Singh, 2003).

Haung (2008) perceives stock markets to be more efficient after liberalization and this leads to higher level of volatility, because stock prices rapidly respond to relevant information. Also, Bhattacharyya (2014) argues that the volatility of the stock market is not determined by financial liberalization but by quality of market information. Financial liberalization integrates the stock market of a country with other countries, thus establishing the market as a member of the global financial market. At the country aggregate level, the expected return on stocks after financial liberalization is determined by the price of risk and covariance of the domestic stock market with the global market (Haung, 2008).

The neo-classical economists (Mckinnon, 1973; Shaw, 1973) believe that financial repressive policies such as capital controls distort financial prices, thus giving room for volatility to occur. They opine that financial liberalization results to reduction in stock market volatility. However, the post-Keynesian economists argued that stock market liberalization introduces volatility into the economy (Spyrou, 1999). This shows that controversy exists among economists on the effect of financial liberalization effect on the volatility of the stock market. Also, there is ambiguity in empirical literature on the effect of financial liberalization on emerging stock market volatility. Studies such as Grabel (1995), Levine and Zervos (1998), Miles (2002), Haung (2008), and Zhang and Ding (2008) provide evidence that volatility of emerging stock markets tends to increase due to financial liberalization, whereas Spyrou and Kassimatis (1999), Kim and Singal (2000), Kassimatis (2002), Cunado, Biscarri, and Pérez de Gracia (2006), and Ndako (2012) showed that financial liberalization is not a determining cause of volatility of emerging stock markets.

Financial liberalization has been given as the root cause of financial crises such as the Mexico crisis of 1991, Turkey crisis of 2001 and the 2008 global financial crisis experienced by countries other than the country where the crisis originated from. The global financial crisis that emanated from the United States in 2008 caused a decline in the stock market performance of most economies, especially emerging stock markets in Africa. The Nigerian stock market was overwhelmingly affected by this crisis and this led to increased uncertainty about return on investment in the market. A large exodus of investors from the Nigerian stock market was witnessed during the crisis, because equity became less attractive, thus resulting to a near collapse of the stock market.

The emerging stock markets possess higher level of volatility compared to the developed ones (Bekaert & Harvey, 1997). This can be as a result of greater procyclicality of capital flows, higher exposure to exogenous shocks and high country risk associated with emerging economies. Miles (2002) points out that the instability of emerging stock markets due to volatility has been an area of concern for academics and policymakers. Literature is replete on the effect of financial liberalization on stock market volatility in emerging economies, however, there is no substantial evidence on emerging stock markets in Africa. Therefore, this study intends to investigate the effect of financial liberalization on the volatility of an emerging stock market in Africa, focusing particular attention on the Nigerian Stock Exchange (NSE).

The NSE is one of the largest stock markets in Africa, thus findings from this study can be related to other emerging markets in Africa. Also, the findings would either validate or justify the assertions of the neo-classical and post-Keynesian economists. The motivation for this study was borne out of the lack of empirical attention on this area of discourse in the Nigeria despite being one of the most attractive investment grounds for foreign equity investors in Africa. This study would inform policy makers on how the openness of the financial sector affects equity investment in the Nigerian stock market. Also, it would provide investors with the knowledge of how financial liberalization is associated with investment uncertainty.

The rest of this paper is structured as follows: section 1 reports empirical evidence on the how financial liberalization affects stock market volatility in emerging economies. Section 2 focuses on data issues and preliminary analyses, while section 3 presents the model and estimations. Final section concludes the study.

1. LITERATURE REVIEW

1.1. Overview of the Nigerian stock market

The Nigerian stock market is referred to as the Nigerian Stock Exchange (NSE). The NSE was established on 15 September 1960 as the Lagos Stock Exchange through the Lagos Stock Exchange Act of 1960 and started operations on 5 June 1961. Trading started officially on 15 August 1961 with 19 listed securities comprising of 3 equities, 6 Federal Government bonds and 10 industrial loan stocks. The Lagos Stock Exchange was changed to the Nigerian Stock Exchange in December 1977. Presently, the NSE has its headquarters in Lagos and branches in Kaduna, Port Harcourt, Kano, Ibadan, Onitsha, Abuja, Yola, Benin, Bauchi, Uyo, Ilorin and Abeokuta. The Capital Issue Commission established in 1963 as the apex regulatory body of the market was changed to the Securities and Exchange Commission on 1 April 1978.

The NSE is a foundation member of the African Stock Exchanges Association (ASEA). The NSE All-Share Index (NGSEINDX) was introduced in January 1984. The NSE also reports the NSE 30 Index (comprising of stocks of 30 blue chip companies) and five sectoral indexes namely NSE Consumer Goods Index, NSE Oil/Gas Index, NSE Insurance Index, NSE Banking Index and NSE Industrial Index. On the basis of firm listing, NSE is categorized into first-tier and second-tier securities market. Firms in the first-tier securities market are those that have met the conventional listing requirements of the NSE. The second-tier securities market was established in 1985 to provide an avenue for firms that desire to raise long-term financing through the exchange, but are that unable to meet the listing requirements for the first-tier securities market. The World Development Indicators database reports that the NSE has 183 listed domestic companies in 2015. Trading on the floor of the NSE starts at 9.30 a.m. and closes at 2.30 p.m. from Monday to Friday.

The NSE was deregulated in January 1993. In January 1995, the Exchange Control Act of 1969 and the Nigerian Enterprises Promotion Decree of 1989 were abolished by the Federal Government, thus leading to the internationalization of the NSE. Following the internationalization of the Exchange, the Federal Government promulgated the Nigerian Investment Promotion Commission Decree No. 16 and the Foreign Exchange (Monitoring and Miscellaneous Provision) Decree No. 17, both of 1995. These allowed unrestricted foreign investment in Nigerian companies and accorded both foreigners and residents the same rights, privileges and opportunities of investment in the Nigerian stock market.

The Central Securities Clearing System (CSCS) Limited incorporated by the NSE in July 1992 to handle central depository, clearing and settlement services for transactions in the stock market was commissioned on 8 April 1997 and commenced operations on 14 April 1997. To facilitate

Source: authors' Computation from CBN Statistical Bulletin (2015)

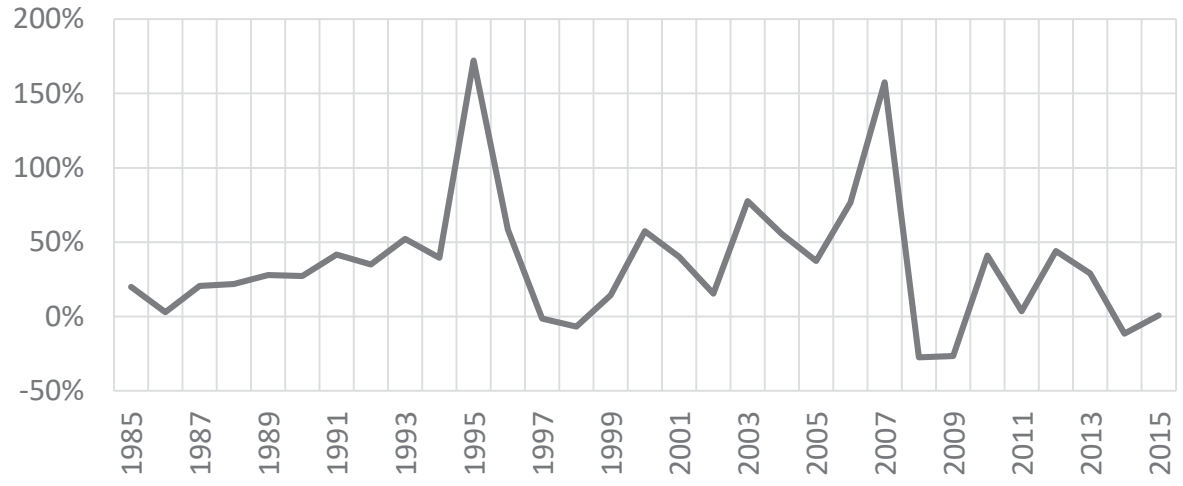

Figure 1. Trend of annual growth rate of NSE capitalization (1985–2015).

buying and selling transactions on the floor of the NSE, an automated trading system was introduced in April 1999. The Exchange Trust Fund (ETF) was introduced in December 2011. The NSE became a full member of World Federation of Exchanges on 28 October 2014. Figure 1 shows the trend of annual growth rate of NSE market capitalization from 1985 to 2015.

Market capitalization recorded a growth rate of 20% in 1985, but decreased to 3.03% in 1986, however, it increased by 20.59% in 1987. In 1988, it grew by 21.59%, but marginally dropped from 28% in 1989 to 27.34% in 1990. The market capitalization improved by 41.72% in 1991, but the growth rate declined to 35.06% in 1992. However, it rose to 52.24% in 1993, but fell to 39.58% in 1994. In 1994, market capitalization tremendously increased by 172.10%, but gradually declined to –6.34% in 1998. The situation improved in 1999 when the market capitalization improved by 14.24% and further increased by 57.43% in 2000. The market capitalization recorded a growth rate of 40.27% in 2001 and decreased to 15.46% in 2002. In 2003, it sharply increased by 77.71%, but the growth rate fell to 37.28% by 2005.

The market capitalization grew by 76.58% in 2006 and tremendously grew by 157.41% in 2007. The NSE experienced a drastic decline in market capitalization during the global financial crisis, as it recorded a negative growth rate of –27.45% and –26.48% in 2008 and 2009, respectively. The market capitalization took a positive turn in 2010 when it improved by 41.07%. However, it increased slightly by 3.03% in 2011. In 2012, 44.04% increase in market capitalization was attained but by 2014, market capitalization experienced a negative growth rate of –11.54%. The market capitalization moved upward, as it grew by 0.76% in 2015.

1.2. Empirical review

Prior studies have provided divergent evidence on the impact of financial liberalization on volatility in emerging stock markets. Grabel (1995) observed that financial liberalization is positively correlated with volatility of nine emerging markets. However, Bekaert and Harvey (1997) found that there is no positive correlation between financial liberalization and stock market volatility in twenty emerging stock markets. Levine and Zervos (1998) evaluated the impact of financial liberalization on the volatility of sixteen emerging markets and observed that volatility became more pronounced in these markets after financial liberalization.

Aggarwal, Inclan, and Leal (1999) examined the kinds of events between 1985 and 1995 that led to high volatility in emerging stock markets and found that the crash of October 1987 is the only global event that led to significant rise in the volatility of several emerging stock markets. Spyrou and Kassimatis (1999) showed that there was low intensity in volatility of eight emerging stock markets subsequent to financial liberalization. Kim and Singal (2000) discovered that volatility in emerging stock markets declined after financial liberalization.

Kassimatis (2002) found that stock market volatility in six emerging economies declined after important events of financial liberalization. Contrarily, Miles (2002) found that financial reforms have a significant impact in almost all the emerging stock markets in the sample and it does not reduce stock market volatility. Edwards, Biscarri, and Pérez de Gracia (2003) analyzed stock market cycles in six countries comprising of four Latin American and two Asian countries. The study found that volatility in the Latin American countries is lower in both the bull and bear cycle phases and behaves in a similar way to that of some more developed countries. However, it was evidenced from that the 1997 financial crises adversely affected the Asian countries. In a study of nine emerging stock markets, Kedmey (2005) showed that financial liberalization caused increase in volatility of some emerging stock markets while it led to decline in volatility of others. The author attributed the mixed results to be due to the country-specific factors.

Demetriades, Karoglou, and Law (2006) examined the impact of financial reforms on stock market volatility of five East Asian emerging markets in the short and medium term. The findings suggested that there is a richer evolution of volatility when the possibility of multiple breaks is taken into account than focusing on only the official liberalization dates. Cunado, Biscarri, and Pérez de Gracia (2006) revealed that the stock markets of six emerging economies experience less volatility and responsiveness to news after liberalising the financial sector. Haung (2008) found strong evidence to affirm that the openness of the financial

sector reduces the aggregate cost of equity and raises the level of volatility in emerging stock markets.

Zhang and Ding (2008) indicated that foreign exchange reforms caused increase in the volatility of the Chinese stock market. Waliullah (2010) observed that financial liberalization caused Karachi Stock Exchange of Pakistan to be highly sensitive and volatile. Ndako (2012) analyzed whether there is a persistent increase in stock market volatility in South Africa preceding financial liberalization. The results indicated that after considering structural breaks, volatility decreases following financial liberalization. The study of Afef (2013) on three Latin American and four Asian countries found that financial liberalization creates more unstable market in the short run but generates a less volatile market in the long run.

Afef (2014) analyzed the behavior of the stock market cycles in six Latin American countries and four Asian countries before and after financial reform. The study observed that stock market volatility reduced after financial liberalization compared to the financial repression era in the Latin American countries. For the Asian countries, stock market volatility increased following financial liberalization. Bhattacharyya (2014) built a rational expectation model to assess whether financial globalization and other indices of deregulation have impact on the volatility of the stock market in an emerging economy. It put forward that the quality of information is a major determinant of volatility and deregulation has no association with volatility. Ben Rejeb and Boughara (2014) evaluated the relationship between financial liberalization and stock market volatility in thirteen emerging economies from January 1986 to December 2008. The study observed that financial liberalization does not lead to excessive volatility. However, it affirmed that emerging stock markets are more volatile than the developed ones.

In a nutshell, the neo-classical economists' argument that financial liberalization does not increase stock market volatility was supported by studies such as Bekaert and Harvey (1997), Spyrou and Kassimatis (1999), Kim and Singal (2000), Kassimatis (2000), Cunado, Biscarri, and Pérez de Gracia (2006), Ndako (2012), Bhattacharyya (2014) and Ben Rejeb and Boughara (2014) while it was contradicted by Grabel (1995), Levine and Zervos (1998), Miles (2002), Haung (2008), Zhang and Ding (2008) and Waliullah (2010) who lend credence to the post-Keynesian economists' argument. However, Kedmey (2005) and Afef (2014) provide evidence to support both the neo-classical and post-Keynesian economists.

2. DATA ISSUES AND PRELIMINARY ANALYSES

This study aims to determine the effect of financial liberalization on the volatility of the Nigerian stock market. Monthly data on Nigerian Stock Exchange (NSE) All-Share Index (ASI) was

Source: authors' computation.

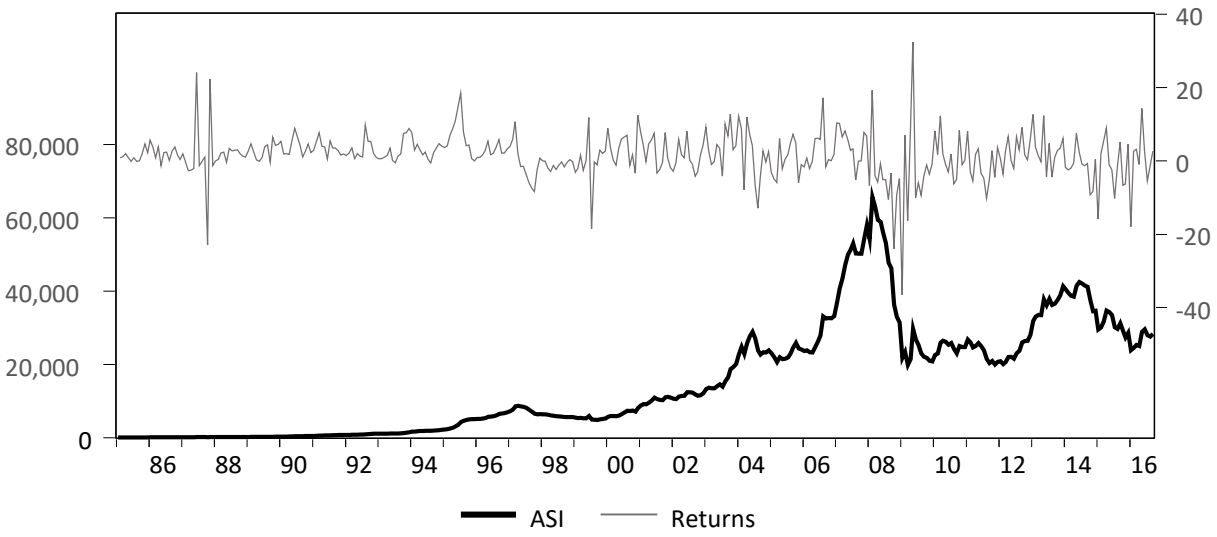

Figure 2. Combined graph of ASI and returns (January 1985 – September 2016)

Table 1. Descriptive statistics

Source: authors' computation.

Statistic	Full period	Pre-liberalization	Liberalization
Mean	1.457796	2.902747	0.741009
Maximum	32.35158	24.03743	32.35158
Minimum	–36.58828	–23.03526	–36.58828
Std. Dev.	6.172651	4.637537	6.700421
Skewness	–0.530516	0.428576	–0.527440
Kurtosis	10.06185	15.47361	8.699884
Jarque-Bera (JB) JB p-value	807.4295* 0.000000	820.7099* 0.000000	355.6154* 0.000000
Observations	380	126	254

Note: * and *** denote rejection of null hypothesis at 1% significance level.

sourced from NSE database from January 1985 to September 2016. The sample period consists of period of no liberalization (pre-liberalization) and period of liberalization. The Nigerian financial sector became liberalized subsequent to the adoption of the Structural Adjustment Program (SAP) in July 1986. The liberalization of the Nigerian stock market is traceable to the repealing of the Exchange Control Act of 1962 and the Nigerian Enterprises Promotion Commission Decree of 1989 by the Federal Government on 15 January 1995. Bekaert and Harvey (1998) date the official liberalization period of the Nigerian stock market as August 1995. Therefore, the pre-liberalization period is from January 1985 to July 1995, while the liberalization period stretches from August 1995 to September 2016. Returns (Rt) is used to capture the stock market instead of price, because investors tend to react to yields and it is derived from the stock market price index (i.e., ASI) and it is calculated as:

$$R_t = 100 \cdot \Delta \ln \text{ASI}, \qquad (1)$$

where R_t is return at time t, Δ is the first difference operator, ln is natural logarithm.

Table 1 shows that the mean return for the market in the pre-liberalization and liberalization period is 2.902747% and 0.741009%, respectively. This indicates that the market was more profitable before the implementation of the liberalization reform. In the full sample period, the mean return is 1.457796% which indicates that the market is relatively profitable. The maximum and minimum return of the market in the full sample period are 32.35158% and –36.58828% and both values were recorded in the liberalization period. Despite having a lower mean return, the liberalization period has a higher standard deviation statistic compared to the liberalization period. This indicates that the market is more volatile in the liberalization period. Returns in the pre-liberalization period are positively skewed, but otherwise in the liberalization period. This implies that there is a high tendency to obtain more positive values of returns in the pre-liberalization period than the liberalization period. The Kurtosis statistic in the pre-liberalization, liberalization and full period greatly exceeds 3 and this indicates that return has a leptokurtic (high-peaked) distribution in all periods. The *p*-value of the Jarque-Bera statistic in the pre-liberalization, liberalization and full period is less than 0.01 in each case, hence, the rejection of the null hypothesis of normal distribution at 1% significance level.

Table 2. ARCH-LM test

Source: authors' computation.

Lag	F-statistic	nR^2
1	3.673404*** (0.0560)	3.657256*** (0.0558)
4	15.46620* (0.0000)	53.73733* (0.0000)
8	8.696587* (0.0000)	59.83051* (0.0000)

Note: * and *** imply rejection of null hypothesis at 1% and 10% significance level, respectively, and p-values are in parentheses.

The presence of conditional heteroscedasticity is determined by performing the ARCH-LM test on the return series. The null hypothesis for the test is that there is homoscedasticity, i.e., there is no autoregressive conditional heteroscedasticity (ARCH) effects. Table 3 presents the results of the ARCH-LM test at lag 1, 4 and 8.

From Table 2, it can be seen that the ARCH-LM test rejects the null hypothesis of no ARCH effects in returns at lag order 1, 4 and 8. This implies that return volatility clustering exists in the Nigerian stock market, hence a volatility model can be modelled for the market.

3. MODEL AND ESTIMATION

This study built a first order autoregressive model [AR (1)] which specifies returns (*R*) as a function of past returns and a dummy variable (DUM). DUM is the stock market liberalization index and it is either 0 or 1 where 0 is assigned to each month in the pre-liberalization period and 1 is given to each month in the liberalization period. The model is transformed into generalized autoregressive conditional heteroscedasticity (GARCH) model. This study adopted four variants of GARCH model namely symmetric GARCH model, asymmetric GARCH or threshold GARCH (TGARCH) model, power GARCH (PGARCH) model and exponential GARCH (EGARCH) model. The models consist of a conditional mean equation and a conditional variance equation. The conditional mean equation in AR (1) form is presented as

$$R_t = \alpha_0 + \alpha_1 \cdot R_{t-1} + \alpha_2 \cdot DUM_t + \varepsilon_t, \qquad (2)$$

where α_0 is the constant parameter, α_1 is the coefficient of the one-month period lagged value of returns, α_2 is the coefficient of the dummy variable, and ε_t is the error term.

The dummy variable was incorporated as a variance regress or in the conditional variance equation. The symmetric GARCH model was developed by Bollerslev (1986) and the conditional variance equation in GARCH (1,1) is stated as:

$$\sigma_t^2 = \varphi + \rho \cdot \varepsilon_{(t-1)}^2 + \gamma \cdot \sigma_{(t-1)}^2 + \lambda \cdot DUM_t, \qquad (3)$$

where σ_t^2 is the conditional variance, φ is the intercept (constant term); ρ is the coefficient of ARCH term, γ is the coefficient of GARCH term, λ is the coefficient of the stock market liberalization index (dummy variable).

The TGARCH model allows asymmetric impact of news (innovations) on volatility to be determined. The a symmetry impact of news can be said to exist if the asymmetric term is statistically significant. The conditional variance of the TGARCH (1,1) model is expressed as:

$$\begin{aligned}\sigma_t^2 &= \varphi + \rho \cdot \varepsilon_{(t-1)}^2 + \gamma \cdot \sigma_{(t-1)}^2 + \\ &+ \tau \cdot \varepsilon_{(t-1)}^2 \cdot dummy_{t-1} + \lambda \cdot DUM_t,\end{aligned} \qquad (4)$$

where τ is the asymmetric term (if $\tau \neq 0$, news impact is asymmetric). If $\tau < 0$, this implies bad news and if $\tau > 0$, it implies good news.

The PGARCH model was developed by Ding, Granger, and Engle (1993) to also account for asymmetry impact of news on volatility. When the power is fixed at 1, it indicates that the conditional standard deviation is modelled and the PGARCH model is a GARCH model with asymmetric term when the power is fixed at 2. Using this model, the conditional standard deviation is modelled instead of the conditional variance modelled in other variants of the GARCH model. The PGARCH $(1, \delta, 1)$ model is expressed as:

$$\begin{aligned}\sigma_t^{\delta} &= \varphi + \rho \cdot (|\varepsilon_{(t-1)}| - \tau \cdot \varepsilon_{(t-1)})^{\delta} + \\ &+ \gamma \cdot \sigma_{(t-1)}^{\delta} + \lambda \cdot DUM_t,\end{aligned} \qquad (5)$$

where δ is the power parameter fixed at 1 and σ_t^{δ} is the conditional standard deviation.

The EGARCH model was introduced by Nelson (1991) to also capture asymmetry impact of innovations or shocks on volatility and it is covariance stationary when the coefficient of the GARCH term is less than 1. The model is usually expressed in natural logarithm (ln) of the conditional variance so that the conditional variance is always

Table 3. GARCH models estimation results

Source: authors' computation

	GARCH (1,1)	TGARCH (1,1)	PGARCH (1,1,1)	EGARCH (1,1)
Mean equation				
$\propto_0$	1.695543*(0.0000)	1.681900* (0.0000)	2.431323 (0.5621)	1.631957* (0.0000)
$\propto_1$	0.322501* (0.0000)	0.316023* (0.0000)	–0.275528* (0.0002)	0.334595* (0.0000)
$\propto_2$	–0.901596** (0.0202)	–0.973167** (0.0114)	–3.563544 (0.4279)	–0.937171* (0.0075)
Variance equation				
φ	1.629279* (0.0009)	1.566777* (0.0025)	24.79312* (0.0004)	–0.054159 (0.6302)
ρ	0.329436* (0.0001)	0.244659* (0.0015)	–0.521088* (0.0006)	0.564021* (0.0000)
γ	0.478989* (0.0000)	0.488820* (0.0000)	0.132583 (0.6108)	0.814338* (0.0000)
τ	—	0.208244 (0.1509)	–0.097228 (0.5754)	–0.056592 (0.2666)
λ	6.853507* (0.0004)	6.435661* (0.0010)	–6.700367** (0.0441)	0.281770* (0.0004)
Model diagnostics				
ARCH LM(1)	0.036083 (0.8494)	0.006378 (0.9364)	19.89449* (0.0000)	0.006282 (0.9369)
ARCH LM(2)	0.297572 (0.7428)	0.447352 (0.6397)	21.23367* (0.0000)	0.344047 (0.6123)
AIC	5.945737	5.945346	7.837505	5.937336
SC	6.018462	6.028461	7.920619	6.020450
HQ	5.974598	5.978330	7.870489	5.970329
Log Likelihood	–1119.717	–1118.643	–1477.207	–1117.125

Note: * and ** indicate p–value < 1% and 5%, respectively, and p–values are reported in parentheses. Also, F–statistic is reported for ARCH-LM test.

positive even if the parameters are negative. The EGARCH (1,1) model is specified as:

$$\ln \sigma_t^2 = \varphi + \rho \cdot \left\{ \frac{|\varepsilon_{(t-1)}|}{\sqrt{\sigma_{(t-1)}^2}} \right\} + \tau \cdot \frac{\varepsilon_{(t-1)}}{\sqrt{\sigma_{(t-1)}^2}} + \\ + \gamma \cdot \ln(\sigma_{(t-1)}^2) + \lambda \cdot DUM_t. \quad (6)$$

The GARCH models were estimated with maximum likelihood estimation (MLE) method. The Gaussian error distribution cannot be assumed for the model because of the non-normal distribution of the return series; hence, an alternative for series with non-normal distribution was applied. The Student's *t* distribution with fixed degree of freedom was employed. Table 4 presents the estimation results of the GARCH models.

The EGARCH model fits best, because its AIC, SC, HQ and Log Likelihood produced the lowest information compared to other models, hence, only the result of the EGARCH model is discussed. The coefficient of the dummy variable in the mean equation indicates that stock market liberalization has a significant negative impact on returns. This implies that increase in stock market liberalization reduces market returns. The statistical significance of the ARCH term provides evidence of returns volatility clustering, while the statistical significance of the GARCH term indicates that returns volatility is persistent. The asymmetry term is not significant and this suggests that the volatility of returns is non–asymmetric (i.e., good and bad news have the same effect on volatility). The coefficient of the stock market liberalization index in the variance equation is positive and significant, thus indicating that financial liberalization increases returns volatility in the stock market. The ARCH–LM test accepts the null hypothesis of no ARCH effects at lags 1 and 2.

Source: authors' computation.

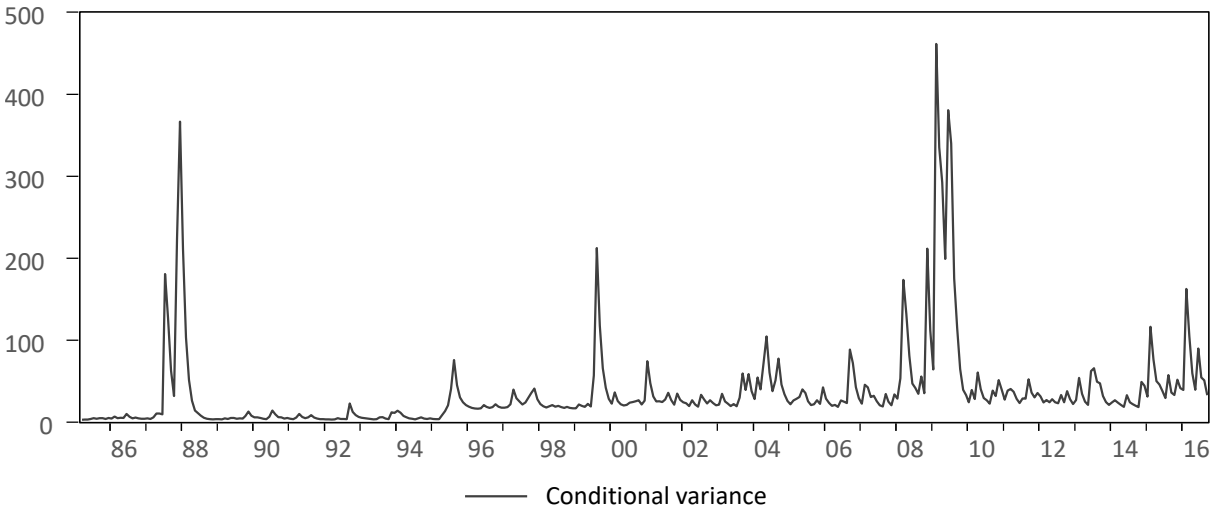

Figure 3. Conditional variance graph

Source: authors' computation.

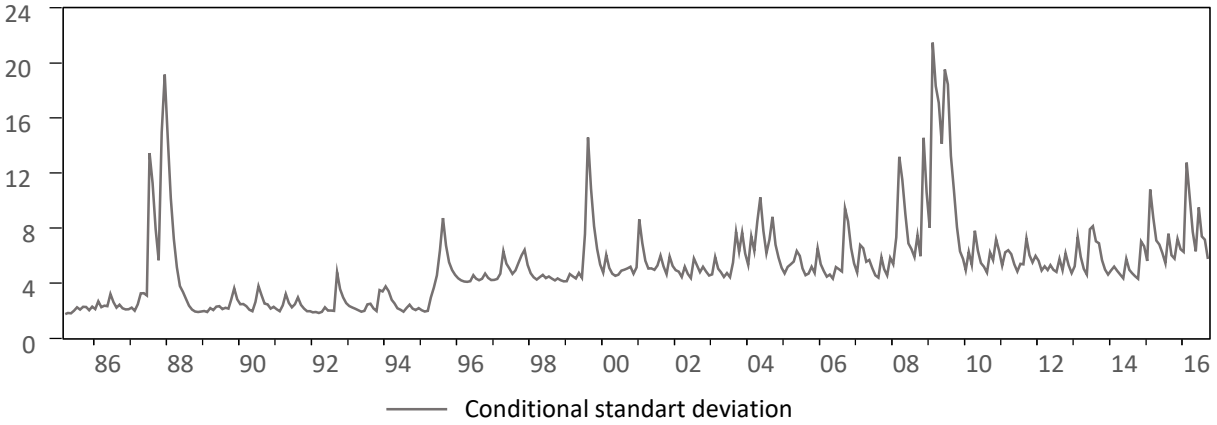

Figure 4. Conditional standard deviation graph

It can be observed from Figure 3 and Figure 4 that there are notable spikes which provide evidence of structural breaks. Subsequent to the full liberalization of the Nigerian stock market in January 1995, the most prominent structural break occurred during the period the market experienced turmoil as a result of the global financial crisis. It can also be deduced from the plots of conditional variance and standard deviation of return that the risk associated with investment was relatively higher in the financial liberalization episode compared to the period with no financial liberalization episode.

CONCLUSION

There are two contrasting views on the effect of financial liberalization on stock market volatility. The neo–classical economists believe that financial liberalization reduces stock market volatility, while the post–Keynesian economists argue that financial liberalization increases volatility in the stock market. This study assessed the effect of financial liberalization on emerging stock market volatility in Africa, with special focus on the Nigerian stock market. It was found that financial liberalization in creases volatility of the Nigerian stock market. This implies that there is a positive association between financial liberalization and market risk. This study is in line with previous studies such as Grabel (1995), Levine

and Zervos (1998), Miles (2002), Kedmey (2005), Haung (2008), and Afef (2014). It also supports the argument of the post–Keynesian economists against financial liberalization. The financial liberalization–induced volatility of the Nigeria stock market may be attributed to the large inflows of foreign portfolio investment which created excess liquidity, weak risk–based regulatory framework, macroeconomic instability, relatively low level of stock market development and high political risk. It was also revealed that there is no evidence of asymmetry in the Nigerian stock market, thus implying that investors react to good and bad news in the same way. In spite of financial liberalization increasing stock market volatility, it is important to note that financial liberalization still provides benefits to the Nigerian economy such as allowing the inflow of foreign capital, which, in turn, accelerates the rate of capital formation in the domestic economy, thus promoting economic growth. However, this study recommends that the government may increase capital controls as a way to suppress the negative effect of financial liberalization on the volatility of the Nigerian stock market.

REFERENCES

1. Afef, M. T. (2013). The effects of financial liberalization on stock market cycles: Structural time series models. *Global Journal of Management and Business Research Interdisciplinary, 13*(7), 17-24. Retrieved from https://globaljournals.org/GJMBR_Volume13/3-The-Effects-of-Financial-Liberalization.pdf
2. Afef, M. T. (2014). Financial liberalization and stock market behaviour in emerging economies. *Journal of Behavioral Economics, Finance, Entrepreneurship, Accounting and Transport, 2*(1), 8-17. https://doi.org/10.1007/s10644-005-4522-6
3. Aggarwal, R., Inclan, C., & Leal, R. (1999). Volatility in emerging stock markets. *The Journal of Financial and Quantitative Analysis, 34*(1), 33-55.
4. Arestis, P., & Demetriades, P. (1999). Financial liberalization: The experience of the developing countries. *Eastern Economic Journal, 25*(4), 441-457.
5. Bekaert, G., & Harvey, C. R. (1997). Emerging equity market volatility. *Journal of Financial Economics, 43,* 29-78.
6. Bekaert, G., & Harvey, R. C. (1998). *Capital flows and the behaviour of emerging market equity returns* (NBER Working Paper Series No. 6669). Cambridge: National Bureau of Economic Research.
7. Ben Rejeb, A., & Boughara, A. (2014). The relationship between financial liberalization and stock market volatility: The mediating role of financial crises. *Journal of Economic Policy Reform, 17*(1), 46-70. http://dx.doi.org/10.1080/17487870.2013.827967
8. Bhattacharyya, S. (2014). *Financial deregulation and asset price volatility under perfect and imperfect information.* Paper presented at the International Economic Association 17th World Congress, Jordan.
9. Bollerslev, T. (1986). Generalised autoregressive conditional heteroscedasticity. *Journal of Econometrics, 31,* 307-327.
10. Cunado, J., Biscarri, J. G., & Pérez de Gracia, F. (2006). Changes in the dynamic behaviour of emerging market volatility: Revisiting the effects of financial liberalization. *Emerging Market Review, 7*(3), 261-278.
11. Demetriades, P., Karoglou, M., & Law, S. H. (2006). *Financial liberalization and breaks in stock market volatility* (Discussion Papers in Economics 06/13). Leicester: Department of Economics, University of Leicester.
12. Ding, Z., Engle, R., & Granger, C. (1993). Long memory properties of stock market returns and a new model. *Journal of Empirical Finance, 1,* 83-106.
13. Edwards, S., Biscarri, J. G., & Pérez de Gracia, F. (2003). Stock market cycles, financial liberalization and volatility. *Journal of International Money and Finance, 22,* 925-955.
14. Grabel, I. (1995). Assessing the impact of financial liberalization on stock market in selected developing countries. *Journal of Development Studies, 31*(6), 903-917.
15. Haung, W. (2008). Stock market effects of emerging markets financial liberalization. Ningbo: University of Nottingham, China Campus. Retrieved from http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.407.890
16. Kaminsky, G., Lyons, R., Schmukler, S. (2000). Fragility, liquidity and risk: The behavior of mutual funds during crises. A paper prepared for the World Bank, IMF, ADB conference on International Financial Contagion: How It Can be Stopped, February 3-4, Washington D. C.
17. Kassimatis, K. (2002). Financial liberalization and stock market volatility in selected developing countries. *Applied Financial Economics, 12*(6), 389-394.
18. Kedmey, D. (2005). Financial liberalization in emerging market economies: A catalyst for stock market volatility? Retrieved from http://digitalcommons.carleton.edu/ecp/2
19. Kim, E. H., & Singal, V. (2000). Stock market openings: Experience of emerging economies. *Journal of Business, 73*(1), 25-66.
20. Levine, R., & Zervos, S. (1998). Capital account liberalization and

stock market development. *World Development, 26*(7), 1169-1183.

21. Mckinnon, R. I. (1973). *Money, capital and banking.* Washington D.C.: Brooklyn Institution.
22. Miles, W. (2002). Financial deregulation and volatility in emerging equity markets. *Journal of Economic Development, 27*(2), 113-126.
23. Ndako, U. B. (2012). Financial liberalization, structural breaks and stock market volatility: Evidence from South Africa. *Applied Financial Economics, 22*(15), 1259-1273. http://dx.doi.org/10.1080/09603107.2012.654911
24. Nelson, D. (1991). Conditional heteroscedasticity in asset returns: A new approach. *Econometrica, 59*(2), 347-370.
25. Shaw, E. S. (1973). *Financial deepening in economic development.* New York: Oxford University Press.
26. Singh, A. (2003). Capital account liberalization, free long–term capital flows, financial crises and economic development. *Eastern Economic Journal, 29*(2), 191-216. Retrieved from https://www.jstor.org/stable/40325410?seq=1#page_scan_tab_contents
27. Spyrou, S. (1999). Financial liberalization or financial repression? The case of the Greek equity market. *Journal of Southern Europe and the Balkans, 1*(1), 65-76. Retrieved from http://ijbssnet.com/journals/Vol._1_No._3_December_2010/8.pdf
28. Spyrou, S. I., & Kassimatis, K. (1999). Did equity market volatility increase following the opening of emerging markets to foreign investors? *Journal of Economic Development, 24*(1), 39-51.
29. Waliullah (2010). Financial liberalization and stock market behaviour in an emerging market – a case study of Pakistan. *International Journal of Business and Social Science, 1*(3), 75-86.
30. Zhang, Y., & Ding, L. (2008, May). The impact of foreign exchange reform on the volatility of China's stock market. *Proceedings of the 5th International Annual Conference on WTO and Financial Engineering* (pp. 105-109), Hangzhou. Retrieved from http://www.seiofbluemountain.com/upload/product/201002/1265766758p3s5zs9x.pdf