The Effect of Regulations on Stock Market Risk (Volatility) in Nigeria

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Abstract

Recent regulations are directed at mitigating financial market risk, because risks, especially volatility dampen investors' confidence, and hinder firms' ability to raise funds at the exchange. Though, volatility had been investigated in the past, the joint utilization of micro and macro regulatory tools to address it after the global crisis is rare. It is on this backdrop that this study investigates the effect of regulations on stock market risk (volatility) in Nigeria. Thirteen interest charging banks listed in the Nigerian Exchange Limited for the period of 2010-2020 were investigated, because bank stocks are mostly traded at the exchange. Data for this study were collected from the banks' annual reports, stock exchange official daily price lists as well as the Central Bank of Nigeria Statistical Bulletin various issues. The first difference generalized method of moments (DGMM) and the dynamic model were engaged in the investigation. Results of this study reveal that regulatory liquidity ratio and monetary policy rate positively and significantly impact stock market risk (volatility), while prescribe cash reserve ratio has negative and significant effects. The implication of this finding is that regulations except cash reserve instruments constitute frictions impacting equity market risk. Therefore, it is recommended that caution is exercised in the use of micro and macro regulatory weapons. Otherwise, investors' confidence will decline and investments will reduce.

Keywords: Difference Generalized Method of Moments, Dynamic Model, Financial Regulations, Stock Market Volatility, Nigeria

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I. Introduction

Financial market risks, especially the volatility of stock price inhibit investors' confidence and possibly hinder firms' ability to raise funds through an initial public offering in the equity market. Significant regulatory measures targeted at minimizing financial risk have taken place since the 2007/2008 financial crisis. Notwithstanding that measures were in place to guide the activities of financial market operators before 2007, the crises exposed the flaws of previous regulatory actions, and thus necessitate the introduction of more measures to reinforce earlier regulations. For instance, Basel III regulatory rules came into existence, because the previous regulatory actions failed to prevent the global financial crises (Zgarni & Hassuona, 2018). Basel III Accord stressed among others the strengthening of banks' capital, to build the needed resilience against internal and external shocks. Indeed, a reduction in risk-taking through low leverage and a boost in banks' capital may have the capacity to instill confidence and ensure stability in the financial system, particularly the stock exchange. However, large capital at the disposal of banks is an incentive to create more credits because of the excess liquidity, and this will stimulate trading activities at the exchange, thus instigating volatility.

Therefore, to guarantee stability in the aggregate economy, consideration should also be given to the volatility of asset returns because a financial crisis occurs when there is high uncertainty in the markets, portraying that the financial institution is weak and face macroeconomic surprises. It is on this backdrop that this study seeks to examine whether regulations post-financial crisis has succeeded in mitigating financial market risk (volatility) in Nigeria.

Sarin and Summers (2016) showed that indicators of instability in the stock market are still on the high side post-2007/2009 than before, an indication that existing regulations aimed at arresting market risk may not have achieved the desired result. However, Onoh (2017) declared that the use of prudential guidelines, specifically monetary policy is yielding the desired outcome. Gummi (2015) reviewed the effect of regulation on banks in Nigeria since 2005 and reported that regulation boosts confidence, safety, and stability of the system. Elkelish and Tucker (2016) investigated the impact of regulatory capital on stock market stability during the crisis period and reported that regulatory capital ensures stock market stability. Zare, Azahi and Habitullah (2013) examined the effect of monetary policy surrogate by the interest rate on stock market volatility in developing countries and discovered that interest rate influence stock market volatility.

It is obvious from the foregoing that, joint utilization of micro (firm's specific) and macro (aggregate) regulatory indicators to tackle stock market risk is uncommon in Nigeria. To this end, both economy-wise and bank regulatory variables are engaged in this study to examine whether regulations have a significant effect on the volatility in the Nigerian stock market post-financial crisis. This study is of the view that in measuring the effect of regulations on stock market instability, there is a need to activate firms' specific and economy-wise monetary policy regulatory factors. Indeed, regulation directed at curtailing banks' credit creation may hinder access to investment funds, thus limiting the volume of trading activities at the exchange, and this may affect stock market risk (volatility).

II. Literature Review

Financial Regulations and Stock Market

Regulations are the standard of behaviour economic agents, that are expected to comply with while carrying out their activities. Financial regulations are a compendium of guidelines instituted by the government and targeted at controlling the activities of the operators in the financial system (Chris, 2003). Regulation is initiated when it is perceived that the behaviors of economic agents will harm the economy. This means that, government intervention is premised on the belief that it knows what is best for the citizens than they do themselves (Ajefu & Barde, 2015). Indeed, Basel III regulatory guidelines came into operation to strengthen the banking system following the distortions caused by the financial crisis of 2007. Dewatripont and Tirole (1994) declared that regulatory capital is a procedure by which depositors assigned power to regulators to control the activities of banks, particularly as it relates to risk-taking. Certainly, the capital requirement is vital because adequate capital in the possession of banks helps to safeguard exposure to failure (Chortareas, Girardone & Ventouri, 2012), and boosts resilience in a crisis situation. However, large capital at the disposal of banks is an incentive to create more credits because of the excess liquidity, and this will stimulate trading activities at the exchange, thus instigating volatility.

Central banks regulate the behavior of financial institutions (Fabizzi & Drake, 2009) through monetary policies, and the effect is conveyed through liquidity, credits, and exchange rate (Osuagwu, 2009 citing Uchedu, 1996) to the financial market. Undeniably, liquidity rates and monetary policy rates are commonly used to ensure stability in the financial system. Huo and Rios-Rull (2016) asserted that borrowing constraints decrease domestic prices, and lower wealth, particularly for extremely indebted economic agents; and this ultimately may affect stock market activities. The reduction in trading activities at the exchange has been credited to financial and cash policies (Shaban, Al-Zubi & AlGhusin, 2017). Jun, Marathe and Shawky (2003) posited that macroeconomic policies, as well as legal activities, impact stock market behavior.

The reactions of the stock market to regulations may also be ascribed to frictions because of the effect of regulations on investors' confidence and the trading activities at the exchange. Indeed, frictions caused distortions in buying and selling procedures (Olbrys & Majewska, 2014). Financial market frictions include regulations and restrictions on private enterprises (Degennaro & Robotti, 2007), and this is capable of limiting investors from incorporating some financial assets in their portfolios. For instance, restraints on access to funds through an increase in liquidity ratio or cash reserve ratio may prevent investors from including some financial assets in their portfolio, and this may affect the level of activities at the exchange, hence the need to examine in this study their impact on financial market risk.

Theoretical Foundation for the Study

This study is predicated on the agency theory enunciated by Jensen (1986). An agency conflicts arise in an organization where the principal is separated from management because the managers have the motivation to embark on risky activities which may not be in the interest of the principal and other stakeholders. It can be argued that inadequate regulation of financial institutions, particularly banks is an impetus for them to engage in risky behavior. Therefore, to safeguard depositors' funds and guarantee stability in the financial system, government introduces various regulatory policies. Indeed, banking institutions require regulatory attention to minimize the risk level for participants because of the volatile nature of the industry (Currie, 2003). Stieglitz (1989) opined that government should intervene (through regulation) when the investments of the public are at risk due to the activities of institutions' managers.

Empirical Literature

Elkelish and Tucker (2016) inspected the effect of mandatory capital on stock market stability in the crisis period of 2007 to 2008, using the generalized least squares technique. It was discovered that regulatory capital boost stock market stability. Brumm, Kubler, Grill and Schmedders (2014) showed that margin regulation in the aggregate economy has a depressing effect on the volatility of asset returns. Tennant and Tracey (2014) investigated the link between bank and stock market volatility in small but bank overshadowed country, using generalized autoregressive model, and found that strict regulations determine market volatility. Bleich, Fendel and Bulke (2013) studied the effect of interest rate on financial market stress proxy by market volatility. They revealed that prominent financial regulatory authorities like the Bank of England, and Federal Reserve Bank tackle market volatility through interest rate reduction. Zare, Azahi and Habitullah (2013) examined the effect of monetary policy surrogate by the interest rate on stock market volatility in developing countries, using pool mean regression covering 1991M1 to 2011M12. The outcome of the investigation shows that a rise in interest rates influences stock market volatility.

Mertzanis and Siriopoulos (1999) considered whether regulation of price limits influence stock market volatility in Athens for the period 1991 to 1998, using ANOVA technique. It was reported that price limits regulation does not mitigate stock return volatility except for large capitalized shares. Wang, Tsai and Li (2017) considered policies' impact on the stock market in China with the aid of GARCH methodology and daily data from 19th December 1990 to 29th May 2015. The result revealed that policy on deposit reserve ratio influences stock market volatility. Tchereni and Mpini (2020) considered the impact of monetary policy on stock market volatility in South Africa for the period spanning the first quarter of 2000 to the fourth quarter of 2016, applying an error correction model. Results revealed that the money supply negatively influences volatility, while the repo rate has a positive effect on volatility.

III. Methodology

This study aims to investigate the impact of regulations on financial market risk in Nigeria, focusing on banks. This is necessary, because bank stocks are the most highly traded securities on Nigerian Exchange, and instability associated with the stocks may affect investors' confidence, thus constituting a risk to the entire economy. Thirteen interest-charging banks quoted in the Nigerian Stock Exchange form the sample for the study because of their trading frequency, and regulations are directed at them most of the time. Data for the study were collected from banks' audited annual reports, the Nigerian Stock Exchange's official daily price list,s and the Central Bank of Nigeria Statistical Bulletin, covering the period of 2010-2020. Stock prices were subjected to the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) to ascertain stock volatility and the residual which is called volatility in this study was extracted and incorporated among the investigated variables in the excel work file. The Generalized Method of Moments (GMM) in the first difference option and the dynamic model were used for the investigation. To test for serial correlation, the regression output was subjected to the Arrelano and Bond (1991) autocorrelation procedures. The J.statistic initiated by Hansen (1982) was engaged to test for the existence of over or under restrictions in the instrumental variables added as a requirement for GMM estimation. This study applied E-views 9.0 computer software for the analysis.

IV. Model Specification

Regulations are directed at ensuring financial system stability, and volatility is one of the indicators of stock market stability. Therefore, to examine the nexus between regulations and stock market risk (volatility) in Nigeria, this study implemented the dynamic model. Dynamic model is invoked when the lagged value (s) of the dependent variable is added as regressors thus:

$$K_{it} = K_{it\_1} + \mathrm{b}Z_{it} + \mathrm{a}_i + \mu_{it} \quad (1)$$

Where;

K = dependent variable,
Z = set of regressors,
it = unit and time identifiers respectively
a = individual specific effects (unknown effects),

t_1 = lagged value, and
U = error term.

The effect of regulations on stock market risk in this study take the following form:

$$VR = f(BLR, CAR, MPR, PCR, LEV, EXR) \quad (2)$$

The implementable form of the above model is stated as follows:

$$VR_{it} = \gamma VR_{it\_1} + b_1 BLR_{it} + b_2 CAR_{it} + b_3 MPR_{it} + b_4 PCR_{it} + \mu_{it} \quad (3)$$

Where;

VR_{it} = The volatility of stock price for bank i at time t (proxy for stock market risk in this study)
BLR_{it} = Regulatory liquidity ratio for bank i at time t (surrogate by the ratio of cash and cash equivalent to bank total deposits)
CAR_{it} = Regulatory capital adequacy ratio for bank i at time t (calculated as bank capital divided by risk weighted assets)
MPR_{it} = Prescribed monetary policy rate for the aggregate economy (Benchmark for interest rate)
PCR_{it} = Prescribed cash reserve ratio for the banking industry
t-1 = The lagged value of the variable
γ = Coefficient of the dependent variable in the immediate past
U = Error term
b_i –b_2 are coefficients of the variables to be estimated.

Note: Leverage (LEV) and EXR (exchange rate) were added as external instruments which is a requirement for estimating GMM.

Stock price volatility is best captured using the generalized autoregressive conditional heteroscedasticity (GARCH). Therefore, stock price was subjected to GARCH procedures, the residual extracted and added to the other variables in excel work file to enable further investigation.

The mean equation of ARCH model (Gujarati, 2009) takes the form:

$$X_t = E_{t-1}(X_t) + \mu_t \quad (4)$$

Where;

X_t = stock market returns at time t (proxy in this study by stock price),
E_{t-1} = expectation depending on information available to t-1,
μ = error term

The variance of the above equation takes the form:

$$б^2t = K_0 + \sum_{i=1}^{q} a_1 E^2 б^2 t - 1 + \mu_t \quad (5)$$

The general pattern of equation 5 with log conditional variance as autoregressive model of abbreviated as GARCH (1,1) in its summarized form is stated as:

$$log б^2 t = K_0 + K_1 E^2 t_1 + K_2 б^2 t\_1 \quad (6)$$

Where;

$log б^2 t$ is the log conditional variance and it take value from $K_1 E^2_{t\_1}$, $E^2_{t\_1}$ is the past period error variance, $б^2_{t\_1}$ is the past conditional variance, and K_0, K_1, K_2 are factors to be estimated.

V. Results and Discussion

The main concern of this study is to examine the impact of regulations on stock market risk, therefore it was necessary to first ascertain volatility of stock price. To achieve this, GARCH technique was applied on stock price and the output is displayed in Table 1 below.

Table 1: GARCH Estimation of Volatility

Variable	Coefficient	Z-Statistic	P. Value
Log(GARCH)	1.3269	11.8683*	0.0000
Variance Equation			
C	0.6856	4.4547	0.0000
Residual Variance	0.4836	4.7732*	0.0000
GARCH(-1)	0.4999	10.0897*	0.0000

Source: E-Views 9.0 Software Output

It is obvious from Table 1 above that the stock price exhibit volatility, because the mean and variance equations are positive and significant at 1% level. A further look at Table 1 revealed that the sum of the variance residual and GARCH (-1) is not more than one, which is a valid condition for accepting the GARCH estimate. To further confirm the presence of volatility in stock price, the GARCH residual was graphed. The outcome in Figure 1 demonstrates that the stock price is volatile because of the high level of oscillation. Specifically, the prices swing between the positive and the negative region (That is, above and below the zero line). A swing to the extreme up indicates upward volatility, while movement downward (the negative region) is a sign of downward volatility. At this point, loss occurs abruptly due to a substantial decline in prices. To check for ARCH effect on the residual variance, the Autoregressive Conditional Heteroscedasticity Lagrange Multiplier (ARCH-LM) test was applied to the GARCH residuals. The result highlighted in Table 2 reveals that the F.statistic and the observed R-squares are not significant at 5%, an indication that there is no ARCH effect in the residual. This means that, there is no autocorrelation in the residual.

Table 2: ARCH-Lm Test for Heteroscedasticity

F-statistic	0.074577	Prob. F(1,140)	0.7852
Obs*R-squared	0.075602	Prob. Chi-Square(1)	0.7833

Source: E-Views 9.0 Software Output

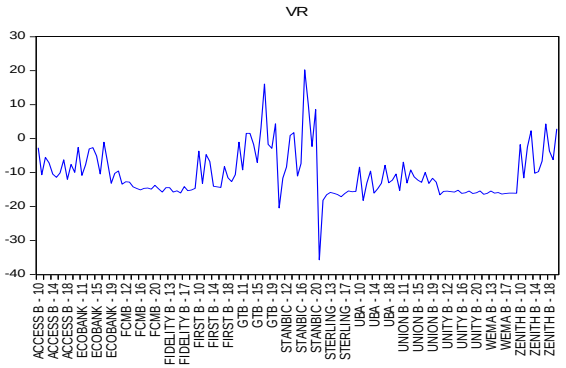

Figure 1: Volatility of Bank Stocks

Source: E-Views 9.0 Software Output

Based on the fact that the incidence of volatility in the stock price has been established, the GARCH residual which is called volatility in this study was extracted and added to other modeled variables in excel-work-file to enable this study investigate the impact of regulations on stock market risk (volatility).

The concern in this study is to assess whether regulations after the 2007 financial crisis played any major role on stock market risk (proxy by volatility in this study). Specifically, whether micro and macro prudential regulatory tools are potent factors in arresting volatility. To this end, the modelled variables were subjected to difference generalized method of moments (DGMM) regression technique. The outcome of DGMM estimate is highlighted in Table 3 below.

Table 3: DGMM Regression Output (VR as Dependent Variable)

Variables	Coeff.	T. Statistics	Probability
VR(-1)	-0.1646	-2.3962	0.0184**
BLR	30.2367	3.4497	0.0008*
CAR	-3.9428	-0.1654	0.8690
MPR	0.3685	2.0077	0.0474**
PCR	-0.1755	-3.0422	0.0030*
J. Statistic = 9.9452 Pro. J. Statistic = 0.2689 Instrument Ranking = 13 *; ** = Significant at 1% and 5% level respectively			

Source: E-Views 9.0 Software Output

Table 3 reveals that the goodness of fit statistic represented by J.Statistic is very impressive, because the probability of J.Statistic is not significant at the 0.05 percent level. The result implies that the model is well specified because there are no over-or-under restrictions in the model and the instrumental variables added infuse into the model. To be sure there is no serial correlation in the regression estimates, the Arrelano and Bond (1991) autocorrelation test were applied to it, and the result is presented in Table 4. The result in Table 4 clearly shows the absence of autocorrelation in the regression output due to the not significance of AR(1) and AR(2) statistics at the 5% level. The condition for accepting the DGMM result is that at least AR(2) should not be significant, judging by the probability value.

Consequent to the impressive outcome of the diagnostic tests, the study went ahead to interpret the DGMM results in Table 3 above because of the sureness that it is consistent and reliable, and therefore good for policy direction. The result in Table 3 reveals that previous market volatility has a spillover effect on current volatility because of the significance of the past value at the 5% level. This portent that there is volatility spillover in the market, and therefore investors should demand a high reward for taking a high risk.

A further look at Table 3 indicates that bank regulatory liquidity ratio (BLR) is positively related to stock market volatility. The significance of the indicator at the 1% level, implies that bank liquidity is an effective instrument affecting stock market risk. This is because a rise in this regulatory tool denies investors access to investment funds, thereby limiting the inclusion of some financial assets into their portfolios and depressing the volume of activities and by extension stock market liquidity. Therefore, financial regulation worsens the capacity of the stock market to resist shocks because of its effect on trading volume and liquidity, hence the positive effect. Indeed, Hameed et. al. (2010) demonstrated that funds restrictions are the major determinant of stock market liquidity.

However, the capital adequacy ratio (CAR), another micro regulatory tool, negatively relates to stock market volatility. It means that this indicator can curtail stock market volatility, as a rise in this regulatory instrument depresses stock market risk. The insignificance of this regulatory weapon in this study may be due to the undeveloped nature of the Nigerian financial system and the fact that the current capital adequacy ratio adopted by the regulatory authority is not sufficient to forestall current market risk at the moment. This calls for review of the current standard of 10% for national banks and 15% for global banks if the unpredictable fluctuations in market price are to be abated.

Also, Table 3 shows that the monetary policy rate (A benchmark for the interest rate in Nigeria) can be deployed to address stock market volatility. The monetary policy rate (MPR) is employed by the Central Bank to regulate the quantity of money in circulation. The significance of MPR at the 5% level, implies that it has the potential to influence stock market risk. The positive impact of this indicator on volatility may be due to its high rate presently. High-interest rate discourages investment, especially trading activities at the exchange, thus worsening stock market liquidity and the capacity of the market to withstand shock, hence the positive effect. Indeed, regulations constitute frictions that distort buying and selling at the exchange (Olbrys & Majewska, 2014). This finding tends to support Zare et al (2013) that monetary policy (Interest rate in their study) influences stock market volatility; as well as Tchereni and Mpini (2020) who reveal that repo rate (the equivalent of the monetary policy rate in Nigeria) has a positive impact on volatility.

Finally, the prescribed cash reserve ratio (PCR), another aggregate (macro) regulatory weapon, is negatively and significantly related to stock market risk (volatility). The result implies that a rise in the cash reserve ratio will depress stock market volatility to the tune of 36.85%. Surely, an increase in cash reserve reduces the ability of banks to create credits, thus restricting access to funds for trading, thereby

discouraging the level of activities at the exchange and depressing volatility. This result tends to agree with Wang et al (2017) who revealed that the deposit reserve ratio influences stock market volatility.

Generally, this study reveals that both micro and macro regulatory tools have a significant influence on stock market risk (volatility) in Nigeria. Indeed, bank liquidity ratio and monetary policy rate as regulatory tools have positive and significant effects. However, cash reserve ratio regulatory instrument has a negative and significant impact on volatility.

Table 4: Arellano-Bond Test for Serial Correlation in Regression Output

Test Order	M-Statistic	Rho	SE(Rho)	Probability
AR(1)	-1.1389	-657.7494	577.5147	0.2547*
AR(2)	-1.6068	-1585.6946	986.8663	0.1581*
* = Not Significant at 5% level				

Source: E-Views 9.0 Software Output

VI. Conclusion

The aim of this study was to investigate the effect of regulations on stock market risk in Nigeria. Specifically, it examined whether volatility existed in the Nigerian Stock Market post-finance crisis (2010 and 2020) and whether financial regulations were mitigating factors. The first difference generalized method of moments (DGMM) and the dynamic model were engaged in the investigation.

The E-views 9.0 software was employed for the analysis. Thirteen banks listed in the Nigerian Exchange Limited for the period of 2010-2020 were investigated. Data for this study were collected from the bank's annual reports, the stock exchange's official daily prices list as well as the Central Bank of Nigeria Statistical Bulletin various issues.

The results of this study showed that the regulatory liquidity ratio for banks and monetary policy rate positively and significantly impact stock market risk (volatility), while the prescribed cash reserve ratio has negative and significant effects on market risk. The impact of the regulatory capital adequacy ratio on market risk is positive, but not significant. Thus, this study concludes that (i) stock market volatility persists after the global financial crisis in Nigeria (ii) liquidity ratio, monetary policy rate, and cash reserve ratio are potential regulatory instruments to influence stock market risk (volatility).

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