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# ASYMMETRIC EVALUATION OF BANKING STABILITY AND BANK PERFORMANCE IN NIGERIA: AN NARDL APPROACH

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**ABSTRACT**: *The study examines asymmetric evaluation of banking stability and bank performance in Nigeria. The study employs a longitudinal research design and utilizes secondary data covering the period from 1985-2018. The data was sourced from the CBN statistical bulletin. We consider the Non-Linear auto-regressive Lag Model (NARDL) to model the relationship between bank stability and bank performance in Nigeria. On the overall, the results suggest that in the short run bank stability/regulation variables, LIQR, LDR, CRR tend to exhibit significant asymmetric effects on bank performance, however, this effects tends to be quite weak as we move into the long run. The long run effects indicate that positive and negative shocks to stability variables do not appear to be significant in their effects on bank performance which this is quite insensitive to the nature of financial stability shocks. The study recommends that there is still need for banks to improve their stability ratios at levels that can adequately ensure that economic and financial shocks can be absorbed while still maintaining their day to day operations. The need for proper fiscal and monetary coordination is also important especially if monetary authorities expect to use stability indicators for effective instruments of monetary policy.*

**KEY WORDS**: banking stability, bank performance, non-linear auto regressive lag model

## INTRODUCTION

Globally, banking stability is an integral part of ensuring financial system stability and this is because the spill-over effects of banking instability can be wide spread on the economy in general. Basically, banks stability improves the ability of commercial banks to absorb shocks and unexpected financial imbalances (ECB 2007). It is critical that banks pay close attention to the ensuring financial stability and the regulatory financial institutions have this objective as part of their statutory functions and thus Central banks globally are very much concerned about financial stability of deposit money banks. It is important to emphasize that for the deposit banks to continue with their financial inter-mediation functions without much interruptions, they must be sound, stable and profitable (Onuonga, 2014). Several studies have pointed out that banks experience certain levels of imbalances between their assets and liabilities that need to be managed (Khan & Ali, 2016; Sumaila, 2015) because of the implications that this can have on the performance of the bank. For banks to remain in operation, they must be profitable in a sustainable manner providing returns on investment for shareholders. Therefore, if banks are unable to manage these imbalances, liquidity challenges will arise which could result in dire consequences such as reputation risk or even insolvency.

This study examines asymmetrically, the implication of banking stability on bank financial performance in Nigeria. Studies have shown that stability indicators such as bank liquidity have positive implications on performance of banks (Athanasoglou, Panayiotis & Brissimis, Sophocles N. & Delis, Matthaios, D, 2008) though there are also studies that find otherwise (Lartey, Antwi & Boadi, 2013). Other strand of literature have examined the impact of bank liquidity on its performance and have reported conflicting results (Khan and Ali, 2016; Ibe, 2013; Bordeleau and Graham, 2010). Another indicator of bank stability is the cash reserve requirement (CRR) which is crucial to banks and reduces their vulnerability to liquidity shocks (Bianchi & Bigio, 2013; Bouwman, 2013), thus it plays a role of preventing the bankruptcy as it is the percentage of total deposits that banks are required to keep with Central Bank. (Glocker & Towbin, 2012; Bech & Keiser, 2012). The CRR directly influences banks liquid positions and hence their ability to generate revenues. The central bank pays zero interest on the amount commercial banks keeps with them as cash reserve and thus a rise in CRR results in smaller amount of funds at disposal of banks, increase in interest rate, decrease in liquidity and profitability in the system and vice versa (Carvalho & Azevedo 2008 and Vargas et al. 2010). The lending-deposit ratio (LDR) is another stability indicator that influences banking performance. The loan-to-deposit ratio regulation is basically an instrument for managing banks' liquidity, by limiting the sizes of their loans to within a certain ratio to their deposits. This has spill-over implication for both liquidity positions and bank performance because it directly affects banks' ability to generate income for loans (Abreu & Mendes 2002; Devinaga 2010).

The main research gap in this study is that though several studies have examined the relationship between bank stability indicators and bank performance (Khan & Ali 2016; Lartey et al. 2013; MacCarthy, 2016; Bawa, Akinniyi and Njarendy 2018; Rengasamy 2017; Edem 2017; Nwosu, Okaro, Ogbonna and Atsanan, 2017; Kurotamunobaraomi, Giami and Obari 2017; Edison, Mohd and Sinaga 2019), none of these studies has employed the Non-linear Autoregressive Distributive Lag Approach (NARDL). The advantages of using the NARDL approach over other approaches such as the Ordinary Least Squares (OLS), Panel regression, Vector error correction models is that, it allows modelling the cointegration relation that could exist between the dependent and independent variables. Secondly, it permits to test both the linear and nonlinear cointegration. Thirdly, it distinguishes between the short-and long-run effects from the independent variable to the dependent variable. Fourthly, unlike other error correction models where the order of integration of the considered time series should be the same, the NARDL model relaxes this restriction and allows combining data series having different integration orders (Shin, Yu, & Greenwood-Nimmo, 2014). Therefore, the results from this study is expected be more robust than earlier studies and in this regards, the study contributes incrementally to the literature. The rest of the paper is structured as follows. Section 2 gives the literature reviewed, section 3 discusses the methodology, section 4 presents the results of the empirical analysis and section 5 contains the conclusion.

**Objective of the study**

Assess the relationship between bank financial stability indicators and bank performance in Nigeria.

**Research Hypotheses**

$H_0$: Bank stability indicators does not have a significant positive impact on bank performance in Nigeria.

$H_1$: Bank stability indicators have a significant positive impact on bank performance in Nigeria.

## LITERATURE REVIEW

The relationship between banking stability and bank financial performance has been an intense area of discourse for both academics and policy institutions alike. The findings have been quite at polarity though insightful, providing empirical measures on the direction and magnitude of the relationship between stability indicators and bank performance. For example, V. C Lartey, S. antwi, EK Boadi (2013) investigated the impact of liquidity on performance of Ghanaian banks with data spanning from 2005 to 2010. The study employed the multiple regression analysis with results indicating that liquidity has a weak though positive and statistically insignificant impact on bank performance.

Nwosu, Okaro, Ogbonna and Atsanan, (2017) examines the effect of liquidity management on the performance of DMBs in Nigeria. The study employs Augmented Dickey Fuller Unit Root Test, OLS regression and Granger Causality. The result of the study revealed that liquidity mechanism is not significantly related to Deposit Money Banks (DMBs) performance in the short run and long run. Similarly, the study of Charmler, Musah, Akomeah and Gakpetor (2018) also investigated the implications of bank liquidity levels on profitability of commercial banks in Ghana. The study sample covered 21 banks with data from 2007 to 2016 and utilizing the panel regression, the study findings reveal that there is a weak positive relationship between the liquidity ratios and bank performance.

On the contrary, Khan and Ali (2016) focusing on Pakistan, investigated the effect of liquidity on performance of the banks. Secondary data was employed covering the period from 2008 to 2014 and with the aid of regression analysis, the results indicated that increasing the bank liquidity ratios tends to result in an increase in bank performance and this is significant.

MacCarthy (2016) provides empirical evidence on the relationship between cash reserve ratio and financial performance of banks. Using a sample of 20 commercial banks and employing the panel regression techniques, the results of the study revealed that cash reserve ratio positively relates to the financial performance of commercial banks. In the same vein, Bawa, Akinniyi and Njarendy (2018) investigate the extent to which cash reserve ratio affects bank performance in Nigeria. The study used data covering 2002-2012 and the regression analysis technique were used to analyse the data. The results differ from that of MacCarthy (2016) as the effect of cash reserve ratio on bank financial performance was found to be negative and insignificant.

Rengasamy (2017) focusing on Malaysia, examined to what extent the loan Deposit ratio impacts the financial performance of Malaysian commercial banks. The study used a sample of eight banks covering the period 2009 to 2013. Data were obtained from the annual reports of the banks. The regression analysis was used for the study and the findings reveal that loan deposit ratio has a statistically weak though positive effect on financial performance of Malaysian banks.  In the same vein, Edem (2017) investigated the effect of liquidity ratio, cash reserve ratio and loan to deposit ratio on bank financial performance in Nigeria for the period 1986-2011. The results from the estimations carried out using the multiple regression technique revealed that though loan to deposit ratio indicates a negative impact on bank performance contrary to that of Rengasamy (2017), the impacts of liquidity and cash reserve ratios were positive.

Kurotamunobaraomi, Giami and Obari (2017), examined the implications of Cash Reserve Ratio, Liquidity Ratio and Loan-to-Deposit Ratio on performance of commercial banks in Nigeria. The study utilized the error correction model approach in the estimation with data coverage from 1995-2015.  The findings of the study revealed that banks reserve ratio and loan-to-deposit ratio have negative effects on bank financial performance. Similarly, Edison, Mohd and Sinaga (2019) focusing on Indonesia, examined the impact of Loan to Deposit Ratio (LDR) on financial performance in privately owned banks covering the period 2014-2016 using a sample of 40 banks. The results of the study showed that Loan to Deposit Ratio has a significant Influence on financial performance of banks.

**Theoretical Framework: Financial Intermediation Theory**

The theory regarding financial intermediation was developed starting with the 60’s, the starting point being the work of Gurley and Shaw (1960), Guttentag and Lindsay (1968) and Merton (1995).  The modern theory of financial intermediation focuses on a number of key issues such as the roles of financial intermediation done by the banking system, the spill-over effects of such financial intermediation roles on economic agents and the economy in general. In addition, the theory is also concerned with the role of regulatory policies on financial intermediaries. The financial intermediation theory has several perspectives or dimensions. The first relates to the theory of informational asymmetry and the agency theory which provides the basis for financial intermediation. The second approach for the financial intermediation is founded on the argument of transaction cost and this dimension was built largely by the studies of Benston and Smith (1976) and Fama (1980). The third approach of financial intermediaries is based on the method of regulation of the monetary creation, of saving and financing of economy. The method of regulation influences the liquidity and solvability of intermediaries. Greenbaum and Thakor (2007) show that the regulations of financial intermediaries can influence their stability, ability for refinancing and the process of income generation from lending. The theory especially the first and third approaches is useful for this study as it points out that banks acting as financial intermediaries operate in an environment of regulation which has implications on their stability and can generate spill-over effects on both the economy and solvability of the banking system.

## METHODOLOGY

The study employs a longitudinal research design and utilizes secondary data covering the period from 1985-2018. The data was sourced from the CBN statistical bulletin. As earlier mentioned, we consider the NARDL approach of Shin et al (2014) to model the relationship between bank stability and bank performance in Nigeria. The IMF (1999) banking stability indicators namely: liquidity ratio (LIQRR), cash reserve ratio (CRR) and loan to deposit ratio (LDRR) were used as proxies for bank stability and growth in assets was used to proxy bank performance. Interest rate is included as a control variable in the model. The NARDL model is adopted from Shin et al (2014) which the authors presented below as;

$$\Delta y_t = \gamma_y y_{t-1} + \gamma_x x_{t-1} + \lambda k_t + \sum_{i=1}^{u-1} \delta_{iy} \Delta y_{t-i} + \sum_{i=0}^{v-1} \delta_{ix} \Delta x_{t-i} + e_t \qquad \text{---------------------- (1)}$$

where $\Delta$ is the difference operator, $\gamma$ ($\delta$) is the long (short) run coefficients, $\lambda$ is the vector of deterministic regressors regarded as exogenous, for example, trend, and $e_t$ is an i.i.d. component. Let $y_t$ be the dependent variable which is bank performance in this study, x and k the vector of independent variables. Therefore, to represent this method, equation (1) starts to modify into the following long-run linear asymmetric representation:

$$bnkp_t = \beta^+ \theta^+ + \beta^- \theta + \mu_t \qquad \text{------------------------------------------------------ (2)}$$

where $\beta^+$ and $\beta^-$ are the long-run coefficients linked to the partial sum of positive (negative) changes in $\theta_t$ which captures financial regulation variables in this study (Shin et al., 2014), integrated by the function; $\theta_t = \theta_t^{\ +} + \beta^- \theta_t^{\ -} + \mu_t$ using the process;

$$\theta_t^{\ +} = \sum_{j=1}^{t} \Delta\theta_{t\ J}^{\ -} = \sum_{j=1}^{t} \min(\Delta\theta_{t\ J,}\ 0) \text{ and } bnkg_t^{\ +}$$
$$= \sum_{j=1}^{t} \Delta\theta_{t\ J}^{\ +} = \sum_{j=1}^{t} \max(\Delta\theta_{t\ J,}\ 0) \qquad \text{---------------------------------------------- (3)}$$

The linear stationary combination ($z_t$) of (2) and asymmetric partial squares is;

$$Z_t^{\ +} = K + \emptyset_1^{\ +} bnkp_t^{\ +} + \emptyset_2^{\ -} bnkp_t^{\ -} + bnkp_1^{\ +} \theta_t^{\ +} + bnkp_2^{\ -} \theta^- + \mu_t \text{ ------(4)}$$

Stationarity in equation (4) is achieved if $z_t$= I(0) and with linear asymmetric long-run cointegrating relationship for a rejected null hypothesis $\phi_1^{\ -} = \phi_2^{\ +} = \beta_1^{\ +} = \beta_2^{\ -} = 0$. However, the estimated equations (2) and (4) are likely to assume multicollinearity and endogeneity that require to be corrected before cointegration analysis. The dynamic formats of the equations are therefore appropriate in addressing such issues. We therefore write equations (2) and (4) considering their dynamic formats as;

$$bnkp_t = \sum_{i=1}^{p} \lambda un_{t-1} + \sum_{i=0}^{q} (\beta^+ \emptyset^+{}_{t-1} + \beta^- \emptyset^-{}_{t-1}) + \mu_t \qquad \text{------------------------ (5)}$$

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where λ is the AR parameter and β is the parameter causing dynamic adjustments with the cointegrating dynamic format, which is represented as;

$$\Delta bnkp_t = \rho Y_{t-1} + \emptyset^+ \theta^+{}_{t-1} + \emptyset^- \theta^-{}_{t-1} + \sum_{i=1}^{p} \delta \Delta bnkp_{t-1}$$
$$+ \sum_{i=0}^{q} \Delta \pi_i{}^+ \theta^+{}_{t-1} + \Delta \pi_i{}^- \theta^-{}_{t-1} + \mu_t \text{ -------------------------------------------(6)}$$

Equation (6) is the NARDL by Shin et al. (2014) where $\beta^+ = -\varphi^+/\rho$ and $\beta^- = -\varphi^-/\rho$ reflect the long-run asymmetric coefficients and δ and η the asymmetric short-run dynamics. Equation (6) is cointegrated for a rejected null hypothesis that $\rho = \varphi^+ = \varphi^- = 0$ based on F-statistics (Pesaran et al., 2001) or individually, $\rho$, $\varphi^+$, $\varphi^- = 0$ (Banerjee et al., 1998) and after rejected nulls that $\varphi^+ = \varphi^-$, respectively, that their long-run parameters are valid. The asymmetric short-run dynamics are significant for rejected nulls that $\eta^- = \eta^+$, whereas long-run asymmetries are significant for rejected nulls that $\varphi^+ = \varphi^-$.
Finally, we explored how growth would respond in the long run to nonlinearities in bank performance after a standard shock. This is the dynamic multiplier useful in expediting the temporal growth behavior as it changes from a backdrop of previous short-run dynamics and initial instabilities to new-found equilibrium after an economic shock in financial regulation variables. The multiplier uses the process

$$mh^+ = \sum_{i=0}^{k} \partial bnkp_{t+i} / \partial \theta_t{}^+ = \sum_{i=0}^{k} = \beta_1{}^+ \text{ and } mh^- = \sum_{i=0}^{k} \partial bnkp_{t+i} / \partial \theta_t$$

$$= \sum_{i=0}^{k} \beta_t{}^- \; h = 0,1,2,\ldots..t \text{ ----------------------------------------------(7)}$$

in which m →∞ and $mh^+$ ($mh^-$) → $\beta^+$ ($\beta^-$) where $mh^+$ is the long-run asymmetric coefficients. $mh^+$ and $mh^-$ are the asymmetric long-run coefficients which achieve consistency as m →∞ so that mh+ ($mh^-$) → $\beta^+$ ($\beta^-$)· mh is important because it enshrines the crucial information responsible for the volatilities.
The model also includes interest rate as it plays a very broad role in monetary policy and economic stability. Equation (6) is therefore modified adding interest rate as follows:

$$\Delta bnkp_t{}^{+} = \rho bnkp_{t-i} + \emptyset^{+} liqr^{+}{}_{t-i} + \emptyset^{-} liqr^{-}{}_{t-i} + \emptyset^{+} crr^{+}{}_{t-i} + \emptyset^{-} crr^{-}{}_{t-i} + \emptyset^{+} ldr^{+}{}_{t-i} + \emptyset^{-} ldr^{-}{}_{t-i} + \emptyset^{+} int^{+}{}_{t-i} + \emptyset^{-} int^{-}{}_{t-i} + \sum_{i=0}^{k} \delta \Delta bnkp_{t-1} + \sum_{i=0}^{k} \Delta \pi_i{}^{+} liqr^{+}{}_{t-1} + \sum_{i=0}^{k} \Delta \pi_i{}^{-} liqr^{-}{}_{t-1} + \sum_{i=0}^{k} \Delta \alpha^{+} crr^{+}{}_{t-1} + \sum_{i=0}^{k} \Delta \alpha^{-} crr^{-}{}_{t-1} + \sum_{i=0}^{k} \Delta \Omega^{+} ldr^{+}{}_{t-1} + \sum_{i=0}^{k} \Delta \Omega^{-} ldr^{-}{}_{t-1} + \sum_{i=0}^{k} \Delta \vartheta_i{}^{+} int^{+}{}_{t-1} + \sum_{i=0}^{k} \Delta \vartheta_i{}^{+} int^{+}{}_{t-1} + \mu_t$$

Where: bnkp= Bank performance measured using asset growth, liqr= Liquidity ratio (LIQRR), crr= cash reserve ratio (CRR), ldr= Loan to deposit ratio (LDR) and int= Interest rate (INTR).

## PRESENTATION OF RESULTS

Table 1: Descriptive Statistics

| | BNKG | CRR | LDR | INTR | LIQR |
|---|---|---|---|---|---|
| Mean | 0.871037 | 11.48125 | 66.8625 | 17.335 | 7.338947 |
| Maximum | 1.462873 | 22.5 | 85.7 | 20.71 | 43.49372 |
| Minimum | 0.27587 | 1.4 | 38 | 15.14 | 8.878 |
| Std. Dev. | 0.345906 | 7.907652 | 14.23465 | 1.336842 | 35.10407 |
| Skewness | 0.18559 | 0.2096 | -0.81258 | 1.018387 | -2.49602 |
| Kurtosis | 2.296916 | 1.628017 | 2.674084 | 3.918499 | 9.30107 |
| Jarque-Bera | 0.4214 | 1.372044 | 1.83157 | 3.32806 | 43.08261 |
| Probability | 0.810017 | 0.503575 | 0.400202 | 0.189374 | 0.000 |

*Source: Researchers' Compilation (2020).*

The descriptive statistics reveals that BNKG has a mean of 0.871 with maximum and minimum values of 1.463 and 0.276 respectively. CRR has a mean of 11.48 with maximum and minimum values of 22.5 and 1.4. The mean for LDR for the period under review stood at 66.86 with maximum and minimum values of 85.7 and 38 respectively. For, interest rate, the mean stood at 17.335 with maximum and minimum values of 20.71 and 15.4 respectively. The mean for LIQR is 7.338 with maximum and minimum values of 43.494 and 8.987 respectively. The Jacque bera statistics for the variables have probability values less than 0.05 for BNKG, CRR, LDR and INTR except for LIQR.

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Table 2. Augmented -Dickey Fuller (ADF) Unit root test Results

| Unit root test at levels: Intercept and Trend | | | |
|---|---|---|---|
| | ADF-Test Statistic | 95% Critical ADF Value | Remark |
| BNKG | 1.7881 | 2.96 | Non-stationary |
| LDR | 1.7881 | ,, | Non-stationary |
| LIQR | 2.9573 | ‘’ | Stationary |
| CRR | 1.9403 | ‘’ | Non-stationary |
| INT | 2.3891 | ‘’ | ‘stationary |
| Unit root test at 1st difference: Intercept and Trend | | | |
| | ADF-Test Statistic | 95% Critical ADF Value | Remark |
| BNKG | 3.1688 | 2.96 | Stationary |
| LDR | 3.829 | | |
| LIQR | 6.4613 | ‘’ | ‘’ |
| CRR | 4.8813 | ‘’ | ‘’ |
| INT | 7.4777 | ‘’ | ‘’ |

Source: Researchers’ compilation (2020).

The Augmented -Dickey Fuller (ADF) test is employed in order to analyse the unit roots. The results are presented in levels and first difference. This enables us determine in comparative terms, the unit root among the time series and also to obtain more robust results. The result indicates that all of the variables have ADF values that are less than the 95% critical ADF value of 2.96. The implication of this is that the time series for these variables are stationary in their levels. Moving forward, we take the first differences of the respective variables and perform the unit root test on each of the resultant time series. The rationale behind this procedure is that Box and Jenkins (1976) have argued that differencing non-stationary time series will make it attain stationarity. The result of the unit root test on these variables in first differencing shows that the ADF values in absolute terms is greater than the 95% critical ADF values. With these result, all variables are adjudged to be stationary. Thus we accept the hypothesis that the variables possess unit roots.

Table 3. Bounds Test for Co-integration

| Test Statistic | Value | Significance | 1(0) | 1(1) |
|---|---|---|---|---|
| *F-statistic* | 6.67 | | Asmptotic n=1000 | 7 |
| *K* | 7 | | I0 Bound | I1 Bound |
| | | 5% | 2.17 | 3.21 |
| | | 1% | 2.73 | 3.59 |

Source: Researchers’ Compilation from E-views 10 (2020).

Table 3 showed the result of the Bounds test of long run co-integration between BNKP and bank stability. The evaluation of the results was based on the critical F-statistic values for the lower and upper bounds as also reported in the results. According to the empirical output of the F-values, it could be seen that the null hypothesis of no long-run relationship is rejected at the 5% level of significance as the f-value of 6.67 exceeds critical values for 1(0) and I(1) respectively.

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Table 4. Parsimonious NADRL Regression Result

| Variable | Coefficient | t-Statistic | |
|---|---|---|---|
| C | 30288.6 | 3.5631 (0.038)* | |
| $BNKG_{(-1)}$ | -1.0036 | -1.4047 (0.2547) | |
| $LIQRR^{+}_{(-1)}$ | -195.93 | -1.4829(0.2347) | |
| $LIQRR^{-}_{(-1)}$ | 935.8 | 3.774(0.0326)* | |
| $LDRR^{+}_{(-1)}$ | 2029.3 | 3.1452 (0.0515)* | |
| $LDRR^{-}_{(-1)}$ | 2126.1 | 3.7727 (0.3227)* | |
| $CRR^{+}_{(-1)}$ | 1359.3 | 4.6499 (0.0188)* | |
| $CRR^{-}_{(-1)}$ | -288.81 | -1.3617 (0.2665) | |
| $INTR_{(-1)}$ | 147.78 | 0.4751 (0.6671) | |
| $D(BNKG)_{(-1}$ | -0.2715 | -0.4346 (0.6932) | |
| $D(BNKG)_{-2}$ | -0.7777 | -1.5809 (0.2121) | |
| $D(LIQRR)^{+}$ | 698.97 | 3.7388 (0.0334)* | |
| $D(LIQRR)^{-}$ | 379.123 | 4.546 (0.0199)* | |
| $D(LDRR)^{+}$ | -147.82 | -1.1067 (0.3492) | |
| $D(LDRR)^{-}$ | 1385.2 | -1.3606 (0.2668) | |
| $D(CRR)^{+}$ | -54.0323 | -0.3013 (0.7828) | |
| $D(CRR)^{-}$ | 1103.27 | -2.5682 (0.0826)** | |
| D(INTR) | 493.12 | 2.6615 (0.0762)** | |
| *Asymmetric Long run effects* | | | |
| $LIQRR^{+}$ | -195.224 | -1.5203 (0.2258) | |
| $LIQRR^{-}$ | 932.45 | 1.2259 (0.3077) | |
| $LDRR^{+}$ | 2022.05 | 1.0811 (0.3588) | |
| $LDRR^{-}$ | 2118.45 | 1.0921 (0.3547) | |
| $CRR^{+}$ | 1354.47 | 1.3386 (0.2731) | |
| $CRR^{-}$ | -287.77 | 1.2459 (0.3012) | |
| INT | 147.26 | 0.3754 (0.7323) | |
| $R^2$ | 0.9885 | $\chi^2_{Hetero}$ | 2.6615 (0.0762) |
| Adj $R^2$ | 0.8777 | $\chi^2_{Serial/Corr}$ | 1.4698 (0.2379) |
| F-stat | 12.08568 | $\chi^2_{Norm}$ | 0.1197 (0.9122) |

Asymmetry Test

| Variable | Wald Test Chi-square | p-value |
|---|---|---|
| $W_{LR-LDRR}$ | 2.092 | 0.1480 |
| $W_{LR-LIQRR}$ | 7.883 | 0.0050* |
| $W_{LR-CRR}$ | 6.887 | 0.0087* |
| Short-run | | |
| $W_{SR}$ | 17.738 | 0.000* |

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*Note.* (+) and (–) indicate the positive and negative partial sums. Diagnostic tests are represented by $\chi het$ for heteroskedasticity, $\chi$norm for normality in residual distribution, and $\chi$s/corr for serial correlation. Numbers in parentheses are the *p*-values.

The Non-linear regression results is presented in table 4. Preference of the NARDL model in this case than other time series techniques which explore nonlinearities is threefold. They are mostly inferior compared with the NARDL (Tsagkanos et al., 2019). The strength and superiority of the NARDL over other times series techniques such as threshold regression, Ordinary Least Square estimations and also the vector error correction estimation is that it generates from the regressors, partial sum of positive and negative squares and observes their effects while also investigating their asymmetric behaviors. Also, the NARDL provides more robust estimates since it incorporates bound testing alongside the long run and the short run and finally, the NADL examines the temporal dynamics using the dynamic multiplier framework (Chen, Hongo, Ssali, Nyaranga, & 2020).

Exploring short-run results and starting with LIQRR, significant positive and negative partial sum shocks by liquidity ratios have coefficients of 698.97 and 379.12 respectively. That is, both short-run decrease and increase in liquidity ratios increases bank performance and thus lowering or increasing bank liquidity ratios in the short run do not negatively impact bank performance in terms of asset growth. In the case of loan deposit ratio (LDRR), positive and negative partial sum shocks in LDRR have coefficients of 1385.2 and -54.0323 respectively. This implies that short-run increase in LDRR increases bank performance while short run decreases in LDRR reduces bank performance in terms of asset growth though the results did not show statistical significance at 5%. In the case of credit reserve ratio (CRR), positive and negative partial sum shocks in CRR have coefficients of -54.03 and 1103.27 respectively. This implies that short-run increase in CRR has a negative impact on bank performance while short run decreases in CRR positively impacts bank performance in terms of asset growth though only the negative partial sum shocks showed statistical significance at 5%.

The long run results, showed that positive shocks in LIQRR though negatively impacting bank performance (-195.224) tends to be weak or insignificant (p=0.2258) and negative shocks in LIQRR positively affects bank performance (932.45). This suggest that reducing LIQRR can positively drive bank performance though the effects also tends to be weak or insignificant (p=0.3077). Similarly, Lartey et al. (2013) showed weak positive and statistically insignificant relationship between liquidity and profitability of listed banks in Ghana there was a weak positive relationship between the ratios of liquid assets to total assets (LIDQ1). In addition, Nwosu, Okaro, Ogbonna and Atsanan, (2017) revealed insignificant relationship between liquidity bank performance in the short run and long run. Findings by Khan and Ali (2016) revealed positive and significant relationship between liquidity and profitability of commercial banks.

Both positive and negative shocks in LDRR tends to positively impact bank performance with magnitudes of 2022.05 and 2118.4 respectively though weak or insignificant at 5% level with p-vales of 0.3588 and 0.3547 respectively. In a similar vein, Rengasamy (2017) indicated that there was a positive and nonsignificant impact of LDR on bank performance but on the contrary, Edem (2017) revealed negative impacts between bank performance and

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loan to deposit ratio shows negative impact. In the same vein, Kurotamunobaraomi, Giami and Obari (2017), discovered that banks loan-to-deposit ratio negatively impacted the banks performance while Edison, Mohd and Sinaga (2019) results of the study showed the Loan to Deposit Ratio has a significant Influence on bank performance. In addition, positive shocks in CRR positively impacts bank performance (1354.47) though it tends to be weak or insignificant (p=0.2731) and negative shocks in CRR negatively affects bank performance (-287.77). This suggests that, reducing CC can negatively impact bank performance though the effects also tend to be weak or insignificant (p=0.7323). The model summary and diagnostics revealed that $R^2$ and Adj $R^2$ stood at 98.85% and 87.8% respectively and the $\chi^2_{\text{Hetero}}$ p-value (0.0762) implied the homoscedastic behaviour of the errors and the $\chi^2_{\text{Serial/Corr}}$ p-value (0.2379) also revealed the absence of serial correlation. In addition, $\chi^2_{\text{Norm}}$ p-value (0.2379) revealed that the series follow a normal distribution.

To test for asymmetries, the null hypothesis of no long- and short-run asymmetry is tested using the Wald test. In the long-run, the results revealed a significant difference in the impact of a negative shock than a positive shock for the LIQRR and CRR ratios but not for LDR. That is, negative shocks on LIQRR and CRR will have a significantly different long-run run impact (in sign and magnitude) on bank performance from positive shocks. On the short-run, the impact is also significantly different. Such results strongly suggest that asymmetry need to be accounted for when studying the impact of changes in bank stability and bank performance and therefore, restrict the findings of symmetric models.

On the overall, the results suggested that in the short run bank stability variables, LIQR, LDR, CRR tend to exhibit significant asymmetric effects on bank performance, however, this effects tends to be quite weak as we move into the long run. The long run effects indicate that positive and negative shocks to stability variables do not appear to be significant in their effects on bank performance which this is quite insensitive to the nature of financial stability shocks. The finding thus suggest that for developing though stability indicators appear as a necessary condition for bank performance in terms of asset growth, it may not be a sufficient condition. In this regards, the CBN (2014) have pointed out that income from bank charges has become a major source of revenue for banks, especially following the increased credit risk aversion that has characterized the post 2007-2008 financial crisis. Also another trend in the Nigerian environment is the focus by banks on non-interest income sources which directly puts less dependence on LDR. The shift towards noninterest income is justified on the need to reduce volatility in earnings since non-interest income may be less dependent on overall business conditions than traditional interest income would. Of particular mention also, is the overriding fiscal policy activities coming on the heels of oil output and price volatility as swings in fiscal revenues tend to distort the relationship between liquidity innovations shocks and bank performance.

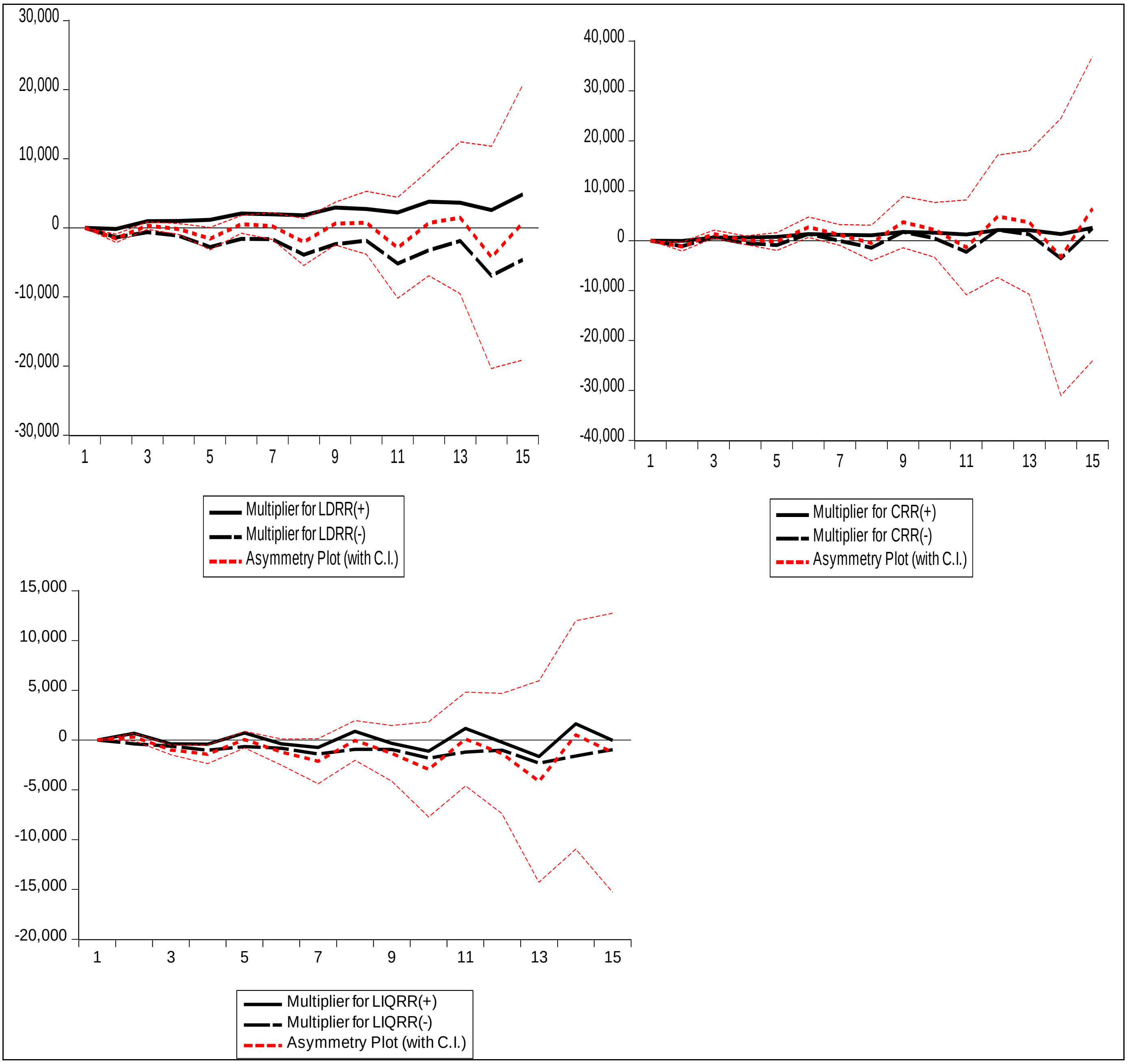


Figure 4.1. Dynamic Multiplier
Source: Researcher's Compilation from E-views 10 (2020).

The dynamic multiplier explains the adjustment process and the period of disequilibrium caused by a shock on the explanatory variable. That is, it explains the adjustment process from the initial equilibrium to the new equilibrium point that results from a positive or negative shock. As illustrated by Shin et al. (2013), even if no evidence of short run asymmetry is found, one can still observe asymmetry in the adjustment path given by the dynamic multipliers. This is because the adjustment path back to equilibrium depends on a combination of the long run parameters, the error correction coefficients, and the dynamics of the model itself. From figure 4.1, the result reveals that positive LDDR shocks have a quite stable effect on performance but negative LDDR shocks tends to negatively affect performance but however, none tends to exhibit significant domineering tendencies. In the case of CRR also, we find that neither positive nor negative shocks tend to be domineering in their effects on bank performance. The dynamics of the LIQRR cumulative multiplier shows that the negative shock moves bank performance moderately away from equilibrium point on the short run. Positive shocks to LIQRR tend to have largely benign effects on bank financial performance though neither of the shocks tend to be most domineering.

## CONCLUSION

Consequently, banking stability is a key issue for financial regulatory institutions and stakeholders in general and is even very germane for a country like Nigeria that has a third place ranking in terms of financial system in Africa after South Africa and Egypt (Ozili, 2019). The study examines the relationship between banking stability and bank performance in Nigeria. The study employs a longitudinal research design and utilizes secondary data covering the period from 1985-2018. The data was sourced from the CBN statistical bulletin. As earlier mentioned, we consider the NARDL to model the relationship between bank stability and bank performance in Nigeria. On the overall, the results suggest that, in the short run bank stability/regulation variables, LIQR, LDR, CRR tend to exhibit significant asymmetric effects on bank performance, however, this effects tends to be quite weak as we move into the long run. The long run effects indicate that positive and negative shocks to stability variables do not appear to be significant in their effects on bank performance which is quite insensitive to the nature of financial stability shocks. The dynamic multiplier result reveals that positive LDDR shocks have a quite stable effect on performance but negative LDDR shocks tend to negatively affect performance but however, none tends to exhibit significant domineering tendencies. In the case of CRR also, we find that neither positive nor negative shocks tend to be domineering in their effects on bank performance. The dynamics of the LIQRR cumulative multiplier shows that the negative shock moves bank performance moderately away from equilibrium point on the short run. Positive shocks to LIQRR tend to have largely benign effects on bank financial performance though neither of the shocks tend to be most domineering. The study recommends that there is still need for banks to improve their stability ratios at levels that can adequately ensure that economic and financial shocks can be absorbed while still maintaining their day to day operations.

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**Appendix**

ARDL Long Run Form and Bounds Test
Dependent Variable: D(BNKG)
Selected Model: ARDL(3, 1, 3, 3, 3, 3, 3, 3)
Case 2: Restricted Constant and No Trend
Date: 04/06/20 Time: 21:29
Sample: 1981 2017
Included observations: 33

Conditional Error Correction Regression

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | 30288.59 | 8500.600 | 3.563111 | 0.0377 |
| BNKG(-1)* | -1.003593 | 0.714452 | -1.404703 | 0.2547 |
| LIQRR_POS(-1) | -195.9253 | 132.1167 | -1.482971 | 0.2347 |
| LIQRR_NEG(-1) | 935.8000 | 248.0482 | 3.772654 | 0.0326 |
| LDRR_POS(-1) | 2029.311 | 645.2060 | 3.145213 | 0.0515 |
| LDRR_NEG(-1) | 2126.066 | 563.9810 | 3.769747 | 0.0327 |
| CRR_POS(-1) | 1359.336 | 292.3327 | 4.649963 | 0.0188 |
| CRR_NEG(-1) | -288.8045 | 212.0918 | -1.361696 | 0.2665 |
| INTR(-1) | 147.7851 | 311.0423 | 0.475129 | 0.6671 |
| D(BNKG(-1)) | -0.271479 | 0.624599 | -0.434645 | 0.6932 |
| D(BNKG(-2)) | -0.777743 | 0.491962 | -1.580901 | 0.2120 |
| D(LIQRR_POS) | 698.9740 | 186.9496 | 3.738837 | 0.0334 |
| D(LIQRR_NEG) | 379.1231 | 83.38854 | 4.546466 | 0.0199 |
| D(LIQRR_NEG(-1)) | -208.3399 | 161.3422 | -1.291293 | 0.2871 |
| D(LIQRR_NEG(-2)) | 450.3790 | 174.8496 | 2.575808 | 0.0821 |
| D(LDRR_POS) | -147.8147 | 133.5605 | -1.106725 | 0.3492 |
| D(LDRR_POS(-1)) | -1124.644 | 425.8690 | -2.640822 | 0.0776 |
| D(LDRR_POS(-2)) | -848.8646 | 313.3481 | -2.709014 | 0.0732 |
| D(LDRR_NEG) | 1385.220 | 328.4083 | 4.217980 | 0.0244 |

| | | | | |
|---|---|---|---|---|
| D(LDRR_NEG(-1)) | -1136.334 | 327.1826 | -3.473089 | 0.0403 |
| D(LDRR_NEG(-2)) | -128.5152 | 94.45379 | -1.360614 | 0.2668 |
| D(CRR_POS) | -54.03228 | 179.3069 | -0.301340 | 0.7828 |
| D(CRR_POS(-1)) | -735.7963 | 207.2899 | -3.549600 | 0.0381 |
| D(CRR_POS(-2)) | -603.4385 | 157.6250 | -3.828316 | 0.0314 |
| D(CRR_NEG) | 1103.272 | 429.5889 | 2.568205 | 0.0826 |
| D(CRR_NEG(-1)) | -112.4886 | 369.3918 | -0.304524 | 0.7806 |
| D(CRR_NEG(-2)) | 1131.097 | 448.4365 | 2.522312 | 0.0860 |
| D(INTR) | 493.1221 | 185.2795 | 2.661504 | 0.0762 |
| D(INTR(-1)) | 493.9569 | 182.7864 | 2.702373 | 0.0736 |
| D(INTR(-2)) | 506.0426 | 143.9713 | 3.514886 | 0.0391 |

* p-value incompatible with t-Bounds distribution.

Levels Equation
Case 2: Restricted Constant and No Trend

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LIQRR_POS | -195.2239 | 128.4087 | -1.520332 | 0.2258 |
| LIQRR_NEG | 932.4502 | 760.6128 | 1.225920 | 0.3077 |
| LDRR_POS | 2022.046 | 1870.285 | 1.081143 | 0.3588 |
| LDRR_NEG | 2118.455 | 1939.845 | 1.092074 | 0.3547 |
| CRR_POS | 1354.470 | 1011.881 | 1.338566 | 0.2731 |
| CRR_NEG | -287.7707 | 230.9666 | -1.245941 | 0.3012 |
| INTR | 147.2561 | 392.1793 | 0.375482 | 0.7323 |
| C | 30180.16 | 23361.62 | 1.291869 | 0.2869 |

EC = BNKG - (-195.2239*LIQRR_POS + 932.4502*LIQRR_NEG + 2022.0464
*LDRR_POS + 2118.4554*LDRR_NEG + 1354.4701*CRR_POS
-287.7707*CRR_NEG + 147.2561*INTR + 30180.1625 )

| F-Bounds Test | | Null Hypothesis: No levels relationship | | |
|---|---|---|---|---|
| Test Statistic | Value | Signif. | I(0) | I(1) |
| | | | Asymptotic: n=1000 | |
| F-statistic | 6.666305 | 10% | 1.92 | 2.89 |
| K | 7 | 5% | 2.17 | 3.21 |
| | | 2.5% | 2.43 | 3.51 |
| | | 1% | 2.73 | 3.9 |

| | | | | |
|---|---|---|---|---|
| Actual Sample Size | 33 | | Finite Sample: n=35 | |
| | | 10% | 2.196 | 3.37 |
| | | 5% | 2.597 | 3.907 |
| | | 1% | 3.599 | 5.23 |
| | | | Finite Sample: n=30 | |
| | | 10% | 2.277 | 3.498 |
| | | 5% | 2.73 | 4.163 |
| | | 1% | 3.864 | 5.694 |

Estimation Equation:
=========================
BNKG = C(1)*BNKG(-1) + C(2)*BNKG(-2) + C(3)*BNKG(-3) + C(4)*LIQRR_POS + C(5)*LIQRR_POS(-1) + C(6)*LIQRR_NEG + C(7)*LIQRR_NEG(-1) + C(8)*LIQRR_NEG(-2) + C(9)*LIQRR_NEG(-3) + C(10)*LDRR_POS + C(11)*LDRR_POS(-1) + C(12)*LDRR_POS(-2) + C(13)*LDRR_POS(-3) + C(14)*LDRR_NEG + C(15)*LDRR_NEG(-1) + C(16)*LDRR_NEG(-2) + C(17)*LDRR_NEG(-3) + C(18)*CRR_POS + C(19)*CRR_POS(-1) + C(20)*CRR_POS(-2) + C(21)*CRR_POS(-3) + C(22)*CRR_NEG + C(23)*CRR_NEG(-1) + C(24)*CRR_NEG(-2) + C(25)*CRR_NEG(-3) + C(26)*INTR + C(27)*INTR(-1) + C(28)*INTR(-2) + C(29)*INTR(-3) + C(30)

LDRR
Wald Test:
Equation: LRFORM01

| Test Statistic | Value | df | Probability |
|---|---|---|---|
| t-statistic | 1.446600 | 3 | 0.2438 |
| F-statistic | 2.092653 | (1, 3) | 0.2438 |
| Chi-square | 2.092653 | 1 | 0.1480 |

Null Hypothesis: C(12)=C(13)
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(12) - C(13) | 319.8509 | 221.1052 |

Restrictions are linear in coefficients.

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LIQRR

Wald Test:
Equation: LRFORM01

| Test Statistic | Value | df | Probability |
|---|---|---|---|
| t-statistic | -2.807700 | 3 | 0.0674 |
| F-statistic | 7.883180 | (1, 3) | 0.0674 |
| Chi-square | 7.883180 | 1 | 0.0050 |

Null Hypothesis: C(4) = C(6)
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(4) - C(6) | -1190.266 | 423.9292 |

Restrictions are linear in coefficients.

CRR
Wald Test:
Equation: LRFORM01

| Test Statistic | Value | df | Probability |
|---|---|---|---|
| t-statistic | -2.624414 | 3 | 0.0787 |
| F-statistic | 6.887549 | (1, 3) | 0.0787 |
| Chi-square | 6.887549 | 1 | 0.0087 |

Null Hypothesis: C(18)=C(22)
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(18) - C(22) | -794.8323 | 302.8609 |

Restrictions are linear in coefficients.
LDR SHORTRUN

Wald Test:
Equation: LRFORM01

| Test Statistic | Value | df | Probability |
|---|---|---|---|

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| | | | |
|---|---|---|---|
| t-statistic | 4.211740 | 3 | 0.0245 |
| F-statistic | 17.73876 | (1, 3) | 0.0245 |
| Chi-square | 17.73876 | 1 | 0.0000 |

Null Hypothesis: C(11) + C(12) + C(13)= C(15) + C(16)
+C(17)
Null Hypothesis Summary:

| Normalized Restriction (= 0) | Value | Std. Err. |
|---|---|---|
| C(11) + C(12) + C(13) - C(15) - C(16) - C(17) | 1899.399 | 450.9773 |

Restrictions are linear in coefficients.