Macroprudential Policy and the Banking System Stability in Nigeria

Jibrin, Y., Adegbe, B. and Ogbonnaya-Orji, N. [*]

Abstract

This study investigated the effectiveness of some macroprudential policy instruments in achieving banking system stability in Nigeria, using the autoregressive distributed lag (ARDL) bounds testing approach to cointegration analysis on quarterly data, spanning 2007Q1 to 2018Q4. The study constructed indices of macroprudential policy by calculating the difference between the actual observation and the policy target, while banking system stability was proxied by a z-score to denote Banking System Stability Index (BSI), calculated as unit of financial sector performance per unit of volatility (standard deviation) in return on assets (ROA). A dummy variable was included to account for a structural break in the model. Findings from the study showed the existence of a significant long-run relationship between BSI and the macroprudential policy indices analysed, in line with a priori expectations, indicating their impact on banking system stability in the long-run. It, however, showed a positive but insignificant relationship between BSI and the growth rate of real GDP. Hence, the key macroprudential indicators analysed were found to be effective in ensuring banking system stability in Nigeria for the period studied. The study recommended that the Bank should retain its macroprudential policy stance on capital adequacy, non-performing loans and loans-to-deposit ratio, but periodically review, and where necessary, update these, in line with macroeconomic and global developments.

Keywords: Macroprudential Policy, Financial Stability, Banking System

JEL Classification: G0, E6

I. Introduction

An important lesson from the 2007/2008 Global Financial Crisis (GFC) was the need for financial sector regulators to deepen efforts towards preserving and ensuring the safety, soundness and stability of the financial system. This could be achieved through adequate use of macroprudential policies to complement existing sound macroeconomic policies. Prior to the crisis, the traditional approach to regulation focused largely on micro-prudential policy. The crisis, however, exposed the inadequacy of that approach, and brought to the fore the need for a suitable risk-based framework, which captures the interconnectedness of financial institutions and markets, and the associated risks via shared exposure to economic variables and procyclical behaviour. This gave rise to the global adoption of macroprudential policies by governments and financial sector regulators to address systemic risk. Such policies require the use of prudential tools to identify and mitigate systemic risk and, thereby, reduce the economic costs that could accrue from a

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disruption in financial services, which underpin the workings of financial markets. It has since been acknowledged that an effective macroprudential policy (MP) is one that employs a combination of tools, well calibrated, to attain specific sub-objectives, with the overall aim of enhancing the resilience of the financial system to both internal and external shocks. However, assessing the effectiveness of the MP toolkits in attaining the objectives for which they were designed to achieve has been difficult. This is due to their multidimensional nature and complex interactions with other economic variables. For instance, MP instruments are wide-ranging in nature, and hence, have differing objectives. Furthermore, when set in the form of targets, MPs, oftentimes, do not have a high degree of variability, making their estimation in an empirical model problematic. Also, there is no means of distinguishing between monetary policy and macroprudential policy, as a policy tool could serve both uses in achieving different objectives (Klingelhofer & Sun , 2019).

Due to their paramount role in undertaking financial intermediation in the economy, banks are often the most prominent component of the financial system, and in many cases, dictate the overall health and direction of the sector. In Nigeria for instance, banks make up the majority of the financial sector and are the prime target of Central Bank of Nigeria's (CBN) policies for ensuring financial system stability. There is, however, no single universally accepted aggregate measure of banking system stabiility, as this still remains a subject of debate (Jahn & Kick, 2012). The challenges highlighted above are exacerbated when examining the impact of MP on banking system stability, as it is a broad and complex variable that is difficult to measure. In addition, banking system stability is affected by the operations of other policies, including the monetary and fiscal policies (Foot, 2003).

The banking system in Nigeria has faced a number of crises over the years, triggered by a range of macroeconomic, domestic and global developments. Having as one of its core mandates "to promote a sound financial system in Nigeria", the CBN has employed a range of monetary and prudential policies and implemented series of reforms targeted at the financial sector to achieve this goal. The Bank and Other Financial Institutions Act (1991), for example, spelt out the comprehensive guidelines for bank regulation, supervision and liquidation. Also, the effects of the 2007/2008 GFC, coupled with other developments in the global financial services space, as well as the rapid growth due to the banking sector post-consolidation, led the Bank to review its prudential guidelines in 2010. The review adopted a more 'macro' dimension, as well as addressed issues impeding banks' performance such as corporate governance, risk management and loan-loss provisioning (CBN, 2010).

In the case of Nigeria, empirical studies on the effectiveness of macroprudential policies are few. Some of the studies carried out on this subject have also focused on conceptual issues, such as the design of the policy and the ingredients needed for an effective policy (Kama et al., 2013). Others employed different approaches in circumventing data challenges in empirically investigating the effectiveness of the policy on financial stability (Mordi et al., 2016; Okafor & Asuzu, 2018). These have, however, not particularly focused on gauging the effectiveness of macroprudential policy on the stability of the banking system.

This study, therefore, fills the gaps in understanding of how effective MP has been, in guarding against banking system instability. Specifically, it attempts to bridge this gap, building on the works of Mordi et al., (2016) and Okafor and Asuzu (2018). Furthermore, the study aims to empirically investigate the effectiveness of some key macroprudential policy instruments in achieving banking system stability in Nigeria both in the short-and long-run, as well as provide some policy recommendations based on the findings of the study.

This paper is divided into six (6) sections. Following this introduction, is section 2 which provides a review of relevant conceptual, theoretical and empirical literature. Section 3 discusses some stylised facts on key macroprudential policy indicators in Nigeria, while section 4 focuses on the methodology, estimation procedure and data analysis. Section 5 concentrates on the discussion of major findings, and section 6 concludes the study, with policy implications and recommendations.

II. Literature Review

II.1 Conceptual Issues

Macroprudential policy can be defined as the use of prudential tools to identify and mitigate systemic risk and, thereby, reduce the economic costs that could accrue from a disruption in financial services. Central to this definition is the concept of *systemic risk,* that is, the risk of widespread disruption to the provision of financial services, which is triggered by an impairment of all or parts of the financial system, and can cause serious negative consequences to the real economy (FSB/IMF/BIS, 2009). The 2005 International Monetary Fund (IMF) Handbook described a sound and well-functioning financial sector as one possessing macro-prudential surveillance and financial stability analysis. This alludes to the fact that a link exists between prudential regulation and the macroeconomy (Duniya, 2012).

II.1.1 Evolution of Macroprudential Policy

The term "macroprudential" can be traced back to July 1978, when the concept was used in a Bank for International Settlement (BIS) paper on "The Implications of Rising Oil Prices for International Bank Lending and the Stability of the International Banking System", prepared for consideration by the Euro Currency Standing Committee. Subsequently, in June 1979, the Cooke Committee (the predecessor of the present Basel Committee on Banking Supervision) re-emphasised the issue, as microprudential concerns began to materialise as macro-economic, that is, macroprudential problems. In the same year, in a background paper developed by the Bank of England, macroprudential regulation was proposed as a complimentary form of regulation to identify and treat issues affecting the market as a whole, seperately from those impacting on individual bank or financial institution. Thereafter, the limitation of micro-prudential regulation in guaranteeing financial system stability began to manifest.

The financial crises in the late 1990s, particularly the Asian financial crisis, shone more light on the growing interdependence between the macroeconomy and the financial system, and stressed the need to build resilience to systemic shocks. Following the global financial crisis of 2007/2008 and the severity of the global recession that ensued, macroprudential regulation grew more in popularity. It, therefore, became imperative to develop a more reliable macro-based financial regulation framework. Consequently, many countries have since adopted MP tools as instruments utilised in fostering financial system stability (Kahou & Lehar, 2017).

II.1.2 Macroprudential Policy Tools

Macroprudential policy tools are designed with a macro-focus and used alongside other policy tools in curbing systemic risk and attaining the objective of financial stability. Such tools seek to mitigate systemic risk in its two dimensions-cross-sectional and time dimensional (Altunbas et al., 2018), and are especially advantageous, because they can be targeted at specific risks (Kama et al., 2013). Also, due to the broad nature of macroprudential instruments, there is no one-size-fits-all approach to ascertaining their effectiveness. This effectiveness can, only be adequately analysed with respect to the specific goal that the policy under question seeks to achieve. Furthermore, determining what tools to employ, their calibration, as well as when or how to deploy them depends on authorities' perception of the highlighted vulnerabilities in the system and the degree of confidence in the analyses which revealed the highlighted issues. The

prevailing legal and institutional framework in a given system also play a key role in determining the effectiveness of policy tools (Kahou & Lehar, 2017).

Following the Asian financial crisis of the late 1990s, and the GFC of 2007/2008, it became clear that there was need for data to facilitate the timely identification of financial system vulnerabilities by sector regulators. Hence, the IMF launched the compilation of "core" and "encouraged" sets of Financial Soundess Indicators (FSIs) to help in assessing the financial health and soundness of the financial, corporate and household sectors in a country. The core sets of FSIs cut across the major macroprudential areas of capital adequacy, asset quality, earning and profitability, liquidity and sensitivity to market risk (Essien & Doguwa, 2015). A comprehensive list of these macroprudential policy indicators is provided in Appendix 1.

It is also important to note that the choice of MP policy tool or mix of tools is dependent on the extent of economic and financial development, exchange rate regime, as well as vulnerability to certain shocks. MP is also implemented alongside the fiscal and monetary policies, and usually adjusted countercyclically to mimic "automatic stabilisers" (Lim et al., 2011).

II.1.3 Banking System Stability

Financial stability has been defined as a lack of systemic financial crises or panics in a financial system, characterised by the absence of wide fluctuations in the prices of assets and stakeholders' confidence in the key financial markets and institutions. The term "financial stability" gained prominence in 1996, following the launch of the Bank of England's Financial Stability Review. A stable financial system which allocates credit efficiently, is capable of absorbing shocks, managing risks and positively impacting output, employment and inflation (Kama et al., 2013).

As institutions, whose operations entail loans disbursement and deposit taking activities, banks play a central role in allocating capital, conducting financial intermediation, and in many contexts, dictating the overall direction and health of the financial sector. Consequently, any significant failure in the banking system would lead to scarcity of credit and rise in the cost of financial intermediation, giving rise to unpleasant economic fluctuations and adverse feedback effects on the real economy (Merton, 1993). As such, identifying and mitigating potential risks to the banking system are key tasks of central banks and financial system regulators (Jahn et al., 2012).

II.1.4 Theoretical Rationale for Macroprudential Policy and Regulation

Macroprudential regulation inevitably builds from micro-level supervision. Hence, it is impossible to attain macroprudential policy objectives without effective micro-level supervision. Conversely, microprudential regulation must account for the "macro" nature of inherent risks facing the financial sector to be considered effective (Sere-Ejembi et al., 2014). According to Duniya (2012), it has been argued theoretically, that prudential regulation reforms should integrate three different paradigms, namely, the agency paradigm, externalities paradigm and mood swings paradigm. Macroprudential regulation, according to this author, is particularly stressed by the last two. As such, to derive the economic rationale for MP, its tools could be viewed as instruments used to correct externalities that create systemic risk or financial instability. Under the mood swings paradigm, the relevance of employing MP in curbing financial instability is also justified, given that rationality and greed are factors which influence the behaviour of financial institutions' managers, leading to overt optimism in good times and sudden risk adversement, in the event of a downturn. The result is that pricing signals in financial markets may be inefficient, thus, increasing the likelihood of systemic trouble (Duniya, 2012).

The theoretical rationale for macroprudential regulation could, therefore, be said to stem from the negative externalities associated with limited liability, limited enforcement and asymmetric information. These externalities, according to Kenc (2016), can be broadly grouped into three - interconnectedness externality, strategic complementarities, and pecuniary externalities.

i. Interconnectedness Externality

Interconnectedness externality emphasises risks that plague the banking system, as a result of its interconnected nature. Since the banking sector (and overall financial sector) operates as a system, correlations and linkages undoubtedly exist between banks' portfolios and balance sheets. As such, even an idiosyncratic shock affecting one bank could potentially have implications for the entire banking system. Systemically Important Banks (SIBs) are, however, likely to generate much larger externalities than their other counterparts due to their often-complex structure, international linkages and central role in the financial infrastructure of the domestic economy. Interconnectedness externalities can, therefore, destabilise a financial system by excessively exposing the system to shocks and contagion. Furthermore, the extent to which this could occur is dependent on the extent to which financial intermediaries

take into account, the effects of their actions on risk in other institutions and the financial system as a whole (Kenc, 2016).

ii. Strategic Complementarities

Strategic complementarities are those externalities that could arise as a result of strategic interactions between banks, other financial institutions and agents, which could build-up systemic vulnerabilities during the booms and intensify same during downturns. Strategic complementarities are especially present, when agents mutually reinforce one another, and could arise from increased competition in boom times among banks, implicit government guaranties provided to banks, among others. Complementarities have the tendency to generate excessive risk-taking through asset communality (Kenc, 2016).

iii. Pecuniary Externalities

Pecuniary externalities pertain to "fire sales" that have the tendency to take place during downturns, following the sale of an asset by a troubled financial institution. Such sales lead to a reduction in the price of other similar assets due to the similarly troubled nature of potential buyers. The sale price of such an asset would fall below its actual value, thereby causing the seller to incur losses, leading to increased volatility in the financial system. Fundamental market inefficiencies, such as limited liability, asymmetric information and limited enforcement are also sources of endogenous risk. Here, asymmetric information or limited enforcement induces lenders to demand collateral from borrowers, thereby limiting the amount of debt to the value of their collateral. Due to the fact that a shock that causes agents to sell assets can lead to a deterioration of collateral values, borrowers become more credit constrained, profitable investments are stalled causing the real economy, to suffer loss. Fire sales related externalities are also potentially critical for banks, due to their business model of liquidity, maturity and credit transformation (Kenc, 2016).

II.1.5 Macroprudential Policy Versus Monetary Policy

One of the lessons highlighted by the 2007/2008 GFC was that macroprudential supervision was insufficient in dealing with the build-up and materialisation of systemic risks. Likewise, monetary policy had focused mainly on the objective of attaining and maintaining price stability, which may not necessarily translate to financial stability (Smets, 2014). Thus underscored that, financial stability (macro-prudential) mattered for the achievement of price stability (monetary policy).

Gerlach (2009) also noted that monetary policy and financial regulation should not be conducted in isolation, stating that financial regulators needed to look beyond a narrow focus on individual institutions to the broader macro economy. Hence, macroprudential policy identifies and addresses issues affecting the entire market rather than a single institution. According to Smets (2014), macroprudential policy aims to prevent, or at least contain, the buildup of financial imbalances and ensure that the financial system is tough and able to withstand shocks. However, both policies need to be coordinated properly so that they do not work against each other and lead to less than desired outcomes.

II.2 Empirical Review

Studies have employed various methodologies in empirically investigating the relationship between MP and financial or banking system stability. For instance, Lim et al. (2011), using data for 49 countries, studied the effectiveness of MP instruments in reducing systemic risk over time and across institutions and markets. The findings suggested that the most frequently used instruments were effective in reducing pro-cyclicality, but their degree of effectiveness was sensitive to the type of shocks facing the financial sector. Dell'Ariccia et al. (2012) explored the answers to questions about credit booms and bursts to gain understanding of the key factors that triggered booms. It also ascertains whether every credit boom ended in a burst, and if different policies played a role in curbing growth and associated risks in Central and Eastern Europe (CEE) countries. The results showed that credit booms were linked to financial reforms. It also showed that economic growth, fixed exchange rate regimes, weak banking supervision, and loose macroeconomic policies were more conducive to booms; the larger and the longer a boom was, the more likely that it ended up badly; and that monetary and fiscal policies did not appear to be effective in limiting booms. The study concluded that MP tools, by contrast, had proven to be effective in containing booms, and more often, in limiting the consequences of busts, due to the buffers they help build.

Claessens et al. (2013) examined the effectiveness of macroprudential policies on 2,800 banks, across 48 countries using panel data for the 2000 to 2010 period. Controlling for endogeneity, the authors examined how the key variables in the banks' balance sheets responded to specific policies and found that measures aimed at borrowers, such as, caps on debt-to-income and loan-to-value ratios, and limits on credit growth and foreign currency lending were effective in reducing leverage, asset and non-core to core liabilities growth during boom times. Also assessing the effects of MP on bank risk, Altunbas et al. (2018) utilised

the Generalised Method of Moments (GMM) panel methodology on data for 61 banks, operating in 61 emerging and advanced economies. The authors constructed an aggregate index to capture overall effectiveness of MP tools, which they considered "a very rough approximation". To do so, dummy variables were employed, wherein the value +1 was assigned to denote tightening of a macroprudential policy tool, and -1, used to represent easing. The study found that macroprudential policy significantly impacts bank risk, and that the effect varies among banks, as this was dependent on specific balance sheet characteristics.

Klingelhofer and Sun (2019) applied a narrative approach in distinguishing MP and its objectives from other policy decisions, and assessed the effectiveness of these measures on macroeconomic and financial conditions in China. The information obtained was utilised in constructing a time series to measure MP stance for China for the period 2000 to 2015, employing the methodology used in Altunbas et al. (2018). Applying a VAR model framework for assessing bi-directional causality, the study showed that both monetary and macroprudential policies were effective in limiting the excessive growth of credit, but MP had no statistically significant effect on output.

For Nigeria, Sere-Ejembi et al. (2014) developed a banking system stability index (BSSI), encompassing three groups of indicators—banking system soundness, banking system vulnerability and economic climate. Applying statistical normalisation techniques, the BSSI was derived by computing the weighted averages of these three groups of indicators, which were formulated using a mix of Financial Soundness Indicators (FSIs) and macroeconomic soundness indicators. Important to note is that the banking soundness index adopted in the study comprised the four broad catergories of MP indicators denoting capital adequacy asset quality, liquidity and profitability. This findings showed that the derived BSSI is capable of acting as an early warning mechanism for signaling fragility and the resilience of the banking system in the face of adverse shocks.

In an empirical study on Nigeria, Mordi et al. (2016) utilised a structural VAR (SVAR) framework on data from 1999Q1 to 2014Q4, to examine the impact of MP policy on the Nigerian economy, as well as, the channels via which shocks from MP policy instruments are transmitted to the economy. Taking into consideration, loan-to-value ratio, loan-to-deposit ratio and capital adequacy requirement, the study found loan to value ratio (credit channel) to be a major means through which prudential weakness could cause systemic crisis in Nigeria. To proxy MP policy, the authors utlised the difference (deviation) between the MP policy target, and the observed value for the banking sector for

each MP policy indicator analysed. This is the approach we employed in this study, especially given the low level of variability of MP policy targets for Nigeria. Examining the impact of prudential measures on the performance of deposit money banks (DMBs) in Nigeria from 2007 to 2015, Okafor and Asuzu (2018) employed the GMM technique, as well as, fixed and random effects models to analyse panel data for selected Systemically Important Banks (SIBs), small and foreign banks in Nigeria. The study found banks' leverage, liquidity conditions and NPLs to be the key variables which influence DMBs performance in the country. The findings also suggested that banks' capital adequacy was not reflective of their profitability, and that SIBs profitability, determined largely, the trend of the industry's performance.

In assessing the effect of non-performing loans on the banking system stability in Nigeria, Atoi (2018) adopted a Z-score measure of banking stability, constructed from three key financial soundness indicators–equities to assets ratio, the return on assets and the standard deviation of return on assets (to proxy volatility of banks' returns). The study revealed that NPLs drivers differed across the two categories of banks, but, weighted average lending rate was important for both. In addition, while international banks were able to withstand NPLs shocks in the long-run, the stability of national banks was susceptible to NPLs shocks in the long-run.

III.0 Stylised Facts

To capture the banking system stability, we employed the approach used in Atoi (2018). Stability is proxied by a Z-score, calculated as the ratio of the sum of returns on asset (ROA) and capital-asset ratio[1], to the standard deviation of ROA.

$$\text{Stability Index (BSI)} = \frac{\text{ROA} + \frac{\text{Capital}}{\text{Asset}}}{\text{Standard Deviation of ROA}} \quad (1)$$

Since standard deviation is used to measure volatility (Brooks, 2019), this indicator of stability shows the unit of financial sector performance per unit of volatility in ROA. The Z-score denotes banks' distance from insolvency and shows by how many standard deviations ROA could change to make banks total assets fall below its total debts. As such, the higher the Z-score, the more "stable" the banking system and vice versa.

This study considers four indicators of macroprudential policy: Capital

[1]Calculated as the total industry capital divided by total assets.

Adequacy Ratio (CAR), that is the ratio of regulatory capital to risk-weighted assets; the ratio of Non-Performing Loans to gross total loans (NPL); Loans-to-Deposit ratio (LD); and Liquidity Ratio (LR), the ratio of liquid assets (core) to short-term liabilities. In this case, each macroprudential policy index is calculated as the difference between the actual observation for the banking industry, and the policy target:

$$x - \bar{x} \tag{2}$$

Where:

x = Actual observation
$\bar{x}$ = Policy target

Hence, we have the following indices:
CARdev= deviation of observed CAR from target
LDdev= deviation of observed LD from target
LRdev= deviation of observed LR from target
NPLdev= deviation of observed NPL from target

The calculation of the indices was necessitated by the lack of variability in the policy target itself, which posed a challenge for analysis (see Figures 1- 4).

It is important to note that, because policy targets for LD and NPL are maximum thresholds, negative deviations from the target are considered desirable and vice versa. In contrast, targets for CAR and LR are minimum thresholds, implying that positive deviations from the policy target are considered desirable and vice versa.

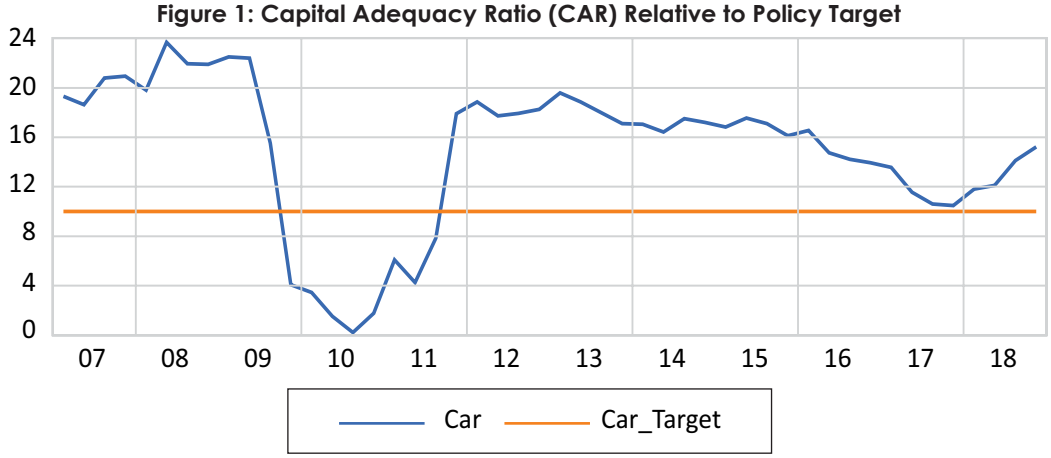
III.1 Trend Analysis of the Banking System Stability Indicators in Nigeria

The Nigerian banking sector has undergone series of reforms in the past two decades, with the aim of making the sector more stable, safe, efficient and resilient to shocks. Most notable among the reforms was the banking consolidation exercise, which was completed in 2005 (Mordi et al., 2016). Prior to the exercise, the sector comprised of 89 banks which were operating under a "universal banking scheme", a policy framework which did not restrict banks' share capital investments in other financial service sub-sectors. The scheme was aimed at creating a level playing field for operators, encouraging greater efficiency through economies of scale and foster competition by opening up various lines of businesses to banks. The result, however, was a high level of

interconnectedness of several subsidiaries in the sector, which posed a major challenge for regulators (Atoi, 2018).

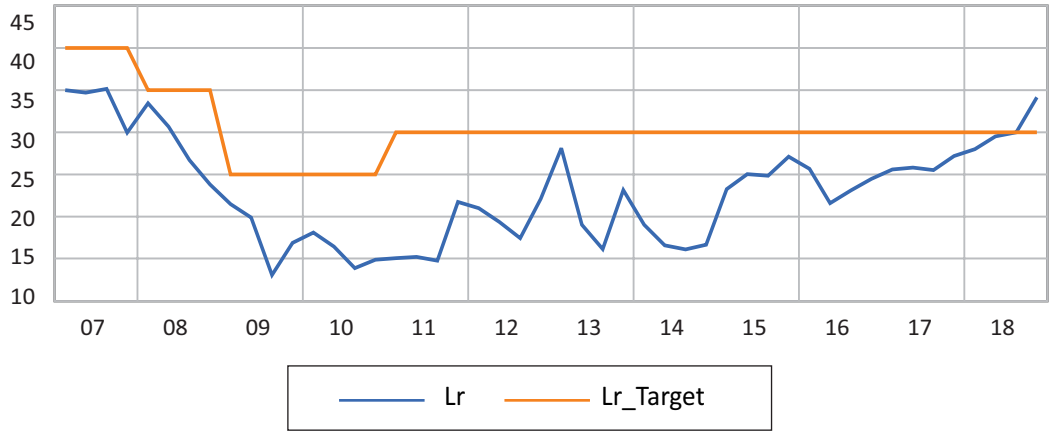
The banking consolidation exercise, subsequently resulted in substantial improvements in the efficiency and capitalisation of banks, and the reduction in the number of banks to 24. These gains were, however, interrupted by the 2007/2008 GFC, as the aftermath of the crisis saw a sharp decline in banks' performance. This was evident in the stress test conducted by the CBN in 2009, which revealed that 10 of the 24 banks were in distress (Sanusi, 2011). This could be further observed in the fall in the capital adequacy ratio, from 22.4 per cent in 2009Q2, to a low of 0.2 per cent in 2010Q3, where it was below the stipulated minimum (for banks with national authorisation) of 10.0 per cent (Figure 1).

Figure 1: Capital Adequacy Ratio (CAR) Relative to Policy Target



Source: Author's computation

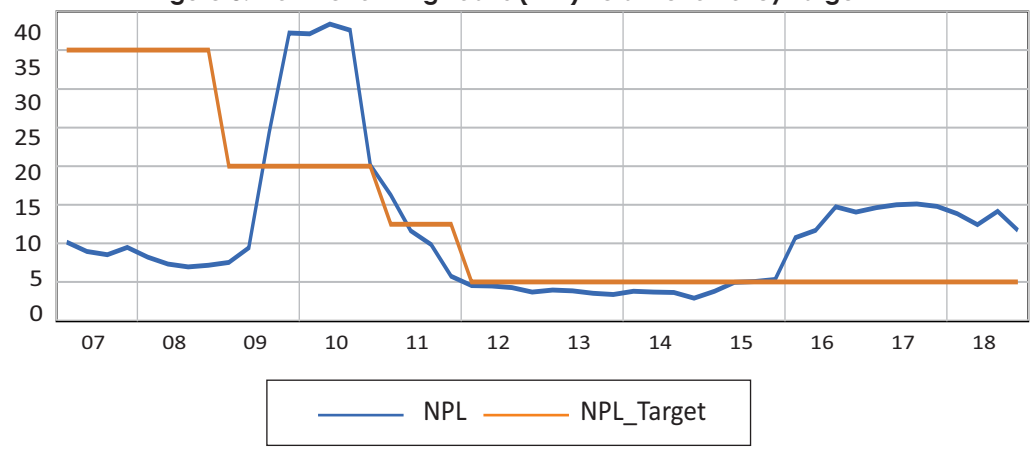
Figure 2: Liquidity Ratio (LR) Relative to Policy Target



Source: Author's computation

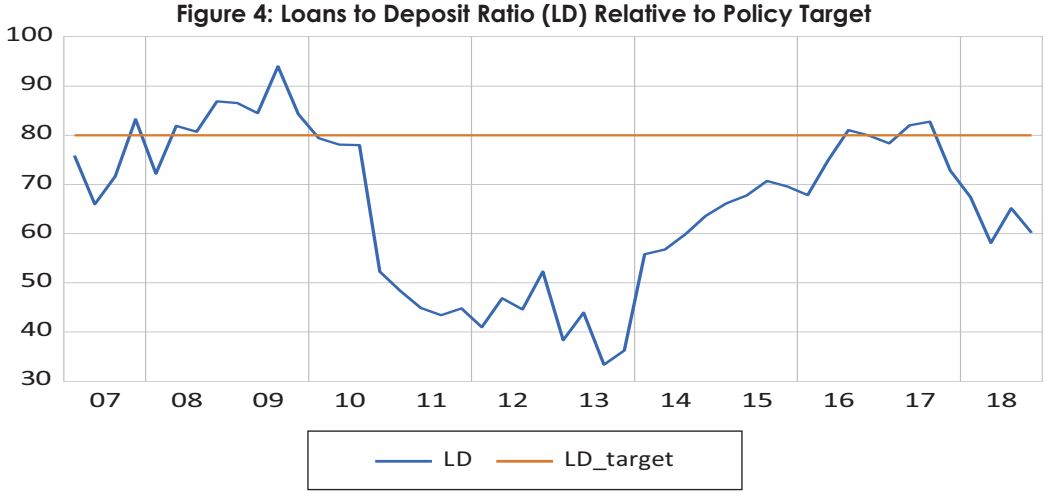
Similarly, the liquidity ratio, dipped from 33.4 per cent in 2008Q1 to 13.1 per cent in 2009Q3. Sectoral data for liquidity ratio showed that banks underperformed relative to the policy target throughout the period under review, until 2018 (Figure 2). The liquidity 'crunch' observed, notably from 2008Q1 to 2009Q3, could be attributed to the impact of the GFC on the economy, as well as, internal challenges faced by banks. Thus, liquidity management by the CBN, in subsequent years, was targeted at boosting the liquidity and efficiency of the financial market, without compromising the objectives of monetary and financial system stability (Essien & Doguwa, 2015).

Figure 3: Non-Performing Loans (NPL) Relative to Policy Target



Source: Author's computation

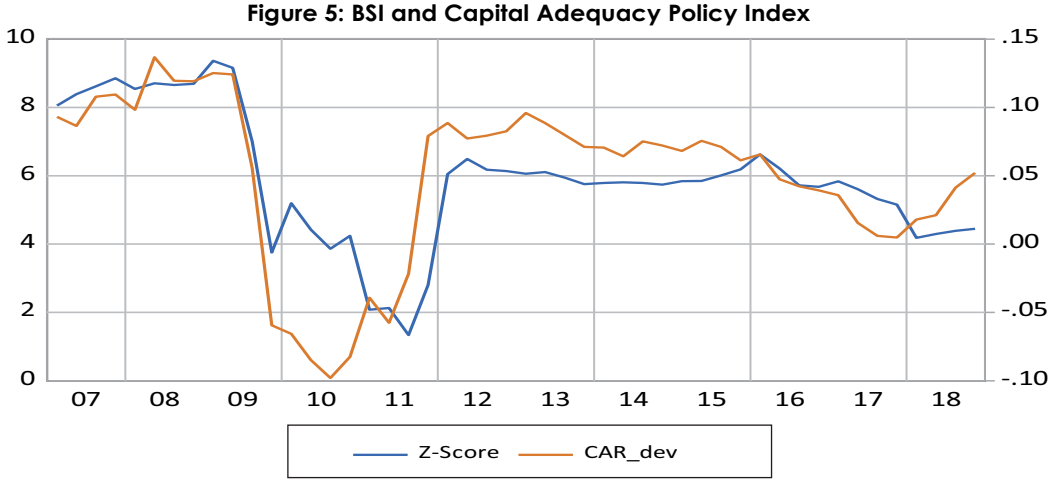
Figure 4: Loans to Deposit Ratio (LD) Relative to Policy Target



Source: Author's computation

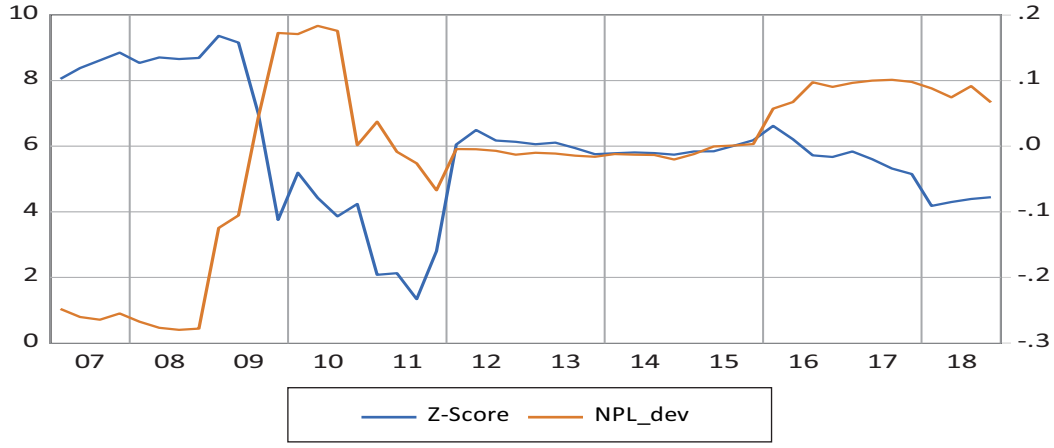
The ratio of NPLs to gross total loans rose sharply from 7.0 per cent in 2008Q3 to 37.3 per cent in 2009Q4, exceeding the set policy benchmark. Around the same period, loans-to-deposit ratio rose above the policy benchmark from 80.72 per cent in 2008Q3 to 94.0 per cent 2009Q3. Notwithstanding, the conditions in the industry significantly rebounded from 2011, following the CBN bailout fund to banks, and the establishment of the AMCON in 2010 to takeover banks' bad loans. The effect of the economic recession of 2016/2017 could also be observed in the trend of these two indicators as NPL ratio rose from 5.32 in 2015Q4 to 15.01 in 2017Q2. Similarly, loans-to-deposit ratio (LD) marginally rose above the policy benchmark of 80.0 per cent to 82.0 per cent between 2016Q4 and 2017Q2 and assumed a mostly downward trajectory post-recession (Figure 4).

Figure 5: BSI and Capital Adequacy Policy Index



Source: Authors' computation

Figure 6: BSI and Non-Performing Loans Policy Index

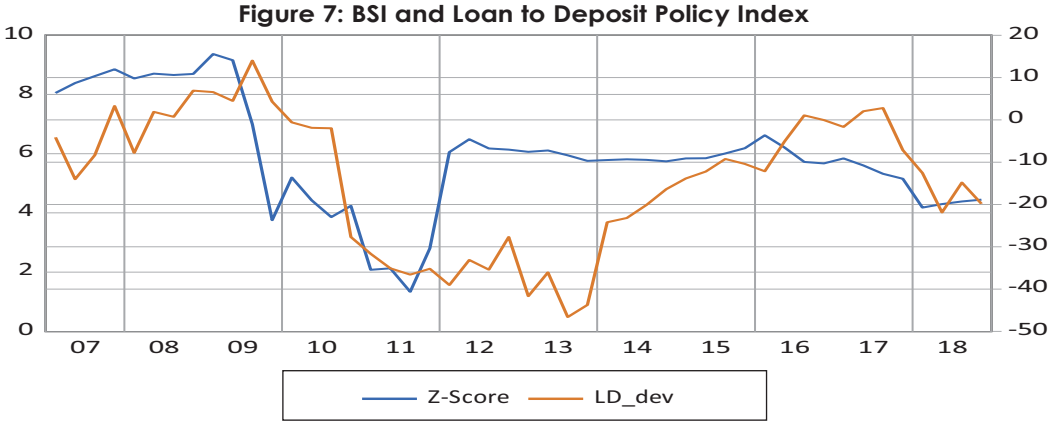


Source: Authors' computation

In Figures 5 - 8, the 4 MP indices[2] for most of the time, moved in tandem with the z-score index of banking system stability (BSI)[3]. It can be observed in our analysis that post-GFC, the stability index significantly worsened, with a sharp decline observed, particularly, from 2009Q2 to 2009Q4. Also, as a spillover from the crisis, CARdev fell below the stability index from 2009Q4 to 2011Q3 (Figure 5). This was attributable to bad lending decisions by banks during the boom preceding the GFC and subsequent loan loss provisions made which eroded on bank's capital base (Egboro, 2016).

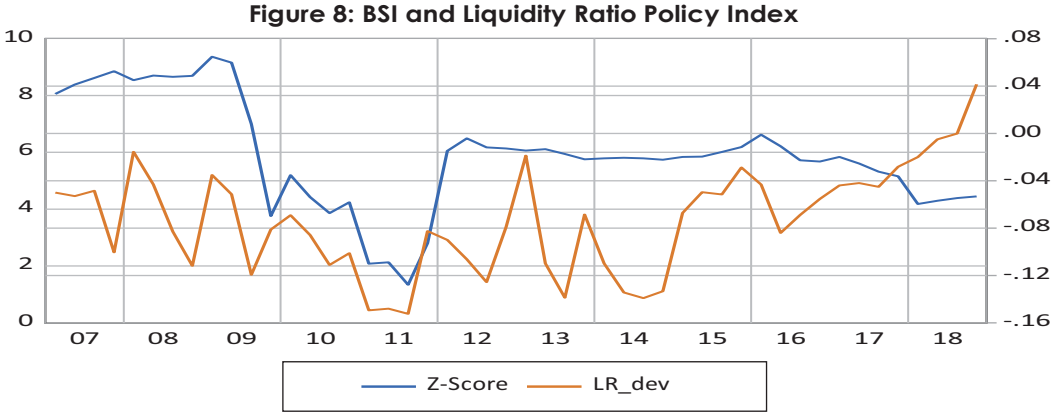
A similar effect can be in the MP indices NPLdev and LDdev, although the decline in the latter was sustained (Figures 6 and 7). Similarly, liquidity ratio of banks underperformed below its policy target of a minimum of 30.0 percent for most of the period under review (Figure 8).

Figure 7: BSI and Loan to Deposit Policy Index



Source: Author's computation

Figure 8: BSI and Liquidity Ratio Policy Index



Source: Author's computation

[2] See Section 4.0 for method of construction.

[3]See Section 4.0 for method of construction.

IV. Methodology

IV.1 Data

This study utilises quarterly data, spanning the period 2007Q1 to 2018Q4. The data were extracted from the Financial Analysis (FinA), CBN Statistical Database, CBN Statistical Bulletin and relevant CBN policy reports or communiques. The scope of the study was informed by the availability of data, while the choice of MP instruments for the study was to reflect the core components of FSIs - capital adequacy, asset quality, liquidity, earnings and profitability, and sensitivity to market risk. However, because policy targets do not apply to earnings and profitability indicators, and comprehensive data on the policy stance of the indicator for sensitivity to market risk (Net Open Position in Foreign Exchange to Capital) was lacking, these were not reflected in the analysis. The growth rate of real GDP (RGDPG) was introduced into the model, as a control variable. The MP instruments analysed are explained briefly in Table 1.

Table 1: Some Selected Macroprudential Instruments/Indicators

Indicator	Measurement	Derivation/Input Data (Formula)	Policy Threshold	Interpretation
Total industry non-performing loans to total loans (NPL ratio)	Asset Quality	Total industry NPLs divided by total loans	NPL ratio not > 5%	The ratio indicates the quality of banks' loans or risk assets.
Total industry liquid assets to short-term liabilities (liquidity ratio)	Liquidity	Total industry liquid assets divided by deposit liabilities	• Liquidity ratio for DMBs not < 30% • OFIs should not be < 20% • Non-interest banks should not be < 10%	This measures the industry's ability to meets its short-term obligation.
Total industry Loans to Deposit ratio (LDR)	Liquidity	Total industry loans divided by total industry deposits	LDR not > 80%	This measures the level of trading with depositor's funds.
Regulatory capital to risk weighted assets	Capital adequacy	Total bank's regulatory capital divided by risk weighted assets	• Not < 10% for Regional & National banks; • Not < 15% for International banks; and • Not < 15% for SIFIs.	This is a broad measure of capital adequacy.

Source: Authors' compilation

IV.2 Technique of Analysis and Model Specification

To examine the effectiveness of macroprudential policies in achieving banking system stability, the study employed the autoregressive distributed lag (ARDL) bounds testing approach to cointegration. The advantage of this approach, relative to other tests of cointegration, is its ability to estimate level relationships among variables that are integrated of different orders. This, however, is applicable only where all the variables are integrated of order d<2 (Belloumi, 2014). Secondly, the technique is more appropriate for time series analysis with fewer observations as is the case here, and allows for the correction of serial correlation and potential endogeneity problems. Finally, the unrestricted nature of the ARDL provides room for flexibility in determining optimal lag length to capture the data generating procedure (Nkoro & Uko, 2016).

The ARDL model utilised in this study is, therefore, expressed as follows:

$$BSI = \alpha_0 + \sum_{i=1}^{p} a_{1i}\Delta BSI_{t-1} + \sum_{i=1}^{r} a_{2i}\Delta CARdev_{t-1} + \sum_{i=1}^{s} a_{3i}\Delta NPLdev_{t-1} + \sum_{i=1}^{t} a_{4i}\Delta LDdev_{t-1} + \sum_{i=1}^{u} a_{5i}\Delta LRdev_{t-1} + \sum_{i=1}^{v} a_{6i}\Delta RGDPG_{t-1} + \delta(BSI_{t-1} - c - b_1 CARdev_{t-1} + b_2 NPLdev_{t-1} + b_3 LDdev_{t-1} + b_4 LRdev_{t-1} + b_5 RGDPG_{t-1}) + \emptyset Dummy_t + e_t \quad (3)$$

Where all variables are as previously defined for a time period *t*; Δ is the differenced operator; a_1 to a_6 and b_1 to b_5 are coefficients of the short- and long-run relationships, respectively, and r, s t, u and v are optimum lags specifications for CARdev, NPLdev, LDdev, LRdev and RGDPG, respectively. *Dummy* is a structural break dummy, which takes the value zero (0) for all observations of BSI from 2009Q4 and below, and one (1) for observations of BSI from 2010Q1 and above.

To ensure that the model was void of basic econometric problems, which could limit the extent of its validity, residual-based tests for serial correlation, heteroskedasticity and normality were performed on the estimated model. The chosen ARDL model was estimated for the sample period, 2007Q1 to 2018Q4.

V. Empirical Analysis

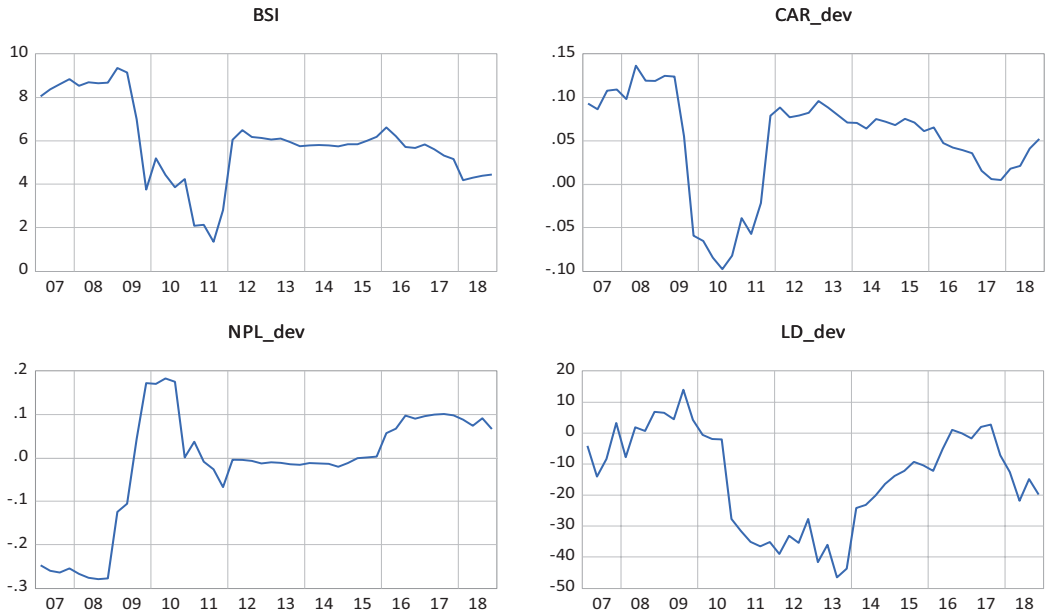
V.1 Graphical Representation of Variables Employed

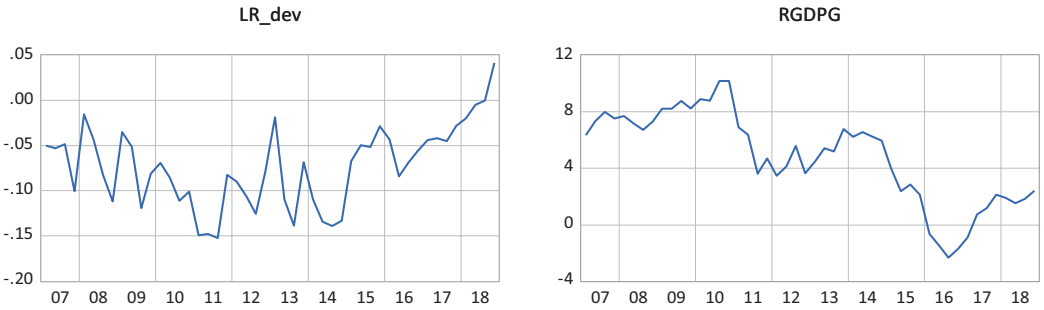
Most striking in Figure 9, is the evidence of a structural break in the model, notably in the variables BSI, CARdev and NPLdev from the period 2009Q1 to 2012Q2. This coincided with the period of banks 'distress', subsequent 'bailout' by the CBN and the establishment of the AMCON, after the banking sector was hit by the second-round effect of the 2007-2008 GFC. LDdev remained negative for most of the time series, with a marginal increase observed in 2017Q3, after the

economy entered into recovery, following the recession. Although, LRdev was negative during this time, it assumed an upward trajectory for the period 2017Q3. The growth rate of real GDP began a downward spiral from 2014Q4, that is following the decline in crude prices and turned negative in 2016Q1, reaching a low in 2016Q3, marking the beginning of the Nigerian economic recession of 2016/2017.

It can also be deduced that the key variables under consideration in the model possess a mix of positive and negative intercepts. As such, a constant term was introduced in the long-run equation. It was also imperative to test for the existence of significant structural shifts in the model. This was done by applying the Bai and Perron (2003) test for multiple structural breaks, which allows for a maximum of five breaks with a trimming parameter of 0.15. The results indicated the existence of significant structural breaks in the model at three time periods-2010Q1, 2012Q1 and 2016Q3. Dummy variables were thus, constructed to capture these structural break dates and were included in the model. However, upon estimation, only the structural break observed in 2010Q1 was found to be significant. Hence, it was retained in the model, while the others were removed.

Figure 9: Graphical Representation of the Variables Employed





Source: Authors' Estimation

V.2 Correlation Analysis

Two tests of correlation were carried out in the study to determine the existence of multicollinearity among the selected variables in the model. The first being a Pairwise correlation test, and the second, a test of variance inflation factors (VIF). While the former is series based, the latter is model based. Results are presented in Table 2 and Table 3, respectively.

From Table 2, it can be observed that the correlation between the dependent and independent variables, as well as, among the independent variables remained below the acceptable threshold of < 0.8. However, a strong, positive correlation was found between BSI and CARdev, while a high, negative correlation was observed between BSI and NPIdev. This is in line with a priori expectations as the banking system is expected to be more stable as banks' capitalisation improves (above the policy target), and non-performing loans decline (below the stipulated maximum). LDdev showed a moderate, positive correlation with BSI, in line with expectations (for most of the period under study the ratio of loans to deposits remained under the policy maximum), while LRdev and RGDPG were slightly, and positively correlated with BSI.

Table 3 showed that the Centered VIF (CVIF) for all the explanatory variables was far below the accepted threshold of < 10. Hence, it can be concluded that there is no multicollinearity in the model.

Table 2: Correlation Matrix

	BSI	CAR_DEV	NPL_DEV	LD_DEV	LR_DEV	RGDPG
BSI						
CAR_DEV	0.76					
NPL_DEV	-0.69	-0.70				
LD_DEV	0.44	0.004	-0.07			
LR_DEV	0.24	0.19	0.02	0.31		
RGDPG	0.19	-0.08	-0.37	0.02	-0.38	

Source: Authors' Estimation

Table 3: Variance Inflation Factors

Variable	Centered VIF
BSI	NA
CAR_DEV	2.79
NPL_DEV	3.17
LD_DEV	1.15
LR_DEV	1.37
RGDPG	1.76

Source: Authors' Estimation

V.3 Unit Root Tests

As stated earlier, a pre-condition for the conduct of an ARDL bounds test is that all variables included in the test equation must be either stationary, or integrated of order *d,* where $d < 2$. As such, the unit root properties of the variables were estimated utilising the Augmented Dickey-Fuller (ADF, 1979) and Phillips-Perron (PP, 1988) tests for unit root. Both tests have the null hypotheses of presence of "unit root".

Table 4: Result of Unit Root Tests

Variables	ADF		PP		Order of Integration
	Level	First Difference	Level	First Difference	
BSI	-1.0844	-5.7600***	-1.0809	-5.7657***	I(1)
CAR_DEV	-3.2805**	NA	1.7460*	4.7695***	I(0)
NPL_DEV	-3.3157***	NA	-2.1565**	NA	I(0)
LD_DEV	-1.0500	-7.8772***	-1.0645	-7.7861***	I(1)
LR_DEV	-0.8306	-8.1526***	-1.2492	-9.5171***	I(1)
RGDPG	-1.0472	-6.3672***	-1.0912	-6.4203***	I(1)

Source: Authors' Estimation
Note: *, **, *** denotes 10%, 5% and 1% levels of significance, respectively.

V.4 The ARDL Model and Lag Length Selection

To decide on the most optimum ARDL model for this study, we estimated series of specifications of the model, applying varying maximum lags and employing the Akaike Information Criteria (AIC) in determining the optimum lags of each variable in the model. Residual based tests of normality, heteroskedasticity, and serial correlation were also conducted, alongside model stability tests. Subsequently, ARDL (1, 2, 2, 1, 3, 3) was selected due to its best-fit suitability in describing the relationship being analysed.

V.5 The ARDL Bounds Test of Cointegration

Table 5 presents results of the ARDL bounds test conducted, with or without structural breaks. The tests are conducted under the null hypothesis of "no level

relationship". The results show that the computed F-statistics are greater than the upper critical bounds. As such, the null hypothesis of no cointegration is rejected at the1 per cent level of significance. This, therefore, confirms the presence of a long-run cointegrating relationship between the variables BSI, CARdev, NPLdev, LDdev, LRdev and RGDPG from 2007Q1 to 2018Q4.

Comparing the results of both models estimated, the F-statistic, R^2, and Adjusted R^2 values improved, while the AIC, SIC, HQ values deteriorated in the model which accounted for a structural break, indicating that this is the more preferred model. Thus, this is a better - performing model.

Table 5: Result of the ARDL Bound Test

	Without Structural Break		**With Structural Break**	
PARSIMONIOUS	**ARDL (1,0,1,0,0,0)**		**ARDL (1,2,2,1,3,3)**	
F-STAT	**9.67**		**17.56**	
CRITICAL VALUES	I(0)	I(1)	I(0)	I(1)
1%	3.93	5.23	3.93	5.23
5%	3.12	4.25	3.12	4.25
10%	2.75	3.79	2.75	3.79
R^2	0.91		0.98	
Adjusted R^2	0.89		0.96	
F-Stat (Prob. value)	49.62 (0.00)***		58.38 (0.00)***	
AIC	2.02		1.09	
SIC	2.37		1.90	
HQ	2.15		1.40	

Source: Authors' Estimation

Note: *** denotes 1% level of significance, respectively. The optimal lag structure is determined by the Schwarz Information Criterion (SIC). The probability values are given in parentheses. Critical bounds are computed by (Pesaran et al., 2001) following unrestricted intercept and restricted trend.

V.6 The Estimated ARDL Long-Run Model

Normalising the model in the long-run, the following results were obtained as shown in Table 6.

Table 6: Estimated Long-Run Coefficients

Dependent Variable= BSI				
Variables	**Coefficient**	**Std. Error**	**T-Statistic**	**Prob. Values**
Constant				
CARdev	27.7829***	5.0159	5.5390	0.0000
NPLdev	-10.9539**	4.8993	-2.2358	0.0345
LDdev	0.0907***	0.0122	7.4062	0.0000
LRdev	20.3077***	4.9241	4.1241	0.0004
RGDPG	0.0105**	0.0589	0.1780	0.8602

Source: Authors' Estimation.
Note: *, **, *** denotes 10%, 5% and 1% levels of significance, respectively.

In line with *apriori* expectations, we found a positive and statistically significant long-run relationship between the BSI and CARdev, implying that the more banks' capital adequacy ratio outperformed the policy minimum of 10 per cent, the higher the level of stability in the banking system. This shows the effectiveness of Nigeria's policy in this regard, which is more stringent than the international convention that stipulates a minimum ratio of 8 per cent. Figure 1 shows further that for most of the quarters under review, banks outperformed this policy benchmark (except for the period between 2009Q4 and 2011Q3).

On the relationship between BSI and NPLdev, a negative and statistically significant long-run relationship was found, consistent with *a priori* expectations. This indicates that the more banks exceeded the stipulated maximum NPL ratio, the more the level of banking instability worsen. Furthermore, it can be observed that between 2012Q1 and 2015Q4, when the NPL for the sector hovered closely around the policy target (see Figure 3), the NPL policy index (NPLdev) tracked very closely the BSI (see Figure 6). This helps to substantiate the empirical studies.

The long-run relationship between BSI and LDdev was found to be positive and significant, in line with *a priori* expectations, suggesting that the more banks did not exceed the stipulated policy maximum of 80 per cent (which was the case for majority of the period under review), the more the stability in banking system improved. It can, however, be seen that banks' lending was far below the policy threshold for most of the period under study, showing that while this was desirable for stability, banks' lending to the real sector was below optimum. This finding is in line with the recent CBN policy which mandated banks to maintain minimum loan to deposit ratio of 65.0 per cent, by December 31, 2019.

In the case of the relationship between BSI and LRdev, the result indicated the presence of a positive and statistically significant long-run relationship between the two variables. This indicated that in the long-run, although minimum liquidity

ratios for banks are prescribed to align with the direction of monetary policy, the LRdev was an effective MP instrument during the period studied. It should, however, be noted that banks did not meet the stipulated minimum LR for most of the period studied, indicating the need to better calibrate this tool to meet the MP objectives.

The study found a positive, but not statistically significant long-run relationship between BSI and growth of real GDP (RGDPG), showing that economic growth, was not a key determinant of banking system stability in Nigeria during the period studied.

V.7 The Estimated ARDL Short-Run Model

Similar to the long-run form, the contemporaneous and one (1) period lag change in CARdev was found to have positive and statistically significant impact on BSI in the short-run. For the variable NPLdev, its contemporaneous term showed a negative, but insignificant relationship with BSI in the short-run, while in the (1) period lag, NPLdev was found to be positively and significantly related with BSI in the short-run. The short-run impact of LDdev (in its contemporaneous term), on banking system stability was found to be positive and significant, while the impact of LRdev on BSI was found to be positive and insignificant in the short-run , but negative and significant in its first and second lags. The result of the LRdev signifies that the lower the deviation of the actual LR and target LR, the better for banking system stability in the short-run. The growth rate of real GDP showed a positive and significant short-run relationship with BSI in its contemporaneous term, first and second lag.

The structural break dummy showed a positive and significant relationship with banking system stability. This implied a significant shift in the relationship between macroprudential policies and banking system stability in Nigeria, as the impact of the 2007-2008 GFC hit the Nigerian banking sector between 2009Q4 and 2010Q1. The speed of adjustment parameter CointEq (-1) = -0.71, is less than unity, negative and significant, implying that about 71 per cent of any movements into disequilibrium are corrected for within the first quarter (Table 7).

Table 7: Estimated Short-Run Coefficients of BSI

Dependent Variable= BSI				
Variables	**Coefficient**	**Std. Error**	**T-Statistic**	**Prob. Values**
D(CARdev)	8.3904***	3.0943	2.7116	0.0119
D(CARdev(-1))	7.6217***	2.3397	3.2576	0.0032
D(NPLdev)	-1.7123	1.4156	-1.2096	0.2377
D(NPLdev(-1))	6.6860***	1.6150	4.1310	0.0032
D(LDdev)	0.0214***	0.0081	2.6396	0.0141
D(LRdev)	1.5017	1.8301	0.8205	0.4197
D(LRdev(-1))	-7.2948***	1.9156	-3.8081	0.0008
D(LRdev(-2))	-7.8323***	2.0019	-3.9124	0.0006
D(RGDPG)	0.0990**	0.0483	2.0490	0.0511
D(RGDPG(-1))	0.2062***	0.0498	4.1383	0.0003
D(RGDPG(-2))	0.1039**	0.0491	2.1160	0.0445
CointEq	-0.7108***	0.0632	-11.2433	0.0000
Dummy	5.226***	0.4431	11.7940	0.0000
C	3.1178***	0.3360	9.2788	0.0000
Trend	-0.0876***	0.0085	-10.3113	0.0000

Source: Authors' Estimation.

Note: *, **, *** denotes 10%, 5% and 1% levels of significance, respectively.

V.8 Diagnostic Tests

The results of the Breusch-Godfrey Serial Correlation LM Test, Breusch-Pagan-Godfrey Heteroskedasticity Test, and the Jacque-Bera Test for Normality, are presented on Table 8, and indicate the absence of serial correlation, no heteroskedasticity and normality of the residuals.

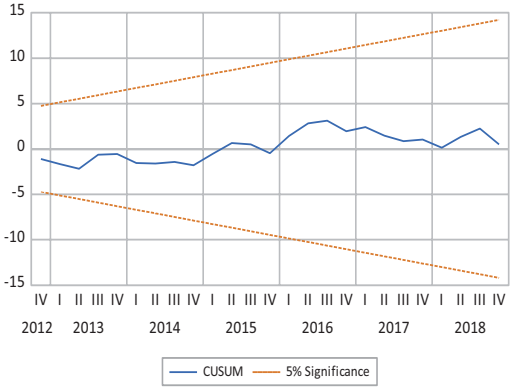
Table 8: Residual-Based Diagnostic Tests

Breusch-Godfrey Serial Correlation LM Test	
F-statistic	1.5933
p-values	0.2169
Heteroskedasticity Test: Breusch-Pagan-Godfrey	
F-statistic	1.7495
p-values	0.1259
Jacque-Bera Test for Normality of Residual	
Jacque-Bera	1.8553
p-values	0.3955

Source: Authors' Estimation

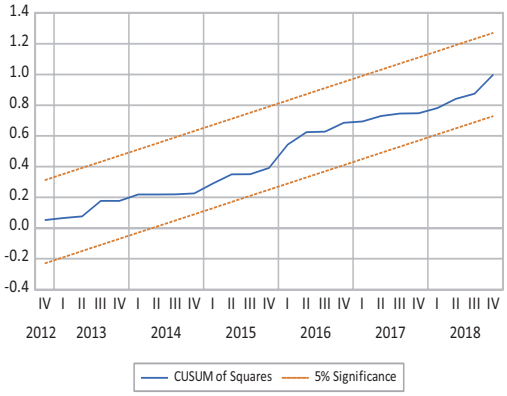
The coefficients of the estimated model are stable, as the CUSUM and CUSUM of squares statistic are within the 5 per cent critical lines.

Figure 11: CUSUM Test



Source: Authors' computation

Figure 12: CUSUM of Squares Test



Source: Authors' computation

Furthermore, the result of the Ramsey RESET test, reported in Table 9 showed that the estimated model is free from omitted variable bias, as the t-statistic and F-statistic were not statistically significant at 5.0 per cent.

Table 9: Ramsey RESET Test

	Value	Probability
t-statistic	1.29	0.21
F-statistic	1.66	0.21

Source: Authors' estimate

VI. Conclusion, Policy Implications and Areas for Further Research

This study assessed the effectiveness of key macroprudential policy instruments in promoting banking system stability in Nigeria. To achieve this objective, the ARDL bounds testing approach to cointegration was applied to analyse quarterly data for the period 2007Q1 to 2018Q4. The results from the estimation showed that macroprudential policy tools on capital adequacy, non-performing loans, loans- to-deposit ratio and liquidity ratio, were effective in attaining the objective of banking system stability. However, economic growth was not a significant factor contributing to banking system stability during the period studied. Furthermore, these policies were seemingly effective, only when actual figures for banks hovered around or outperformed the policy targets, thus suggesting that while the policy targets on these indicators are well calibrated to attain the goal of banking system stability in Nigeria, banks' deviation from the target remains a challenge in the sector, most especially, with regards to the issue of nonperforming loans.

This study, therefore, recommends that:

i. The Bank should sustain its macroprudential policy stance on capital adequacy, non-performing loans and loans-to-deposit ratio, but periodically review, and where necessary, update these, in line with domestic macroeconomic and global developments;

ii. To consolidate on the achievements so far, there is need to give adequate priority to strengthening monetary and fiscal coordination in order to sustain the effectiveness of macroprudential policy in addressing systemic risks and ultimately ensuring financial stability. Macroprudential policy should also be extended in public policy formulation to contain the severity of shocks, in the event of any systemic crisis to the financial system;

iii. There is need to build a comprehensive database on macroprudential policy targets to facilitate greater research in this direction;

iv. Further investigation should be carried out on the interrelationship between macroprudential policy, monetary policy and banking system stability in Nigeria. Specifically, the use of liquidity ratio thresholds in achieving both monetary policy and macroprudential policy objectives should be re-investigated. This is because, although liquidity ratio was found to be an effective macroprudential tool, banks did not meet the stipulated minimum ratio for most of the period studied; and

v. Future research in this area should examine the causes of undesirable deviations from MP targets, and where possible, replicate the methodology used in this study in analysing a wider range of macroprudential policy instruments.

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Appendix

Appendix 1: Macroprudential Indicators for the Banking Sector

Indicator/Ratio	Measurement	Derivation/Input Data (Formula)	Implication/ Threshold/ Rule	Interpretation
Assets-Based Instruments				
Total industry non-performing loans to total loans (NPL ratio)	Asset Quality	Total industry NPLs divided by total loans	NPL ratio not > 5%	The ratio indicates the quality of banks' loans or risk assets.
Total industry Liquid assets to total assets	Liquidity	Total industry liquid asset divided by total assets	No threshold	Assesses the vulnerability of the sector to loss of access to market sources of funding or a run on deposits. The higher the ratio the more resilient the industry is to liquidity shock.
Total industry liquid assets to deposit liabilities (liquidity ratio)	Liquidity	Total industry liquid assets divided by deposit liabilities	• Liquidity ratio for DMBs not < 30% • OFIs should not be < 20% • Non-interest banks should not be < 10%	This measures the industry's ability to meets its short-term obligation
Total industry Loans to Deposit ratio (LDR)	Liquidity	Total industry loans divided by total industry deposits	LDR not > 80%	This measures the level of trading with depositor's funds.
Trend of industry Credit Growth	Build-up of Systemic Risk	Trend analysis of industry credit growth – monthly and annually	(Current period less previous period) divide pervious period x 100	It indicates the level of growth of credit by the banking sector.
Sectoral exposures to total loans	Credit Concentration	Total bank's/industry exposure to each sector divided by total loans	Exposure to each sector not > 5% except manufacturing & SME	Identifies exposure concentrations to sectors. It indicates the level of credit concentration and/or diversification in the loan portfolio. Over concentration in any one sector may be a source of vulnerability to the financial system.
Sectoral NPL ratio	Sectoral concentration of non-performing assets	Total industry NPLs in each sector divided by total NPLs	Sectoral NPL ratio not > 5%	This indicator identifies exposure to problematic sectors.

Loan-to-value ratio	Over Exposure to Obligors	Bank's mortgage loans (principal) divided by value assets financed	No prescribed threshold.	It measures over exposure to obligors. This ratio is an important indicator of the probability of default.
Total industry Foreign currency denominated loans to total loans	Exposure to Foreign Exchange risk	Total industry foreign currency-denominated loans divided by total loans	No prescribed threshold.	This ratio measures the extent of currency mismatch.
Maturity profile of bank's assets & liabilities	• Funding structure • Application of funds • Liquidity	Maturity profile of bank's assets less liabilities	No prescribed threshold.	Excessive mismatch of assets and liability may lead to liquidity crisis
Maturity profile of total industry assets & liabilities	• Funding structure • Application of funds • Liquidity	Total industry maturity profile of assets less liabilities	No prescribed threshold.	Excessive mismatch of assets and liability may lead to liquidity crisis
Maturity profile of loans & Deposits	• Funding structure • Ability to pay customers' withdrawals	Total industry maturity profile of loans less deposits		Excessive mismatch of loans and deposits may lead to liquidity crisis
Maturity profile of loans & Deposits	• Funding structure • Ability to pay customers' withdrawals	Bank's maturity profile of loans less deposits		This shows the ability of institutions to meet maturing deposits. Excessive mismatch of loans and deposits may lead to liquidity crisis.
Liquidity coverage ratio (LCR)	Liquidity	Total bank's high-quality liquid assets minus stressed net cash outflows for a period of 30 days	LCR not < 100%	This ratio indicates bank's ability to withstand serious liquidity demands for a period of 30 days.
Leverage ratio	Capital adequacy	Bank's Capital measure (Tier 1 capital) divided by Exposure measure (on-balance sheet, derivative, securities financing & off-balance sheet exposures)	Leverage ratio not < 3%	This indicator complements the risk-based capital requirement and is aimed at ensuring that bank's exposure is financed with tier 1 capital.
Ratio of non-core to core funding	Reliance on wholesale funding	Individual bank's non-core funding divided by total funding	No prescribed threshold. But it should be lower than non-core funding	Non-core funding is unstable and can expose banks to liquidity risk. The lower the ratio the better.

Liability Based Instruments				
Net Stable Funding Ratio (NSFR)	Stability of Funding	Available amount of stable funding divided by required amount of stable funding	NSFR not < 100%	It measures the stability of funding; long-term assets shall be funded with stable funds
Inter-bank takings to total liabilities	Liquidity and exposure to other banks	Individual bank's inter-bank takings divided by total liabilities	No prescribed threshold.	This indicator measures bank's reliance on interbank funds which are usually expensive and may be unstable.
Foreign currency denominated liabilities to total liabilities	• Exposure to foreign exchange risk; • Pressure on the Naira exchange rate	Total industry foreign currency-denominated liabilities divided by total liabilities	No prescribed threshold.	It is an indicator that measures the extent of dollarisation (or any foreign currency) of an economy. High ratio may lead to volatility in naira exchange due to high demand pressure of the foreign exchange.
Capital-Based Instruments				
Industry Regulatory capital to risk weighted assets	Capital adequacy	Total bank's regulatory capital divided by risk weighted assets		This is an industry broad measure of capital adequacy.
Regulatory capital to risk weighted assets	Capital adequacy	Total bank's regulatory capital divided by risk weighted assets	• Not < 10% for Regional & National banks; • Not < 15% for International banks; and • Not < 15% for SIFIs.	This is a broad measure of capital adequacy.
Regulatory Tier 1 capital to risk weighted assets (Tier 1 CAR).	Capital adequacy	Total bank's regulatory Tier 1capital divided by risk weighted assets	Tier 1 CAR not < 4.5%	This is an indicator of the adequacy of the highest quality capital.
Industry Regulatory Tier 1 capital to risk weighted assets (Tier 1 CAR).	Capital adequacy	Total bank's regulatory Tier 1capital divided by risk weighted assets	Tier 1 CAR not < 4.5%	This is an indicator of the adequacy of industry's highest quality capital.
Non-performing loans net of provision to capital	Capital adequacy	Total industry NPLs net of provision divided by total capital	No prescribed threshold	It measures ability to absorb potential losses from NPL.
Net FX trading position to capital	Capital adequacy	Total industry net FX position divided by total capital	Not more than 20% of shareholders' funds unimpaired by losses	This measures the ability of capital to absorb losses from trading position.
Aggregate foreign currency borrowing	Capital adequacy	Total foreign exchange denominated	Should not exceed 75% of shareholders'	It measures the ability of banks to absorb losses from

		borrowing divided by shareholders' funds unimpaired by losses.	funds unimpaired by losses	foreign exchange risk
Interest margin	Profitability	Bank's net interest income divided by interest income	No prescribed threshold	This measures the cost of funding.
Interest income to gross income	Profitability	Interest income divided by gross income	No prescribed threshold.	This ratio measures the extent of reliance on traditional sources of income (interest)
Non-interest expense to gross income	Profitability	Non-interest expense divided by gross income	No prescribed threshold.	The ratio indicates bank's ability to control operating cost. Lower rate indicates banks' ability to control operating costs.
Personnel expense to non-interest expense	Cost of human capital relative to non-interest expense	Personnel cost divided by non-interest expense	No prescribed threshold.	It measures the level of staff cost relative to non-interest expense.