



Research Paper

Credit Risk Management and Financial Sustainability of Listed Deposit Money Banks in Nigeria

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ABSTRACT

Financial sustainability is generally believed to be the consistent key indicator of how a company is being managed presently and looking at enhanced performance in the future. However, the quality of risk assets and its management can change the entire performance of the company and consequently; its financial sustainability. This study examined the effect of credit risk management on the financial sustainability of listed deposit money banks in Nigeria. The study adopted an Ex-post facto research design. The population consisted of all 14 listed Deposit Money Banks (DMBs) in Nigeria as at December 31, 2019 out of which a sample of 12 banks were purposively selected based mainly on availability of complete data for ten years period (2010 – 2019). Secondary data extracted from the financial statements were analyzed using descriptive and inferential analyses. The population of 14 banks accounted for 53.85% of banks in operation. The study found that credit risk management (CRM) proxied by Loan Deposit Ratio (LDR), Non-performing Loan (NPL) and Assets Growth Percentage (AGP) had a positive significant effect on CAR of listed DMBs in Nigeria ($Adj. R^2 = 0.0969$, $F_{(3,105)} = 13.66$; $P < 0.05$). Bank Size (BS) significantly moderated the relationship between the CRM and CAR of listed DMBs in Nigeria ($\Delta Adj. R^2 = 0.0814$, $\Delta F_{(3,116)} = 12.19$; $P < 0.05$). However, CRM had no significant effect on ROCE of listed DMBs in Nigeria ($Ad R^2 = 0.1873$, $F_{(3,105)} = 2.73$; $P > 0.05$). BS significantly modified the relationship between the CRM and ROCE positively ($\Delta Adj. R^2 = 0.1779$, $\Delta F_{(3,116)} = 22.88$; $P < 0.05$). Overall, CRM positively and significantly affected the financial sustainability of listed DMBs in Nigeria. The study concluded that credit risk management has a positive significant effect on financial sustainability of listed DMBs in Nigeria. This study recommended that regulators should adopt a risk based approach in determining capital adequacy requirements and give special attention to banks that are too big to fail while DMBs' managements should ensure that all the board members and executive managements amongst other stakeholders are trained to appreciate the functions and responsibilities of credit risk management.

KEYWORDS: Capital Adequacy ratio, Credit risk management, Dividend per Share, Earnings per Share, Financial sustainability, Return on Capital Employed

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I. INTRODUCTION

Globally, Deposit money banks play a vital role in the economic resource distribution. Krueger (2004) said "A strong, well-functioning financial sector is crucial for an economy; be it industrial, emerging market or even low income. It is very essential for healthy sustained growth. As an economy grows and matures, its financial sector must grow with it. It must be able to meet the increasingly sophisticated demands that are placed on it". The global importance of well-functioning financial system was further stated by her that as economies grow and diversify, their agricultural and manufacturing sectors expand, and their services sectors develop and grow, their banking sectors need to keep up. Decisions as to which activities to finance and which not are crucial for rapid growth. Banks must therefore develop means of allocating credit among competing needs. They must learn to assess business plans, identify and manage risk.

In Nigeria, Federal government has introduced several banking reforms towards ensuring financial sustainability by establishing a reliable and efficient banking sector so that it could guarantee the safety of the depositors' money. Financial system is the central nervous system of every economy. It plays the critical role of mobilizing savings from the surplus economic units and directing same to the deficit economic units for investment purposes.

Banking sector reforms in Nigeria could conveniently be discussed under the following eras: the post-SAP era – (1986 -1993); The Reforms Lethargy (1993- 1998), the pre-Soludo era. The first is the financial systems reforms of 1986 to 1993 which led to deregulation of the banking industry which hitherto was dominated by indigenized banks with over 60% Federal and State governments' stakes, in addition to credit, interest rate and foreign exchange policy reforms. The second phase began in the late 1993 -1998, with the re-introduction of regulations. During this period, the banking sector suffered deep financial distress which necessitated another round of reforms designated to manage the distress. The third phase began with the advent of the civilian regime in 1999 which saw the return to liberalization of the financial sector accompanied with the adoption of distress resolution programs. This era also witnessed the introduction of universal banking which empowered the banking and non-banking financial markets.

The fourth phase began in 2004 till date and it is informed by the Nigerian Monetary Authorities who asserted that their catalytic role in promoting private sector led growth could be further enhanced through a more pragmatic reforms (Balogun, 2012). This fourth phase consists of Banking Consolidation Era of 2004 and Risk Based Regulatory Framework Era of 2009 where seventy banking licenses in total were withdrawn as a result of inability to meet new capitalization requirement or being found to be insolvent based on volume of non-performing loans (Akpan in Mbat, 2011).

However, some authors were of opinion that the Banking Ordinance of 1952 which stipulated the conditions for the establishment and operations of banks in Nigeria as against the hitherto unregulated scenario which precipitated the incessant banking failures was actually the commencement of banking reforms in Nigeria (Aigbokhaevbolo, Enabulu, & Ofanson, 2010; Akpan in Mbat, 2011).

For survival and growth, deposit money banks need to be profitable. Beyond their intermediating function, the profitability of banks has serious effects on economic growth. Good financial performance promotes high shareholders returns. As a result of this, there exist further investment opportunities thereby promoting economic growth. Also, poor financial performance of deposit money banks can lead to failure and financial crunch which have undesirable impacts on the economic growth (Kusa, & Ongore, 2013). Credit and liquidity problems may adversely affect the financial performance of a bank as well as its solvency if not properly managed. Credit risk management has been an essential part of the loan process in the banking sector. Deposit money banks continue to spend huge resources in credit risk management modeling with the objective of maximizing profits.

Sanusi (2012) stated that various reforms we undertook in Nigeria were targeted at making the system more effective and strengthening its growth potential; thus efficiency. Therefore, the various banking reforms have brought several benefits to the banking system and the economy in general; ranging from increase in bank capitalization from N2billion to N25billion which brought the total capitalization of the 25 successful banks to N755billion as against N324billion when they were 89 banks (CBN, 2010). The increased capitalization has led to superior returns on savings; availability of bank's funds for higher ticket transactions; possible spread of risks and investments; employment creation and wealth generation and the much desired financial inclusiveness among other benefits of increased capitalization.

Other benefits of banking reforms in Nigeria include dilution of ownership structure of banks which has led to improved board composition and excellent board decisions; reduction of public sector deposits or Government funds to maximum of 10% in banks has led to increased and efficient marketing strategies; nearly all banks in Nigeria are now quoted which has deepened the activities of the capital market on banking sectors (Akpan, 2011).

From the above, it is clear that Deposit Money Banks in the whole world including Nigeria have bigger responsibilities in managing the risk of performing their credit functions and combining it with financial safety or sustainability of their banks and economy at large. They face numerous risks that threaten their financial and institutional viability and long-term development. Their portfolio may suffer sudden rises in loan delinquency and arrears. DMBs may be subject to fraudulent loans made by their loan officers. Therefore, it is imperative that they have robust systems and procedures for identifying, assessing and prioritizing risks, internal controls for preventing or detecting undesirable outcomes.

Effective banking sector reform is a regulatory imperative for a sustainable banking industry in Nigeria. From the findings of this study, the banking regulators will be equipped to direct their regulatory searchlight towards enhancing and strengthening regulations that will foster the growth – induced variables of banks and overturning the non – growth variables. The end result of this study will be a sustainable banking industry that will be the pride of all the stakeholders.

Prior studies on Credit Risk Management concentrate more on its relationship with Profitability measured by PBT only. Whenever previous studies looked at risk; the focus was more on operational and market risks without detailed analysis of credit risk. This study believe those earlier studies were not comprehensive enough as the financial sustainability cannot be determined by profitability alone.

Statement of the Problem

In Nigeria, Financial unsustainability has affected the banking system negatively which has resulted to various banks' failures at different periods. The consequences of these banks' collapse as a result of insolvencies because of large volume of non-performing loans or inadequate capitalization have impacted the economic growth and development. The enactment of the Banking Ordinance of 1952 was introduced to reduce the high rate of bank failure and the need to maintain bank customers' confidence. In 1995, 55 units of banks out of 120 banks in Nigeria were distressed as a result of the introduction of the Failed Banks (Recovery of Debts) and Financial Malpractices Decree of 1994. The decree was established to restore sanity and confidence in system (Aigbokhaevbolo, Enabulu, & Ofanson, 2010). In 2005, the consolidation era saw the collapse of 65 banks in a day as a result of non-capitalization from N2billion to N25billion while 5 banks were distressed in 2009 after CBN Risk Based Examinations due to insolvencies as a result of high volume of non-performing loans.

In general, the major reasons for bank's failures and reforms in Nigeria are that some banks have low capital base compare to their peers in developed worlds; majority of the local banks in Nigeria are not very efficient both in human capital and technological advancement, therefore whenever there is a need for sophisticated financial advices; the government need to rely on foreign banks. In addition, like every other corporate organizations in Nigeria; deposit money banks listed in Nigeria had been suffering from weak corporate governance and insolvency for a long time. The government has failed to provide a sound banking system environment and the last but very important is that most deposit money banks depended upon the public sector deposits while the same public funds had not been distributed equally among all the banks (Ugoani, 2019).

Many banks have gone distressed in Nigeria simply because of bad risk assets and its management (Ugoani, 2019). The multiplier effect of these distressed banks as a result of risk assets and its wrong management on the entire economy including all stakeholders (staff, shareholders, government and the industry) will be difficult to overcome in a short period of time.

Objective of the Study

The main objective of the study is to examine the effect of credit risk management on the financial sustainability of listed deposit money banks in Nigeria. Specific objectives are to:

1. determine the impact of Credit Risk Management on the Capital Adequacy Requirement of listed deposit money banks in Nigeria;
2. evaluate the effect of Credit Risk Management on Return on Capital Employed of listed deposit money banks in Nigeria;
3. determine the moderating effect of Bank size on the effect of Credit Risk Management on Capital Adequacy Requirement of listed deposit money banks in Nigeria; and
4. evaluate the moderating effect of Bank size on the effect of Credit Risk Management on Capital Employed in listed deposit money banks in Nigeria.

Research Questions

The following research questions will be answered in this study:

1. What is the impact of Credit Risk Management on the Capital Adequacy Requirement of listed deposit money banks in Nigeria?
2. What is the effect of Credit Risk Management on Return on Capital Employed of listed deposit money banks in Nigeria?
3. What is the moderating effect of Bank size on the effect of Credit Risk Management on Capital Adequacy Requirement of listed deposit money banks in Nigeria?
4. In what way does the Bank size moderate the effect of Credit Risk Management on Return on Capital Employed in listed deposit money banks in Nigeria?

Research Hypotheses

The following hypotheses stated in null were tested at 0.05 level of significance.

Ho₁ Credit Risk Management has no significant impact on the Capital Adequacy Requirement of listed deposit money banks in Nigeria.

Ho₂ Credit Risk Management has no significant effect on Return on Capital Employed of listed deposit money banks in Nigeria.

Ho₃ Credit Risk Management as moderated by Bank's size has no significant impact on the Capital Adequacy Requirement of listed deposit money banks in Nigeria.

Ho₄ Credit Risk Management as moderated by Bank's size has no significant effect on Return on Capital Employed of listed deposit money banks in Nigeria.

Justification for the Study

Deposit money banks like every other business requires adequate and efficient capital to start the business and see it running efficiently thereafter. The main services of banks are deposit takings and lending of same to their customers. Lending is a critical role of banks that require special skills and expertise. If lending is not properly managed; the whole invested capital may be eroded. Therefore, credit risk management has a role in maintaining adequate capital (CAR); protecting shareholders' funds and returns on their investments (ROCE, EPS & DPS) and finally, customers' deposits.

Empirical review was conducted and various gaps which necessitated this study were observed. First, majority of the previous studies concentrated on microfinance institutions and foreign deposit money banks which does not constitute a good percentage of deposit money banks listed in Nigeria. The studies of Charles, Maryanne, and Willy (2015) and Belayet, Muhammad, Qingfeng, and Syeda (2020) focused only on MFIs. Emeka and Nenubari (2019) and Ngozi (2018) works did not cover the whole banking sector but only internationalized DMBs.

Data shortages, missing data or too small observed variable is another gap which may affect the research findings and recommendations. Girma & Jigin (2018) used only three years for their study; Ali, Bojan & Roger, (2018) omitted the first three years of each of the dependent variables which may affect the outcome of their investigations. Ahmad (2018) reviewed period was also considered too small while Peterson (2019) did not report some countries NPL values in their study. Also related to the above gap is the sample selection issue which may be biased when the selection is not total enumeration or not based on scientific sample selection techniques. Adebayo & Oluwaremi (2017) and Nwude & Okeke (2018) randomly selected five banks each for their samples. The sample size of five was considered too small out of twenty four banks and the selection may be biased.

This study would address the gaps noted in the previous studies as stated above and concentrate on credit risk management effectiveness on financial sustainability on deposit money banks listed in Nigeria. The general assumption is that an efficiently managed credit risk functions will improve the overall financial sustainability of listed banks in Nigeria. This assumption needs to be empirically tested with a focus on deposit money banks listed in Nigeria which is the purpose of this study.

II. REVIEW OF LITERATURE

Conceptual Review

In this conceptual review, the study reviewed all variables as related to dependent, independent and moderating variables and their interrelationship.

Financial Sustainability (FS)

In the corporate world, financial sustainability is defined as the consistency of firms in generating the positive outcomes that not only covers cost but also accelerate the firm growth. The aftermaths of subprime crisis have revealed the fact that the firms with financial sustainability were least affected from financial crisis (Gofman, 2017). The financial stability of any corporation is seen as the ratio of income to expenditures, which helps in determining the level of cash at firm disposal (Keister, 2018). The financial stability which is dependent upon a sound financial system helps in normalizing any state of crisis.

In a globalized economy, defining and establishing the financial sustainability has become a challenge for organizations of all sizes and types (Haas & Lelyveld, 2014; Claessens & Horen, 2015). The reason why financial sustainability is so important is its impact on the overall financial system (Acemoglu et al., 2015). CAR and ROCE were used as variables to proxy FS.

Credit Risk Management (CRM)

According to IFC, (2020) publication; "by managing risks and effectively using our financial resources, we remain financially sustainable and maximize our development impact". The statement has shown that management of credit risk by all enterprises; not only deposit money banks alone, is very crucial to their financial sustainability.

Banks are increasingly facing credit risk (or counterparty risk) in various financial instruments other than loans, included in the banking book, in the trading book, and both on and off the balance sheet thus acceptances, interbank transactions, trade financing, foreign exchange transactions, financial futures, swaps, bonds, equities, options, and in the extension of commitments and guarantees, and the settlement of transactions (Adegbe & Otitolaye, 2020). This was further supported by other studies; "in the era of dynamic transformations in the financial sector of economy, tightening of requirements towards credit institutions and strengthening of competitive struggle among them make the issues of bank risk management, which include not only traditional forms of risks – credit, market, operational, liquidities, but reputation as well, more urgent" (Dong et al.; 2014; Halachenko & Vasylychak, 2016; Masood et al., 2017; Strielkowski et al., 2016).

According to Gupta *et al.* (2015) successful credit risk management depends strongly on the size of the company. They argue that within the broad category of small and medium size enterprises exists a huge diversity, as SME differ widely in their capital structure, firm size, access to external finance, management style, numbers of employees etc., which is important to consider while managing credit risk.

Several major variables are considered when evaluating credit risk: the financial health of the borrower; the severity of the consequences of a default (for the borrower and the lender); the size of the credit extension; historical trends in default rates; and a variety of macroeconomic considerations, such as economic growth and interest rates (Sean 2020). Therefore, credits can be quantified as performing, watch list and non-performing facilities. Non-performing can be further categorized into three as follows: Sub-standard; Doubtful and Lost. Provision for facilities other than “Specialized loans” states that each of these categories attracts different rate of provisioning as 20%, 50% and 100% respectively (S6.02 – Revised Prudential Guideline, 2019).

Sound risk-management practice is very crucial to all deposit money banks to ensure their long-term viability and competitiveness. Sustainable businesses generate jobs and create long-term opportunities for millions to escape poverty and improve their lives.

Moderating Variable - Bank’s Size (BS)

Bank size is generally used to capture potential economies or diseconomies of scale in the banking sector. This variable controls for cost differences in product and risk diversification according to the size of the financial institution. The first factor could lead to a positive relationship between size and its profitability, if there are significant economies of scale (Akhavain *et al.* 1997; Bourke 1989; Molyneux & Thornton 1992; Bikker & Hu 2002; Goddard, 2004), while the second to a negative one, if increased diversification leads to lower credit risk and thus lower returns. Other researchers however conclude that marginal cost savings can be achieved by increasing the size of the banking firm, especially as markets develop (Athanasoglou, 2007; Berger. 1987; Boyd & Runkle 1993; Miller & Noulas 1997). Some DMBs may be classified as “Too big to fail” simply because of their economic impacts as a result of their sizes.

III. THEORETICAL REVIEW

Theoretical Framework

This study will be anchored mainly on Stakeholders Theory and Agency Theory. Financial sustainability; the dependent variable impacted various stakeholders which their interests need to be protected and guaranteed. In this study, we will be looking at both internal and external stakeholders represented by dependent variables ranging from meeting capital adequacy requirement in providing adequate return on capital employed, excellent earning per shares and fantastic dividend per shares for external stakeholders.

Agency theory assumptions will assist managements in performing their responsibilities in managing credit risk towards efficient financial sustainability irrespective of all associated risks. Managers are to use the resources of the banks under their care as entrusted on them by bank owners and give adequate returns on the entrusted resources without conflicts of interest which would have been carefully handled as suggested by the theory.

EMPIRICAL REVIEW

Several authors have dealt with Credit Risk Management and Financial Sustainability. However, none has ever related this topic to the deposit money banks listed in Nigeria. In this section of our study; we will be examining few of those related literatures.

Ali, Bojan and Roger (2018) focused on the determinants of financial performance of banks in Central and Eastern Europe. The paper used the Factor Analysis to Model Banking Risk theory developed Haan and Klamps (2012). The methodological approach was Panel Data Regression Analysis using Fixed Effect and Estimation models. He discovered that Assets Quality & Earnings are positively and significantly affected by business mix and the diversification of banks. It was concluded that banks size has a negative and significant impact on bank performance; that is only small banks in CEE countries benefit from economies of scale. Inflation is also seeing to have a positive impact on assets quality and earnings; whereas higher economic growth leads to higher capital adequacy and liquidity. The gap noted is that dependent variables in the first three years of each tables are omitted which may affect the results of the investigation.

Girma and Jigin (2018) investigated the effect of deposit mobilization on financial sustainability of rural savings and credit cooperatives with evidence from Ethiopia. The theories adopted in this paper are The Loanable Fund Theory, Life-Cycle Theory and Institutionalized Theory. The methodology adopted Panel Regression Estimates using balanced data of 166 rural savings and credit cooperatives. In the study, it was observed that deposit to loan ratio was very significant and positively related to financial sustainability. Inflation was also discovered to be significant and negatively related to operational self- sufficiency showing that Inflation negatively affects both the institution and its members. High inflation rates could diminish the capacity

of individuals to save by spending more of their incomes on consumption and reduces an Institution's ability to cover its costs. In conclusion, the primary motive of deposit mobilization lies in lower cost of capital compared to other resources. From the study, it was concluded that Interest rate spread, deposit to loan ratio, deposit to total assets, the volume of deposits, age of institution and inflation are vibrant in determining the financial sustainability of RUSACCO in Ethiopia. Among the few gaps noted are the years of study was limited to only three years which was considered too small to make a relevant conclusion. Also, it failed to discuss the entire story with respect to the financial structure such as shares mobilizing, retained earnings, etc.

Charles, Maryanne, and Willy (2015) examined the effects of deposit to assets ratio on the financial sustainability of deposit taking micro finance institutions in Kenya. Rosengard Theory of (2001) was adopted who defined financial sustainability as the development of products and delivery systems that meet clients' needs at prices that cover all costs of providing these financial services (Independent of external subsidies). Causal Relationship Research Design was adopted in trying to investigate the effect of capital structure on financial sustainability in Kenya. It was observed that Loan to Deposit had a significant relationship with MFI financial sustainability. In their conclusion; it was concluded that a higher proportionally higher deposit as a percentage of total assets is associated with improved financial sustainability; assuming that the deposit program is cost efficient. The study concentrated on MFI alone instead of total deposit money banks which have more economic influence than a small sample of the sector selected. Again, the theory's name was not indicated and defined apart from the founder's name. All these are noted gaps of the study.

Emeka and Nenubari (2019) examined the dynamics of capital adequacy and profitability of internationalized deposit money banks in Nigeria. In their methodology; Static & Dynamic Panel Analysis framework are adopted and divided to GLS and LSDV. Data for only International authorized banks are used. Fixed Effect Model & Random Effect Dynamic Models are adopted. The theory adopted follows the works of Arellano & Bond (1991), Arrellano – Bover (1995) and Blundell – Bond (1998) to estimate the dynamic of the impact of capital adequacy ratios on profitability of selected internationalized deposit money banks in Nigeria from 2005 – 2007. The results show that Assets Quality (Loan to Assets) is the main determinant of profitability (ROE) in the Nigeria DMBs in the short term. Bank size was noted to be positive and significant. The conclusion shows that the weakness of the management of the DMBs to handle short term fluctuations is the main cause of banks' failure. In addition, the harsh macroeconomics and financial environment in Nigeria overpowered the management of the banks. The profitability of DMBs in Nigeria is weak in the very short term due to the inability of the management to respond immediately to short term shocks. The study did not cover all deposit money banks in Nigeria but only those with international license. This is considered a major gap to the study because the scope and coverage are limited.

Jarel and Wambua (2018) investigated Effect of Capital Structure on Financial Sustainability of Deposit Taking Microfinance Institutions in Kenya. Multiple Regression Model using SPSS and R square as the data analysis tools for 10-years data. Correlation & Regression models were used in the methodology. Modigliani – Miller & Pecking Order Theories were adopted (States that firms' value is not affected by capital structure in a Perfect Capital Market – MM Proposition 1 – Without Taxes) while MM Proposition II – With Taxes showed that the value of an Institution is enhanced by the tax shield provided by the interest deduction. This is because the tax shield reduces the cost of debt. The Pecking Order theory states that firms have a specific preference order for capital structure in their firms (Myers, 1984); First is Retained Earnings, then issue debts if Retained earnings was exhausted. Finance through Issuing New Stock is normally a negative signal; not financially sustainable. The findings revealed positive relationship between debt and financial sustainability. A unit change in debt led to a change in financial sustainability. Debt has significant impact on financial sustainability of MFIs. Conceptual framework consists of Independent Vs Independent variables instead Independent Vs dependent. Concentration is again more on Capital Structure variables. These are the noted gaps in the study.

IV. SUMMARY OF GAPS IN LITERATURE

We have reviewed various literatures on the subject and gaps observed on them can be summarized as follows:

Majority of the studies concentrated on Microfinance or International authorized deposit money banks; we are not aware of any studies that have discussed the Credit Risk Management and Financial Sustainability of listed deposit money banks in Nigeria. The study of Charles, Maryanne, and Willy (2015) and Belayet, Muhammad, Qingfeng, and Syeda (2020) focused on only MFI. Emeka and Nenubari (2019) and Ngozi (2018) did not cover the whole sector but only internationalized DMBs.

Data shortages, missing data or too small observed variables is another gap which may affect the research findings and recommendations. Girma & Jigin (2018) used only three years for their study; Ali, Bojan and Roger (2018) omitted the first three years of each of the dependent variables which may affect the outcome of their investigations. Ahmad (2018) reviewed period was also considered too small while Peterson (2019) did

not report some countries NPL values in their study. Also related to the above gap is the sample selection issue which may be biased when the selection is not total enumeration or based on scientific sample selection techniques. Adebayo and Oluwaremi (2017) and Nwude and Okeke (2018) randomly selected five banks each for their samples. The sample size was considered too small out of twenty four banks and the selection may be biased.

V. METHODOLOGY

The study adopted an *Ex-post facto* research design. The sample size of 12 banks were purposively selected out of 14 listed in Nigeria as at December 31, 2019 based mainly on complete data for ten years period (2010 – 2019). The population of 14 banks accounted for 53.85% of banks in operation in Nigeria out of 26 banks. Both descriptive and inferential analyses were conducted on secondary data extracted from the financial reports of sampled banks.

Specification of Model

This study has three groups of variables; namely, Regressed / Dependent variables, Explanatory / Independent variables, and Control Variables. The regressed or dependent variable in this study is Financial Sustainability (FS) measured by Capital Adequacy Ratio (CAR) and Return on Capital Employed (ROCE) while the Independent variable in this study is the Credit Risk Management (CRM) measured by Loan to Deposit Ratio (LDR), Non-performing loan (NPL) and Assets Growth Ratio (AGR). The control variable is Bank Size (BS) only.

Thus,

$$Y = f(X, Z)$$

Y = Dependent Variable

X = Independent Variable

Z = Moderating Variable

Therefore, $Y = f(X, Z)$

$$Y = y_1, y_2,$$

$$X = x_1, x_2, x_3$$

$$Z = z_1$$

Where:

Y = Banks' Overall Financial Sustainability (FS)

y_1 = Capital Adequacy Ratio (CAR)

y_2 = Return on Capital Employed (ROCE)

X = Credit Risk Management (CRM)

x_1 = Loan/Deposit Ratio (LDR)

x_2 = Non-Performing Loan Ratio (NPL)

x_3 = Assets Growth Percentage (AGP)

Z = Moderating Variables

z_1 = Bank Size (BS)

Model 1

$$CAR = f(LDR, NPL, AGP)$$

$$CAR_{it} = \alpha_1 + \beta_1 LDR_{it} + \beta_2 NPL_{it} + \beta_3 AGP_{it} + \mu_1$$

Model 2

$$ROCE = f(LDR, NPL, AGP)$$

$$ROCE_{it} = \alpha_2 + \beta_4 LDR_{it} + \beta_5 NPL_{it} + \beta_6 AGP_{it} + \mu_2$$

Model 3

$$CAR = f(LDR, NPL, AGP)BS$$

$$CAR_{it} = \alpha_3 + \beta_7 LDR_{it} * BS_{it} + \beta_8 NPL_{it} * BS_{it} + \beta_9 AGP_{it} * BS_{it} + \mu_3$$

Model 4

$$ROCE = f(LDR, NPL, AGP)BS$$

$$ROCE_{it} = \alpha_4 + \beta_{10} LDR_{it} * BS_{it} + \beta_{11} NPL_{it} * BS_{it} + \beta_{12} AGP_{it} * BS_{it} + \mu_4$$

Where:

it represents banks i in year t .

$\alpha_1 - 4$ represent the intercepts

$\beta_1 - 12$ represent the coefficients

$\mu_1 - 4$ represent the error terms

VI. DATA ANALYSIS, RESULTS AND DISCUSSION OF FINDINGS

Descriptive Statistics – Credit Risk Management and Financial Sustainability

The study consists of yearly data for the period 2010-2019 for twelve banks listed in Nigeria. The descriptive statistics presented in table below are the mean, median, maximum, minimum and standard deviations and the numbers of observations for each of the dependent and independent variables. The dependent variable of this study, Financial Sustainability, was proxied by Capital Adequacy Ratio (CAR) and Return on Capital Employed (ROCE). The explanatory variable of this study, Credit Risk Management, was measured by Loan to Deposit Ratio (LDR), Non-Performing Loan Ratio (NPL) and Assets Growth Percentage (AGP) while Bank's Size (BS) was the moderating variable in the study.

Table 1.1: Descriptive Statistics of Credit Risk Management and Financial Sustainability

Variables	Mean	Std. Dev.	Minimum	Maximum	Obs
LDR	67.4333	28.5583	3.5504	294.1165	120
NPL	7.2862	11.3217	0	86.8521	120
AGP	15.6646	19.2754	-68.2337	102.405	120
CAR	10.68508	21.6147	-154.7496	28.2753	120
ROCE	1.6712	2.2498	-9.5318	9.5364	120
BS	9.1150	0.3991	8.1954	9.8541	120

Source: Researchers' computation with STATA 11 (2021)

Interpretation

CAR: The mean value of the Capital Adequacy Ratio (CAR) is 10.68, while the standard deviation is 21.61. Since the standard deviation measures the disparity of the individual CAR of all the sampled banks for the sampled periods from the mean value, 21.6 for a mean value of 10.7 therefore means that the level of volatility and deviation from the mean in the CAR of the selected banks for the selected period in this study is not so high. The minimum value of -154.75, indicates that some of the banks in some of the sampled period for this study had a negative capital adequacy ratio.

ROCE: The mean value of the Return on Capital Employed (ROCE) is 1.67, while the standard deviation is 2.2498. Since the standard deviation measures the disparity of the individual ROCE of all the sampled banks for the sampled periods from the mean value, 2.2498 for a mean value of 1.6712 therefore means that the level of volatility and deviation from the mean in the ROCE of the selected banks for the selected period in this study is not so high. The minimum value of -9.53, indicates that some of the banks in some of the sampled period for this study made losses.

Multicollinearity Test

In testing whether there is presence or absence of multicollinearity in the dataset utilized for this study, Variance Inflation Factor (VIF) test was conducted and the results presented in Table 1.2 respectively. Variance Inflation Factor test denotes the existence or otherwise of multicollinearity in a dataset without estimating the magnitude of the association among the variables.

Table 1.2 Multicollinearity Test

Variable	VIF	1/VIF
NPL	1.39	0.72
AGP	1.46	0.68
LDR	1.10	0.91
Mean VIF	= 1.317 Mean = 1.04	

Source: Researcher's Work (2021)

Interpretation

The result of the variance inflation factor is as shown in Table 1.2. According to Baltagi (2015), the benchmark for Mean of the Variance Inflation Factor is 5.0 while for the individual reverse factor is 1. Considering the reverse variance inflation factor of each of the variables all below the threshold of "1" with the average of the aggregate for all the periods being all less than the benchmark of 5.0; this confirmed the report of

the correlation matrix which indicated that multicollinearity problem does not exist among the variables of this study.

Testing of Hypotheses and Discussion of Findings

Table 1.3: Test of Hypothesis One

MODEL ONE				
RANDOM EFFECT WITH CLUSTER STD. ERR.				
Variable	Coeff	Std.Err	t-test	Prob
Constant	-6.124	5.9585	-1.03	0.304
LDR	0.165	0.0628	2.63	0.008
NPL	0.373	0.164	2.28	0.023
AGP	0.187	0.093	2.00	0.045
Adj. R ²	9.69%			
F-Stat	F = 13.66			
Probability of F-Stat	0.0034			
Hausman Test	chi ² ₍₃₎ = 2.599 (0.458)			
Breusch & Pagan LM Test	chi ² ₍₁₎ = 21.94 (0.000)			
Heteroskedasticity Test	chi ² ₍₁₎ = 146.85 (0.00)			
Serial Auto-Correlation Test	F _(1, 11) = 50.776 (0.000)			
Cross-sectional Independence Test	1.485 (0.1375)			

Dependent Variable: CAR

Source: Author’s Work (2021)

Interpretation

Diagnostic Tests

Hausman test was carried out for the model to determining the most appropriate estimation technique between Fixed Effect and Random Effect estimation techniques. The test was conducted at significance level of 5 per cent. The results of the test (p-value = 0.458), higher than the 5 per cent level of significance chosen for the study reveal that Random Effect is the most appropriate estimator according to its null hypothesis which states that there is presence of unsystematic difference in the model coefficients; thus, the study cannot reject the null hypothesis. A confirmatory test on the results of Hausman tests was conducted using the Breusch & Pagan LM Test. This was done to confirm whether the random effect is really the most appropriate estimation technique for this model. The null hypothesis for this test says that random effect is not the most appropriate estimation technique for the model. The test result (p-value = 0.00) is less than the 5 per cent level of significance which connotes that the null hypothesis of the test can be rejected hence, random effect is really the appropriate estimation technique for this model as suggested by the Hausman test.

Based on the results of the diagnostic tests carried out; the model was estimated using random effect with Cluster Standard Errors to rectify all the econometric issues inherent in the model.

$$CAR_{it} = \alpha_1 + \beta_1 LDR_{it} + \beta_2 NPL_{it} + \beta_3 AGP_{it} + \mu_1 \dots \dots \dots \text{Model 1}$$

$$CAR_{it} = -6.124 + 0.165LDR_{it} + 0.3734NPL_{it} + 0.187AGP_{it} + \mu_1 \dots \dots \dots \text{Model 1}$$

VII. FINDINGS

At 0.05 level of significance, the result of the regression estimate presented in Table 1.3 for model one evidenced that individually, Loan to Deposit Ratio (LDR) has significant positive effect on Capital Adequacy Ratio (CAR) (β = 0.165, ρ=0.008); which means a unit increase in LDR would result into 16.5% increase in CAR; likewise, Non-Performing Loan Ratio (NPL) has significant positive effect on Capital Adequacy Ratio (CAR) (β = 0.373, ρ=0.023); which means a unit increase in NPL would result into 37.3% increase in CAR, and finally Assets Growth Percentage (AGP) has a significant positive effect on Capital Adequacy Ratio (CAR) (β = 0.187, ρ=0.045); which means a unit increase in AGP would result into 18.7% increase in CAR. The explanatory powers of the independent variables reflect that the joint variations in the independent variables yield 9.69% variation in the CAR, while the remaining 90.31% changes in CAR is caused by other factors not captured in this model. The probability of the F-test (p-values of 0.0034) showed that credit risk management proxied in this study by Loan to Deposit Ratio (LDR), Non-Performing Loan Ratio (NPL) and Assets Growth Percentage (AGP) significantly affects Capital Adequacy Ratio (CAR) of deposit money banks listed in Nigeria.

Table 1.4: Test of Hypothesis Two

MODEL TWO				
FIXED EFFECT WITH ROBUST STD. ERR.				
Variable	Coeff	Std.Err	t-test	Prob
Constant	0.1687	0.7029	0.24	0.816
LDR	0.0094	0.0049	1.93	0.086
NPL	0.0825	0.0317	2.60	0.029
AGP	0.0169	0.0156	1.09	0.306
Adj. R ²	18.73%			
F-Stat	F= 2.73			
Probability of F-Stat	0.1063			
Hausman Test	chi ² ₍₃₎ = 8.41 (0.038)			
Testparm Test	chi ² ₍₁₎ = 2.51 (0.0126)			
Heteroskedasticity Test	chi ² ₍₁₎ = 1897.04 (0.00)			
Serial Auto-Correlation Test	F _(1, 11) = 4.367(0.0607)			
Cross-sectional Independence Test	6.540 (0.000)			

Dependent Variable: ROCE

Source: Author's Work (2021)

Interpretation

Diagnostic Tests

Hausman test was carried out for the model to determining the most appropriate estimation technique between Fixed Effect and Random Effect estimation techniques. The test was conducted at significance level of 0.05. The results of the test (p-value = 0.038), lower than the 5 per cent level of significance chosen for the study revealed that Fixed Effect is the most appropriate estimator according to its null hypothesis which states that there is presence of unsystematic difference in the model coefficients; thus, the study rejects the null hypothesis. A confirmatory test on the results of Hausman tests was conducted using the Testparm Test. This was done to confirm whether the fixed effect is really the most appropriate estimation technique for this model. The null hypothesis for this test says that fixed effect is not the most appropriate estimation technique for the model. The test result (p-value = 0.012) is less than the 5 per cent level of significance which connotes that the null hypothesis of the test can be rejected hence, fixed effect is really the appropriate estimation technique for this model as suggested by the Hausman test.

Based on the results of the diagnostic tests carried out; the model was estimated using fixed effect with robust standard errors to rectify the econometric issues of heteroskedasticity inherent in the model.

$$ROCE_{it} = \alpha_2 + \beta_4LDR_{it} + \beta_5NPL_{it} + \beta_6AGP_{it} + \mu_2 \dots \dots \dots \text{Model 2}$$

$$ROCE_{it} = 0.168 + 0.0094LDR_{it} + 0.0825NPL_{it} + 0.0169AGP_{it} + \mu_2 \dots \dots \dots \text{Model 2}$$

Findings

At 0.05 level of significance, the result of the regression estimate presented in Table 1.4 for model two evidenced that individually, Loan to Deposit Ratio (LDR) has positive but not significant effect on Return on Capital Employed (ROCE) ($\beta = 0.009$, $\rho=0.086$), likewise, Assets Growth Percentage (AGP) has positive but not significant effect on Return on Capital Employed (ROCE) ($\beta = 0.0169$, $\rho=0.306$), however, Non-Performing Loan Ratio (NPL) has a significant positive effect on Return on Capital Employed (ROCE) ($\beta = 0.0825$, $\rho=0.029$); which means a unit increase in NPL would result into 8.25% increase in ROCE. The explanatory powers of the independent variables reflect that the joint variations in the independent variables yield 18.73% variation in the ROCE, while the remaining 81.27% changes in ROCE is caused by other factors not captured in this model. The probability of the F-test (p-value of 0.1063) showed that credit risk management measured in this study by Loan to Deposit Ratio (LDR), Non-Performing Loan Ratio (NPL) and Assets Growth Percentage (AGP) does not significantly affect Return on Capital Employed (ROCE) of deposit money banks listed in Nigeria.

Table 1.5: Test of Hypothesis Three

MODEL THREE				
RANDOM EFFECT WITH ROBUST STD ERR.				
Variable	Coeff	Std.Err	t-test	Prob
Constant	-5.0323	5.8979	-0.85	0.393
LDR	0.0163	0.0066	2.46	0.014

NPL	0.0427	0.0191	2.24	0.025
AGP	0.0201	0.0106	1.89	0.059
Adj. R ²	8.14%			
F-Stat	F= 12.19			
Probability of F-Stat	0.0068			
Hausman Test	chi ² ₍₃₎ = 2.062 (0.5596)			
Breusch & Pagan LM Test	chi ² ₍₁₎ = 19.35 (0.000)			
Heteroskedasticity Test	chi ² ₍₁₎ = 153.06 (0.000)			
Serial Auto-Correlation Test	F _(1, 11) = 69.247(0.000)			
Cross-sectional Independence Test	1.855 (0.0636)			

Dependent Variable: CAR

Source: Author’s Work (2021)

Interpretation

Diagnostic Tests

Hausman test was carried out for the model to determining the most appropriate estimation technique between Fixed Effect and Random Effect estimation techniques. The test was conducted at significance level of 5 per cent. The results of the test (p-value = 0.5596), higher than the 5 per cent level of significance chosen for the study reveal that Random Effect is the most appropriate estimator according to its null hypothesis which states that there is presence of unsystematic difference in the model coefficients; thus, the study cannot reject the null hypothesis. A confirmatory test on the results of Hausman tests was conducted using the Breusch & Pagan LM Test. This was done to confirm whether the random effect is really the most appropriate estimation technique for this model. The null hypothesis for this test says that random effect is not the most appropriate estimation technique for the model. The test result (p-value = 0.00) is less than the 5 per cent level of significance which connotes that the null hypothesis of the test can be rejected hence, random effect is really the appropriate estimation technique for this model as suggested by the Hausman test.

Based on the results of the diagnostic tests carried out; the model was estimated using random effect with robust standard error.

$$CAR_{it} = \alpha_3 + \beta_{13}LDR_{it} \cdot BS_{it} + \beta_{14}NPL_{it} \cdot BS_{it} + \beta_{15}AGP_{it} \cdot BS_{it} + \mu_3 \dots\dots\dots \text{Model 3}$$

$$CAR_{it} = -5.0323 + 0.016LDR_{it} \cdot BS_{it} + 0.043NPL_{it} \cdot BS_{it} + 0.02AGP_{it} \cdot BS_{it} + \mu_3 \dots\dots\dots \text{Model 3}$$

Findings

At 0.05 level of significance, the result of the regression estimate presented in Table 1.5 for model three evidenced that individually, Loan to Deposit Ratio (LDR) has significant positive effect on Capital Adequacy Ratio (CAR) (β = 0.0163, ρ=0.014, t = 2.46); which means a unit increase in LDR would result into 1.63% increase in CAR; likewise, Non-Performing Loan Ratio (NPL) has significant positive effect on Capital Adequacy Ratio (CAR) (β = 0.0427, ρ=0.025, t = 2.24); which means a unit increase in NPL would result into 4.3% increase in CAR, and finally, Assets Growth Percentage (AGP) has a positive insignificant effect on Capital Adequacy Ratio (CAR) (β = 0.0201, ρ=0.059, t = 1.89); because its ρ=0.059 was greater than 5% level of significance use in this study. The explanatory powers of the independent variables reflect that the joint variations in the independent variables yielded 8.14% variation in the CAR, while the remaining 91.86% changes in CAR was caused by other factors not captured in this model. The probability of the F-test (p-values of 0.007) showed that credit risk management moderated by Bank Size (BS) measured in this study by Loan to Deposit Ratio (LDR), Non-Performing Loan Ratio (NPL) and Assets Growth Percentage (AGP) significantly affects Capital Adequacy Ratio (CAR) of deposit money banks listed in Nigeria.; *p < 0.05*.

Effect of Moderating Variable

Effect of the moderating variable of Bank Size (BS) on the Credit risk management has not enhanced the relationship as anticipated as evidenced from the findings. It has changed the level of increase of Capital Adequacy Return (CAR) as a result of a unit increase in Loan to Deposit (LDR) and Non-Performing Loan (NPL) from 16.5% and 37.34% to 1.6% and 4.3% respectively while Assets Growth Percentage has moved from significantly positive in Model 1 without moderating value to insignificantly positive in this model with moderating variable of Bank Size. Also, the constant value of model 1 has slightly improved from -6.124 to -5.0323 as a result of moderating variable. Though the result was in agreement with the theories and some literatures as detailed discussed in model 1 but not as strong or concrete as expected. Finally, both models 1 & 3, with & without moderating variables, decided that their null hypotheses should be rejected because all the proxies of Credit Risk Management as showed by the probabilities of F- tests are significant; *p < 0.05*.

Table 1.6: Test of Hypothesis Four

MODEL FOUR				
RANDOM EFFECT ESTIMATION				
Variable	Coeff	Std.Err	t-test	Prob
Constant	0.2128	0.5943	0.36	0.720
LDR	0.0009	0.0007	1.52	0.128
NPL	0.0086	0.0018	4.56	0.000
AGP	0.0019	0.0011	1.86	0.063
Adj. R ²	17.79%			
F-Stat	F = 22.88			
Probability of F-Stat	0.0000			
Hausman Test	chi ² ₍₅₎ = 5.505 (0.1383)			
Breusch & Pagan LM Test	chi ² ₍₁₎ = 37.39 (0.000)			
Heteroskedasticity Test	chi ² ₍₁₎ = 4.215(0.0646)			
Serial Auto-Correlation Test	F _(1, 11) = 69.247(0.000)			
Cross-sectional Independence Test	6.430 (0.000)			

Dependent Variable: ROCE

Source: Author’s Work (2021)

Interpretation

Diagnostic Tests

Hausman test was carried out for the model to determining the most appropriate estimation technique between Fixed Effect and Random Effect estimation techniques. The test was conducted at significance level of 0.05. The results of the test (p-value = 0.1383), higher than the 5 per cent level of significance chosen for the study reveal that Random Effect is the most appropriate estimator according to its null hypothesis which states that there is presence of unsystematic difference in the model coefficients; thus, the study cannot reject the null hypothesis. A confirmatory test on the results of Hausman tests was conducted using the Breusch & Pagan LM Test. This was done to confirm whether the random effect is really the most appropriate estimation technique for this model. The null hypothesis for this test says that random effect is not the most appropriate estimation technique for the model. The test result (p-value = 0.00) is less than the 5 per cent level of significance which connotes that the null hypothesis of the test can be rejected hence, random effect is really the appropriate estimation technique for this model as suggested by the Hausman test. Based on the results of the diagnostic tests carried out; the model was estimated using random effect with robust standard error.

$$ROCE_{it} = \alpha_4 + \beta_{16}LDR_{it} * BS_{it} + \beta_{17}NPL_{it} * BS_{it} + \beta_{18}AGP_{it} * BS_{it} + \mu_4 \dots \dots \dots \text{Model 4}$$

$$ROCE_{it} = 0.2128 + 0.0009LDR_{it} * BS_{it} + 0.009NPL_{it} * BS_{it} + 0.002AGP_{it} * BS_{it} + \mu_4 \dots \dots \dots \text{Model 4}$$

Findings

At 0.05 level of significance, the result of the regression estimate presented in Table 1.6 for model four evidenced that individually, only Non-Performing Loan Ratio (NPL) has a significant positive effect on Return on Capital Employed (ROCE) (β = 0.0086, ρ=0.000); which means a unit increase in NPL would result into 0.9% increase in ROCE. The other two proxies of credit risk management in this study, Loan to Deposit Ratio (LDR) and Assets Growth Percentage (AGP) have insignificant positive effect on ROCE (β = 0.0009, ρ=0.128 and β = 0.0019, ρ=0.063 respectively).

The explanatory powers of the independent variables reflect that the joint variations in the independent variables yield 17.79% variation in the ROCE, while the remaining 82.21% changes in ROCE is caused by other factors not captured in this model. The probability of the F-test (p-values of 0.000) showed that credit risk management moderated by Bank Size (BS) measured and proxied in this study by Loan to Deposit Ratio (LDR), Non-Performing Loan Ratio (NPL) and Assets Growth Percentage (AGP) significantly affects Return on Capital Employed (ROCE) of deposit money banks listed in Nigeria.

Effect of Moderating Variable

Effect of moderating variable of Bank Size (BS) in this model has enhanced the relationship between Credit risk management and financial sustainability of ROCE. Therefore, the decision has been affected and changed from accept null hypothesis in model 2 to reject the null hypothesis. This was evidenced by change in Probability of F-Stat from 0.1063 to 0.0000 from model 2 to 6 respectively. Also, as a result of moderating variable, the increase in ROCE as a result of increase in the proxies of credit risk management have changed from 0.9%, 8.25% and 1.69% in model 2 to 0.09%, 0.9% and 0.2% for LDR, NPL and AGP respectively in this

model. The model's constant has also improved from 16.8% in Model 2 to 21.28%. This position is in agreement with the discussed findings and positions of various literatures in model 2.

Implication of the Findings

From the detailed analysis carried out and its findings thereafter, the study means a lot and has implication on the policy and bank regulators (CBN, NDIC & SEC), deposit money banks listed in Nigeria and its stakeholders (investors, management and customers), analysts and academia.

For policy and regulatory authorities; the findings have shown that credit risk management is significant to the adequate capital requirement and banks sustainability. It is therefore necessary that adequate minimum capital requirement that makes provision for all inherent banking risks should be benched mark for issuing any license for banks operation. Efforts should also be made to ensure no bank goes below the minimum CAR while still in operation. This can be achieved by enhanced monitoring and supervisions.

For banks listed in Nigeria and its stakeholders; the study has shown that return on capital employed which covers the interest of all stakeholders is affected by credit risk management when it is moderated by Bank Size. As banks become big and major players, for the purpose of sustainability; they should be more focused on credit risk management and its related functions. Central Bank of Nigeria has mandated all deposit money banks in Nigeria to place the head of risk management at the level of at least Executive Director.

VIII. CONCLUSION, RECOMMENDATIONS AND CONTRIBUTION TO KNOWLEDGE

Conclusion

The study examined the effect of credit risk management on financial sustainability of deposit money banks listed in Nigeria from 2010 to 2019. Financial sustainability as a dependent variable was measured by Capital Adequacy Ratio (CAR) and Return on Capital Employed (ROCE) while the Credit risk management as Independent variable was proxied by LDR, NPL and AGP which were moderated by Bank Size (BS). In conclusion, the *a priori* expectations were confirmed with the actual findings to be positive and credit risk management has significant effect on CAR while the insignificant effect on ROCE became significant after being moderated by Bank Size.

Recommendations

The study recommended, in line with its finding results, that all stakeholders including regulators, investors, management and analysts should be more focused on credit risk management functions and responsibilities. Adequate capital requirement than covers all anticipated inherent risks should be set as minimum before banks were given operating licenses. Management should be equipped with right skills and experience and the function should be handled by at least executive management as stipulated by regulators. Board members experience should be robust on credit risk management while adequate trainings should be made available to all staff of deposit money banks. All these, if properly applied will improve return on capital employed.

Contribution to Knowledge

The study has contributed to the research work on accounting on credit risk management related topics and sustainability. The study is available as a reference on effect of credit risk management on financial sustainability of deposit money banks in Nigeria. Those who wish to undertake further research on Credit risk management and implication on banks' financial sustainability or other related topics would have additional literature to review on as this study would also be an added literature on banks' financial sustainability in Nigeria.

Finally, this study will assist the regulators in policy formulation. The study has recommended risk based approach for capital requirement determination. Risks should for form critical input in determining DMBs' capital requirements. The study has also recommended that special attention should be given to big banks by the regulators.

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