Analysis of Credit Risk, Intellectual Capital and Financial Performance of Listed Deposit Money Banks in Nigeria[1]

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Abstract: This paper examined the effects of credit risk, intellectual capital as well as credit risk moderated by intellectual capital on financial performance of fifteen listed deposit money banks in Nigeria (DMBs) from 2007 to 2016. Data were sourced from annual reports of banks and Nigerian National Bureau of Statistics and analysed using Generalised Method of Moments (GMM). The study finds that credit risk index by loan loss ratio negatively affects financial performance of the sampled banks; while capital employed efficiency, loan loss provision moderated by intellectual capital, capital adequacy ratio, income and diversification have positive relationship with banks' financial performance. Thus, the study recommends that banks should strengthen their credit risk management culture to ensure prompt repayment of loans. The banks should operate within the required capital adequacy ratio to serve as buffer against loan loss provisions provided by the Central Bank of Nigeria. A strong credit risk management culture should be embedded within intellectual capital structure of banks, where all persons at all levels appreciate and understand the banks' risk management policies as well as strategies and incorporate same into decision-making and business processes.

Keywords: Credit risk, Intellectual Capital, Financial Performance, Deposit Money Banks, GMM, Nigeria.

JEL Classification: G32, 034, G21, C33.

Introduction

The banking crisis of the 1990s as well as glaring weaknesses of Basel I accord made the Basel Committee on Banking Supervision (BCBS) to propose Basel II in 1998, which recognised both market, operational and credit risks with the aim of supporting stronger credit risk management practices. Initially published in June 2004, its full implementation in 2008 across major economies was distracted by the 2007-2008 World financial crisis, the worst crisis since the great depression that began in the early 1920s (Stiglitz, 2019) and climaxed in 1929 when the stock market in United States of America collapsed and banks failed.

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1. This paper is extracted from my PhD thesis.

The 2007-2008 financial crisis had shown that Basel II was not enough in dealing with the complicated challenges. At the beginning of the crisis, most Banks were found to have too much leverage and insufficient liquidity buffers as well as poor structure thereby leading to credit and liquidity risk. This led to an agreement on Basel III by the Basel committee members in November, 2010, with the ultimate objective of promoting leverage, capital, funding and liquidity. However, its full implementation, initially due for 2013 was changed to 2015, moved again to March 31, 2019 and now slated for January 1, 2022.

The impact of global financial crisis of 2008 alerted both the government and businesses in Nigeria on the importance of sound credit risk management practices. According to Sanusi (2011), the eventual high magnitude level of Non-Performing Loans (NPLs) in banks was caused by poor corporate governance practices, non-adherence to credit risk management practices and lack of attention to changes in macroeconomic factors like interest rates and inflation rates.

In order to improve on the framework for credit risk management, Nigeria, partly adopted Basel I accord and subsequently Basel II and Basel III accords, to strengthen the capital adequacy of banks, thereby mitigating credit risks, minimise the impact of unpredictable financial losses on banks as well as potential systemic crisis.

As part of its banking industry reforms, the CBN reviewed the universal banking model which permitted banks to act as financial supermarkets. However, the implementation of the universal banking model was characterised by inadequate capital and capacity to manage the wide range of businesses and products, excessive risk appetite and exposure particularly to affiliate transactions (contagion risk), weak group corporate governance, complexity and opaque structures and processes as well as inadequate regulatory/supervisory capacity.

The new banking model which was aimed at addressing these weaknesses, categorised deposit money banks (DMBs) licensed to operate as regional, national or international, with their minimum capital requirements specified as N10 billion, N25 billion and N50 billion respectively. For the purpose of risk-based supervision, CBN classified DMBs into three: large, medium and small, with assets of N1 trillion and above, N501 billion to N999 billion as well as N500 billion and below respectively. Large banks, typically have foreign jurisdictions with branches off-shore as well as subsidiaries. Due to their importance to the economy in terms of the amount of capital, asset base, branch network, staff strength among others, they are classified as 'too big to

fail' or 'systemically important' with a minimum capital adequacy ratio (CAR) requirement of 16%, while the medium and small banks are required to have minimum CAR of 10%. However, the maximum limit of NPLs ratio is 5% across all categories of DMBs in Nigeria.

The rapid technological change, growing financial engineering and innovations and increasingly sophisticated customers have shifted the base of competition for many businesses away from traditional physical and financial resources to the intellectual capital (IC) of organisations. The IC, such as knowledge, experience, processes and people, have become the core means of present and future wealth (Steward, 1997; and Petty & Guthrie, 2000). Consequently, businesses began to embrace formalised approaches to manage and measure IC, with the underlying benefits of doing so including improved growth in businesses, enhanced financial performance as well as more effective strategic planning, leading to enhanced productivity. The intellectual capital, all things been equal, can determine the success or otherwise of an organisation compared to its competitors (El-Bannany, 2008).

The success of credit risk management of banks depends in large part on the skill, knowledge, imaginative mind and professional experience of the bank employees in terms of proper identification and analysis of any possible threats to loans as well as mitigation and articulation of optimal credit administration strategies to avoid the loans getting bad with attendant consequences of provision and negative impact on CAR. On the other hand, structural capital comprising information systems, databases, copyrights and patents support human resources to produce new and better products and services to attract new customers and retain existing ones through relational capital (RC), to enable enhanced financial performance.

Moreover, various studies such as: Sampagnaro *et al.,* (2015) and Fiordelisi *et al.,* (2013) revealed that a bank can optimally compete by building effective and efficient bond with their customers as well as having stronger investments in soft information. On the other hand, Goh (2005) and Kamath (2007; 2015) observed that effective utilisation of IC is very valuable in attaining efficiency in banking. This underscores the imperative for efficient and effective management of IC by banks. However, effective and efficient credit risk management as well as customer relations by banks may only be possible when employees possess requisite knowledge and experience. Structural capital, human capital and relational capital are vital elements of IC and important in the process of credit risk management in banks. In addition, Kamath (2007), argued that

the banking sector is ideal for IC research due in part, to availability of reliable data and the nature of banking business which is intellectually intensive. Also, banking staff are intellectually more homogeneous than staff in other sectors as argued by Kubo and Saka (2002).

Banks' financial performance can be evaluated based on either its financial ratios, CAMELS (Capital, Asset Quality, Management, Earnings, Liquidity and Sensitivity), parametric and non-parametric models (Stochastic Frontier analysis and Data Envelopment analysis) or Skandia's Navigator, Intangible Assets Monitor, Balanced Scorecard, Value-Added Intellectual Coefficient (VAIC), among others. Of course, none of them can alone give enough information about the financial status of a bank or its financial performance. They are however, important financial indicators that guide investors and managers while making policies and crafting strategies for their organisations.

Divergent results have been obtained from studies on how credit risk management affects financial performance. The mixed results were obtained even where the same proxy for financial performance were used (see: Bertin, Moya & Perales, 2014; Yijun Zou, 2014; Menicucci & Paolucci, 2016; Ara *et al.* 2009; Lalon, 2015; Muriithi, 2016; Boahene, Samuel & Agye, 2012; Kwabena, 2014; and Musa, 2015). This lack of convergence implies that there is no consensus on the relationship between credit risk and financial performance.

In Nigeria, Ajayi and Ajayi (2017), Musa (2015), Marshal and Onyekachi (2014), Taiwo and Abayomi (2013), Oluwafemi *et al.* (2013), Ogboi and Unuafe (2013), Kolapo, Kolade and Ojo (2012), Owojori *et al.* (2011) and Kargi (2011) assessed the response of financial performance of Nigerian banks to credit risk. The common credit risk variables used in these studies include loan loss provision ratio, non-performing loan ratio and ratio of loans & advances, control variables like capital adequacy ratio (CAR), size and diversification. Ordinary Least Square (OLS) and generalised least square (GLS) estimation methods were used in most of these studies. However, these studies, did not consider other important variables such as efficiency ratio, inflation rate risk and GDP growth. Methodologically, these studies were deficient as despite the dynamic nature of banks' financial performance dynamic model was not applied. None of these studies considered the moderating effects of intellectual capital on credit risk and financial performance of banks despite the increasing importance of intellectual capital in the banking industry.

This study differs from previous Nigerian studies, by using GMM in recognition of the dynamic nature of events in the banking sector, so as to

examine the effect of immediate past financial performance on the current period. It is assumed that current period's financial performance is affected by information from the past period. Several studies employed GMM to identify factors that influence profitability of banks, such as Athanasoglou, Brissimis and Delis (2008) GMM Greece, Liu and Wilson (2010) for Japan and Dietrich and Wanzanried (2011) for Switzerland.

The study examined the effects of credit risk, intellectual capital as well as credit risk moderated by intellectual capital on financial performance of fifteen listed deposit money banks in Nigeria. The study also assess the effect of other banking industry indicators and some macroeconomic variables on the financial performance of listed banks in Nigeria using GMM.

The paper is as follows: following this introduction is section 2 which reviews literature and theoretical framework, section 3 is data and methodology, section 4 contains results interpretation, while Section 5 is conclusion and recommendations.

Literature Review and Conceptualisation

Credit Risk Management

Credit risk denotes a situation where a borrower is unable or unwilling to comply with a contractual obligation as at when due (Bessis, 2002; and Colquitt, 2007). Credit risk indicates the inability of a bank to receive due obligations in form of principal and interest from loans, guarantees or other commitments. Conford and Coyle (2000), defined credit risk as the possibility of depletion or outright loss from projected return on an investment. Although, credit risk in a bank may not be completely eliminated, it can be mitigated with a sound and well-articulated credit risk management policies. The board of directors of a bank are responsible for developing their credit risk policy which is to be aligned with their overall business strategy.

Banks mitigate credit risk through efficient credit risk management that involves a holistic credit risk analysis of the loans, security arrangement, loan portfolio diversification, pricing, repayment capacity and monitoring (Afriyie & Akotey, 2013). Effective credit risk management by banks is underscored by the underlying importance of mitigating and or minimizing credit risks as well as its negative impact on financial performance.

According to Nijskens & Wagner (2011), credit risk management requires risk identification, measurement, mitigations, monitoring and controlling of

credit risks. Risk based supervision by central banks have played significant role in minimizing credit risk, especially NPLs and also ensuring sufficient capital adequacy.

An important aspect of risk management is enterprise risk management (ERM). This has gained more prominence globally after the 2007-2008 global financial crisis. Most rating agencies such as Moody, Fitch and Standard and Poor (S&P's) use ERM as one of the main parameters for the assessment, measurement and control of various risk levels of financial institutions. In Nigeria, Augusto & Co, Datapro and GCR (global rating), have been licensed by the CBN to provide credit rating services for DMBs.

Intellectual Capital (IC)

Although the increasing importance of IC in the global economy has attracted the attention of researchers, it has no universal definition. IC is defined as "non-financial assets of a company that are not reflected in the balance sheet" (Frykman and Tolleryd, 2010). Similarly, Martinez and Garcia-Meca (2005) view IC as "the knowledge, information, intellectual property and experience that can be put to use to create capital". Stewart & Zadunaisky (1998), defined IC as the knowledge, information and intellectual property which has an impact on firm's wealth. Edvinsson and Malone (1997), defined IC as the value of organisational experience which is embedded in an organisation's process, course of actions, systems and corporate structures.

The value added intellectual coefficient (VAIC) is a method used to measure the value creation efficiency of a company by using its accounting-based figures (Pulic, 2000a). Companies with higher VAIC represent higher value creation in utilising available resources like IC and physical capital. Employees' expenses, according to Pulic (2000b), should be seen as investments rather than costs, as the knowledge held by these employees are the main source of value creation. The VAIC was employed to assess the effects of intellectual capital efficiency (ICE) on the financial performance of banks and non-banks (Chen *et al.*, 2005). VAIC is basically an improved version of earlier IC financial measurement models (Skandia's Navigator, Balanced Scorecard and Intangible Assets Monitor). As a measure of intellectual capital, VAIC has several advantages as compared to other measures. It provides a standardised and consistent basis of measurement and computation of VAIC, based on audited financial statements which is authentic and verifiable (Pulic, 2000a). It produces quantifiable, objective and quantitative measurements without subjectivism.

Even though IC is essentially intangible in nature, it is an important strategic asset with capacity for generating superior and more potent value thereby leading to enhanced financial performance (Barney, 1991). IC consists mainly of three parts: structural capital (SC), human capital (HC) and relational capital (RC). The HC is the combined knowledge as well as capabilities of the company's individual employees. SC represents the knowledge embedded in technology, software, databases and structure. The SC consist of the structures that employees develop and put in place to allow for optimal productivity as well as innovation, while RC constitutes the knowledge entrenched in an organisation's relationship with customers (Edvinsson & Malone, 1997; and Bontis, 1998).

Financial Performance of Banks

The assessment of financial performance of banks was extensively studied over several years (Maghyereh & Awartani, 2014). Researchers have used different methods towards measuring the financial performance of banks such as financial ratios (Poudel, 2012; Oluwafemi *et al.*, 2013; and Alzorqan, 2014); Capital, Asset quality, Management, Earnings, Liquidity and Sensitivity (CAMELS) analysis (Rozzani & Rahman 2013; Soltani et al, 2013); the parametric techniques via Stochastic Frontier Analysis (SFA) (Fan & Shaffer, 2004) and the non-parametric techniques via Data Envelopment Analysis (DEA) (Kao *et al.*, 2011; Fernando & Nimal, 2014; and Maghyereh & Awartani, 2014). The financial ratios have been used as a measure of financial performance of banks in a large number of research studies (Naceur & Kandil, 2009; and Alzorqan, 2014). The most common ratios used are Net Interest Margin (NIM), Return on Assets (ROA) and Return on Equity (ROE), (Ariffin & Kassim, 2011; Aebi, Sabato & Schmid, 2012; and Oluwafemi *et al.*, 2013).

However, in this study ROA was used as a measure of financial performance largely due to availability of data. Moreover, the ROA indicates the level of net income generated by the bank and also determines how the assets utilized by banks generate profit over the years. The ranking of banks is usually based on the ROA ratio and total assets. As a general view, particularly in banking sector, ROA is known as good profitability multiplier because equity multiplier does not influence it (Saeed & Zahid, 2016).

Theoretical Literature

Credit risk management is often analysed within the context of information asymmetry theory. Twin problems of adverse selection (risk assessment/

screening) and moral hazard (monitoring) are critical in credit risk management. They usually impact on the credit risk ratios and thus affect the financial performance of banks. The relationship between IC and credit risk can be captured by the agency theory - managers may maximize their own utility instead of enhancing shareholder value due to information asymmetry between the principals and agents. This creates agency conflicts and costs that affect financial performance of banks.

Modern Portfolio theory can be applied to explain the problem of credit concentration risk that can adversely impact on financial performance of banks. The efficiency and effectiveness of banks' IC assets influences their financial performance. The resource-based theory reveals that intangible assets are central to the understanding of competitive advantage of organisations since they cannot easily be acquired or imitated, contrary to tangible assets. This theory emphasises the significance of IC in improving the financial performance of banks. Thus, the asymmetric performances between heterogeneous companies are very much likely driven by intangible strategic assets. In Signalling theory, voluntary corporate disclosure serves the purpose of informing investors and analysts about the firm's value and quality thereby getting assured of cogent and potentially sustainable financial performance of banks.

Therefore, this study would be based on the information asymmetry theory (Akerlof, 1970; Spence; 1973; Rothschild and Stiglitz, 1976; Mirrlees, 1999; Holmström, 1979; Grossman and Hart, 1983), Agency theory (Jensen and Meckling, 1976; Sappington, 1991; Hart, 1995), Modern Portfolio theory (Markowitz, 1952; Tobin, 1958; Sharpe, 1964) and Resourced based theory (Wernerfelt, 1984; Barney, 1991).

Empirical Literature

Several studies have analysed how credit risk management affects financial performance of banks from different perspectives. Some studies observed inverse relationship between credit risk and banks' financial performance (see: Menicucci & Paolucci, 2016; Tan, 2013; Al Karim *et al.*, 2013; Lalon, 2015; Muteti, 2014; Awoke, 2014; Bizuayehu, 2015; Taiwo & Abayomi, 2013; Oluwafemi *et al.*, 2013; Muriithi *et al.*, 2016; and Ajayi & Ajayi, 2017), others found positive relationship (see: Boahene, Samuel & Agye, 2012; Kwabena, 2014; Ogboi & Unuafe, 2013; Marshal & Onyekachi, 2014; Musa, 2015; and Osuka & Amako, 2015).

Since IC is an asset of a bank, its increase should raise the value of the bank as well. Yet empirical studies have yielded mixed results on the relationship

between IC and financial performance of banks. For instance, Tiwari and Vidyarthi (2018), examined the impact of IC on corporate performance of 39 Indian listed banks from 1999 to 2015. Panel fixed effects technique was used and findings provided evidence of positive association between IC and financial performance of banks. However, only HC and SC have shown instances of statistically significant, positive linkage with banks' financial performance. The result also has indicated that the ICE of private sector banks are better than public sector banks.

Ajayi and Ajayi (2017) observed the response of financial performance to credit risk management of eight (8) DMBs in Nigeria from 2001-2015. Using panel regression for the study, Profit after tax (PAT) was employed as indicator for bank performance, while loan loss provision ratio (LLPR), non-performing loan ratio (NPLR), cost per loan ratio (CPLR) and loan to total asset ratio (LTAR) served as measures of credit risk management. The result of GLS fixed effect (FE) regression revealed that banks' profitability was negative but is not statistically influenced by NPLR, LLPR, CPLR and LTAR. The study concluded that Nigerian DMBs were characterised by high rate of NPLs consistent with the high growth rates of loans and advances.

Nawaz and Haniffa (2017), empirically examined the effect of IC on financial performance of 64 Islamic financial institutions (IFIs) operating in Asia, Europe and the Middle-East from 2007 to 2011, while controlling for firm-specific variables. The VAIC methodology was applied to examine the effect of IC on financial performance and the POLS regression results indicate that VAIC is directly associated with accounting performance indexed as ROA.

Nadeem, Gan and Nguyen (2017), examined the dynamic relationship between IC and financial performance of 6,045 public listed firms in Brazil, Russia, India, China and South African (BRICS) from 2005 to 2014. The GMM results revealed that IC (human, structural and physical) is positively related to ROA.

Muriithi *et al.*, (2016) explored the impact of credit risk on 43 commercial banks' financial performance in Kenya from 2005 to 2014. Panel data techniques of random effects (RE), FE estimations and GMM were applied for the study and the findings indicate that market, liquidity, credit, and operational risks negatively affect return of equity (ROE).

Meles, Porzio, Sampagnaro, and Verdoliva (2016), examined the impact of ICE on performance of 5,749 commercial Banks in the United States of America

from 2005 to 2012. Results found that IC directly affects banks' financial performance. Furthermore, Human Capital component of intellectual capital appeared to have larger effect compared to other components on the financial performance.

Bertin, Moya and Perales (2014), evaluated the determinants of bank performance in Latin America. Using the panel data system estimator version of the GMM and two-stage least squares method, the study conducted on 78 commercial banks from 1995 to 2010 observed that financial performance is directly related to banks' specific factors (size, service diversification, capital ratio) as well as macroeconomic factors (inflation, economic growth and bank concentration). The study revealed that financial performance is inversely associated with liquidity risk, credit risk and operational inefficiencies.

Yijun Zou (2014), examined profitability of 47 commercial banks in relation to their credit risk management in Europe from 2007 to 2012. The OLS regression results indicated that profitability of commercial banks is directly related credit risk management. Unlike CAR, NPLR as a proxy for credit risk management significantly 2effect both ROE and ROA as measures of financial performance.

Oluwafemi, *et al.* (2013), examined the relationship between risk management and financial performance of banks in Nigeria. The study conducted on 10 banks employed panel data estimation technique and obtained data from financial statement and annual report for 4 consecutive years. The paper found that risk management affect financial performance of banks, where doubtful loans and capital asset ratio were indirectly and directly related to financial performance respectively.

Tan (2013), examined the relationship between performance and competitive condition of 101 Chinese banks from 2003-2009. The GMM regression results revealed that Bank size, NPLR, taxation, liquidity risk, capitalisation, cost efficiency, labour productivity, banking sector development, stock market development, stock market volatility, inflation, GDP growth and money market rate, significantly affected Bank performance (ROA).

In general, Al-Tamimi (2010) classified the financial performance determining factors into two: bank-specific (also refer to as internal) and macroeconomic (external) factors. The internal (micro) factors are features that influence performance of individual bank. They are variables that are affected by the internal decisions of the bank. The external variables are industry-wide

Table 1: Data Sources and Measurement

Variables	Acronym	Description	Source	Measurement	A Priori Expectation
Financial Performance	ROA	Return on Assets	Annual report of banks	Annual profit before interest & tax to total assets as used by Tan and Floros (2012), Bertin, Moya & Perales (2014); Lalon (2015), Menicucci and Paolucci (2016)	
Credit Risk	NPL	Non-performing loans ratio	Annual report of banks	Annual non-performing loans to total loan as used by Tan and Floros (2012), Boahene, Samuel & Agye (2012), Bertin, Moya & Perales, (2014), Menicucci and Paolucci (2016), Sobhy and Megeid (2017), Ajayi & Ajayi (2017)	-
	LLP	Loan Loss Provision ratio	Annual report of banks	Annual loan loss provision to total loans as used by Tan (2013), Kwabena (2014), Lalon (2015), Ishtiaq (2015), Ajayi & Ajayi (2017)	-
	LOR	Loan ratio	Annual report of banks	Annual total loans to total assets as used by Tan and Floros (2012), Tan (2013), Menicucci and Paolucci (2016), Sobhy and Megeid (2017), Ajayi & Ajayi (2017)	+
	CLR	Cost per loan ratio	Annual report of banks	Annual total operating cost to total loans as used by Awoke (2014), Ajayi & Ajayi (2017)	-
Intellectual Capital Efficiency	HCE	Human Capital Efficiency	Annual report of banks	Annual value added to human capital as used by Carrington (2013), Purohit and Tandon (2015), Berzkalne and Zelgalve (2014), Ghosh and Maji (2014), Meles, Porzio, Sampagnaro and Verdoliva (2016)	+
	SCE	Structural Capital Efficiency	Annual report of banks	Annual structural capital to value added as used by Carrington (2013), Berzkalne and Zelgalve (2014), Purohit and Tandon (2015), Ghosh and Maji (2014), Meles, Porzio, Sampagnaro, and Verdoliva (2016)	+
	CEE	Capital Employed Efficiency	Annual report of banks	Annual value added to capital employed as used by Carrington (2013), Berzkalne and Zelgalve (2014), Purohit and Tandon (2015), Meles, Porzio, Sampagnaro and Verdoliva (2016)	+
Moderator	VAIC	Value added intellectual coefficient	Annual report of banks	Annual sum of Human Capital Efficiency, Structural Capital Efficiency and Capital Employed Efficiency as used by Carrington (2013), Berzkalne and Zelgalve (2014), Purohit and Tandon (2015), Meles, Porzio, Sampagnaro, and Verdoliva (2016)	+
Control Variables	CAR	Operational risk (CAR)	Annual report of Banks	Annual total equity to total assets as used by Tan and Floros (2012), Tan (2013), Goddard et al., (2008), Bertin, Moya & Perales (2014), Lalon (2015), Menicucci and Paolucci (2016)	+
	BAS	Bank size	Annual report of banks	Log of annual total assets of the bank as used by Tan and Floros (2012), Boahene, Samuel & Agye (2012), Ishtiaq (2015), Menicucci and Paolucci (2016)	+
	EFR	Efficiency ratio	Annual report of banks	Annual total expenses to total assets as used by Tan and Floros (2012), Tan (2013)	+
	DIV	Diversification	Annual report of banks	Annual non-interest income to total assets as used by Bertin, Moya & Perales (2014).	+
	INF	Inflation Rate Risk	NBS	Annual inflation rate as used by Tan (2013) and Lake (2013)	-
	GDP	GDP growth	NBS	Annual GDP growth rate as used by Tan (2013) and Lake (2013)	+

Source: compiled by the author, 2019.

(Banking sector development, Stock market development and Stock market volatility) or country-wide factors (like Inflation rate risk, foreign exchange risk, interest rate risk and Growth Domestic Product), which are beyond the control of the bank and affect their financial performance.

In summary, there are three basic determinants of banks' financial performance used in previous studies, and these are; i) Bank- specific variables indexed by operational risk, liquidity risk, bank size, tax, efficiency ratio, labour productivity, deposit ratio and diversification; ii) Industry-specific variables indexed by stock market development, banking sector development and stock market volatility; and iii) macroeconomic variables proxied by inflation rate risk, interest rate risk, foreign exchange rate risk and Gross Domestic Product (GDP). This study adopted these basic determinants in specifying the independent and control variables.

Data and Methodology

Data were collected from annual reports and accounts of 15 selected DMBs that operated in Nigeria over the period – 2007 to 2016, been the post banking sector reform period. Thus, the financial performance (FP) is indexed by return on assets (ROA), while credit risk is indexed by non-performing loans ratio (NPL), loan loss provision ratio (LLP), loan ratio (LOR) and cost per loan ratio (CLR). The control variables include bank-specific: operational risk (CAR), bank size (BAS), efficiency ratio (EFR) and diversification (DIV) as well as macroeconomic variables: inflation rate (INF) and GDP growth rate (GDP). IC components: structural capital efficiency (SCE), human capital efficiency (HCE) and capital employed efficiency (CEE) indexed by VAIC was used as moderator. All data were generated from audited annual accounts of the sampled banks except INF and GDP that were obtained from the Nigerian National Bureau of Statistics (NBS).

Model Specification

The model of Muriithi *et al.* (2016) was adapted and is specified in equation 1 below;

$$ROA_{i,t} = \beta_0 + \beta_1 CRWAR_{i,t} + \beta_2 LLPR_{i,t} + \beta_3 AQR_{i,t} + \beta_4 LAR_{i,t} + a_i + \mu_{i,t} \qquad (1)$$

From equation 1, $ROA_{i,t}$ refers to performance of bank i at time t. β_0 is intercept, β_1 to β_4 are coefficients of the explanatory variables. $CRWAR_{i,t}$, $LPR_{i,t}$, $AQR_{i,t}$ and $LAR_{i,t}$ represent capital to risk weighted assets ratio of bank, loss

provision ratio, Assets quality ratio and loan and advances ratio of bank i at time t respectively. The a_i is the bank specific effect that is assumed to be normally distributed with a constant variance and $\mu_{i,t}$ is the error term.

However, the model of Muriithi *et al.* (2016) was modified to moderate for credit risk using VAIC and to include variables like return on assets, net interest margin, loan loss provision, loan ratio, cost per loan ratio, diversification, inflation and GDP growth rate. The ICE indexed by VAIC was used to moderate the impact of credit risk on financial performance of listed DMBs in Nigeria. Researchers like Chen *et al.* (2005), Shiu (2006), Ghosh and Mondal (2009), Ting and Lean (2009) as well as Clarke *et al.* (2011), have measured the ICE using VAIC model.

Therefore, to determine the impact of IC on the association between credit risk and financial performance of 15 selected DMBs in Nigeria, we applied difference GMM regression methods to estimate the short run relationships between the variables, following Tan and Floros (2012) and Tan (2013) for China; Bertin, Moya and Perales (2014) for Latin America; and Muriithi *et al.* (2016) for Kenya. The adapted model is as specified below:

$FP_{i,t} = f$ (Credit risk variables, VAIC, Control variables)

The model is specified as follows;

$$FP_{i,t} = \beta_0 + \alpha FP_{i,t-1} + \beta_1 NPL_{i,t} + \beta_2 LLP_{i,t} + \beta_3 LOR_{i,t} + \beta_4 CLR_{i,t} + \beta_5 HCE_{i,t} +$$
$$\beta_6 SCE_{i,t} + \beta_7 CEE_{i,t} + \beta_8 MNPL_{i,t} + \beta_9 MLLP_{i,t} + \beta_{10} MLOR_{i,t} + \beta_{11} MCLR_{i,t} + \beta_{12} CAR_{i,t} +$$
$$\beta_{13} BAS_{i,t} + \beta_{14} EFR_{i,t} + \beta_{15} DIV_{i,t} + \beta_{16} INF_{i,t} + \beta_{17} GDP_{i,t} + \eta_i + \eta_t + \mu_{i,t}$$

A priori: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_{16} < 0;\ \alpha, \beta_5, \beta_6, \beta_7, \beta_8, \beta_9, \beta_{10}, \beta_{11}, \beta_{12}, \beta_{13}, \beta_{14}, \beta_{15}, \beta_{17} > 0;$

All variables are as earlier defined, while moderated NPL (MNPL), moderated LLP (MLLP), moderated LOR (MLOR) and moderated CLR (MCLR) are computed as NPL*VAIC, LLP*VAIC, LOR*VAIC, and CLR*VAIC respectively, indicating the interaction between credit risk represented by NPL, LLP, LOR and CLR respectively with the IC represented by VAIC. The β_{17} is expected to be negative or positive depending on the efficiency of the managers. The η_i and η_t are Fixed individual effect and time effect of banks respectively. The individual effect refers to a set of specific characteristics of each Bank that are constant over time. The time effect includes the macroeconomic factors that have an impact on all the Banks simultaneously. The μ_{it} is the error term. The α is the parameter of the lagged financial performance.

3.3. Estimation Procedure

In order to achieve the objective of the study, Generalised Method of Moments (GMM) econometrics techniques was used. This is because relevant estimators such as Pooled Ordinary Least Square (POLS) and Generalised Least Square (GLS) estimators do not provide a consistent estimate due to the presence of a lagged dependent variable amongst the regressors. One-step difference GMM estimator with one-year time lag is used for the study.

Results and Discussion

Descriptive Statistics and Correlation Analysis

Table 2: Descriptive Statistics

Variables	ROA	NPL	LLP	LOR	CLR	HCE	SCE	CEE	MNPL	MLLP	MLOR	MCLR	CAR	BAS	EFR	DIV	INF	GDP
Obs	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
Mean	0.01	0.14	0.09	0.44	0.14	3.25	0.36	0.38	0.31	0.15	1.62	0.50	0.14	8.94	0.06	0.04	0.11	0.06
Std. Dev.	0.07	0.20	0.13	0.12	0.08	7.57	2.38	0.44	1.03	0.87	2.81	1.04	0.10	0.37	0.02	0.04	0.03	0.03
Min	-0.54	0.01	0.00	0.16	0.02	-13.39	-20.27	-0.62	-7.73	-7.43	-10.74	-2.55	-0.40	8.05	0.01	0.00	0.05	-0.02
Max	0.07	0.98	0.79	0.85	0.52	76.89	6.61	3.19	3.00	2.30	24.34	8.80	0.82	9.71	0.20	0.42	0.16	0.09

Source: Researcher's Computation using STATA 13.

Table 2 shows the average ROA of the sampled banks during the period is 1%. It indicates weak return attributable to shareholders of banks. The mean and standard deviation of NPL ratio are 0.14 and 0.20 respectively, indicating high volatility in credit risk. The mean of NPL of 14% indicates that for every NGN1.00 of loans and advances granted by a bank, NGN0.14k is non-performing. The average LLP of Nigerian banks was 9%. This shows that on average, banks in Nigeria set aside 9% of loans and advances as provision for bad loans. The LOR indicates that on average, the total loans and advances of Nigerian banks constitutes 44% of their total assets. The LOR vary between 16% to 85% among the banks. However, the average CLR shows that total operating cost of the banks constitute 14% of their total loans and advances.

The three components of VAIC (HCE, SCE, CEE) have respective mean value of 3.25, 0.36 and 0.38 as shown in Table 1. From this, it is apparent that human capital is most effective in the matter of value creation than either capital employed or structural capital during the study period. The average HCE shows that the human capital of Nigerian banks including employees' productivity, capabilities, abilities, knowledge, skills, experience, values, attitudes, aptitudes, know-how, individual relationships, creativity, education, qualifications, motivation, commitment, loyalty, interactions, expertise, proactive leadership

abilities, flexibility, learning capacity, behaviour and risk-taking propensity contributed 81.5% to the value of the banks during the study period.

The average SCE indicate that structural capital of the banks including its procedures, policies, databases, routines, hardware, organisational culture, processes as well as the technology used in the bank contributed only 9% to the value of the banks. The average CEE which comprises relationships of the organisation with the external environment such as suppliers, customers, clients, government, competitors and community as well as the image of organisation, reputation of products and satisfaction of clients contributed 9.5% of the banks. The average CAR indicates that the equity capital of Nigerian banks amounted to 14% of their total assets.

The EFR shows that 6% of the banks' total assets constitutes the total expenses incurred each year by the banks. The average DIV reveals that the income generated by Nigerian banks from other sources amounted to 4% of their total assets. The mean INF and GDP indicate that the average inflation rate and GDP in Nigerian economy was 11% and 6% respectively within the study period.

Table 3 presents Spearman correlation for the two indices of FP and the explanatory variables. The result of Skewness and Kurtosis normality test (Jacque-Bera Test) suggests that the variables are not normally distributed, hence the use of Spearman correlation instead of Pearson correlation.

From Table 3, as expected the ROA is negatively related to credit risk variables. This means that the lower the NPL, LLP, LOR and CLR, the higher will be the ROA of banks in Nigeria. On the other hand, strong and positive relationship exist between ROA and IC indexed by HCE, SCE and CEE. This implies that banks that have strong and efficient IC tend to generate higher ROA.

The credit risk moderated by IC measured by MNPL, MLLP, MLOR and MCLR appeared to be positively related to ROA. This implies that IC impact positively on the credit risk of the banks. Positive relationship exists between CAR, BAS, DIV and GDP with ROA with correlation coefficient of 0.35, 0.18, 0.06 and 0.08 respectively. Finally, negative relationship exists between EFR, INF with ROA with correlation coefficient value of -0.36 and -0.14 respectively.

Estimation Results

Table 4 present the one-step difference-GMM estimates of the model specified in equation 2. The lagged ROA (ROA_{t-1}) is negative and statistically significant

Table: 3: Spearman Correlation

Variable	NPL	LLP	LOR	CLR	HCE	SCE	CEE	MNPL	MLLP	MLOR	MCLR	CAR	BAS	EFR	DIV	INF	GDP
ROA	-0.31	-0.32	-0.12	-0.17	0.85	0.51	0.36	0.21	0.29	0.56	0.58	0.35	0.18	-0.36	0.06	-0.14	0.08

Source: Researcher's Computation using STATA 13 based on data collected (2007-2016)

Table 4: DGMM Estimation

Variables	ROA$_{t-1}$	NPL	LLP	LOR	CLR	HCE	SCE	CEE	MNPL	MLLP	MLOR	MCLR	CAR	BAS	EFR	DIV	INF	GDP	Obs	AR (1)	AR (2)	Sargan test	Hansen test
ROA$_t$	-0.131**	-0.028	-0.206***	-0.02	0.246**	-0.001	-0.007	0.015	0.003	0.079***	0.016	-0.057*	0.198*	-0.004	-0.607**	0.177	-0.061	0.037	150	0.03	0.252	0.809	1
	(-2.60)	(-0.45)	(-3.51)	(-0.42)	(2.38)	(-0.19)	(-0.99)	(1.32)	(0.16)	(4.02)	(0.94)	(-1.82)	(2.08)	(-0.07)	(-2.51)	(1.57)	(-0.33)	(0.14)					

Source: Researcher's Computation using STATA 13. **Note:** ***, ** and * indicate 1%, 5% and 10% significant levels respectively. The t-value is presented in parenthesis while the other figures represent the coefficients.

at 5%, thus confirms the dynamic nature of the model. It reveals that a percentage increase in the previous year's ROA is associated with 13% decrease in the current year's ROA.

The NPL was found to be negative but statistically insignificant. Similar result was obtained by Musa (2015), Muriithi *et al.* (2016) as well as Ajayi and Ajayi (2017). However, it contradicts the findings of Awoke (2014), Yijun Zou (2014), Lalon (2015), Ishtiaq (2015) and Bizuayehu (2015) that found a significant, negative effect of NPL on ROA of banks. The LLP is found to have inverse relationship with banks' ROA in Nigeria at 1%. This result is supported by Sufian and Chong (2008), Liu and Wilson (2010), Ishtiaq (2015) as well as Menicucci and Paolucci (2016), but contradicts the findings of Kwabena (2014) and Lalon (2015), who found a significant positive effect of LLP on ROA. Similar to NPL, LOR is found to be negative but statistically insignificant in the different time horizons. This finding is supported by Menicucci and Paolucci (2016) as well as Ajayi and Ajayi (2017). However, the finding is inconsistent with that of Awoke (2014), who found a significant negative association between LOR and ROA.

The CLR was found to be positive and statistically significant with ROA at 5%. This finding tallies with those of Boahene, Samuel and Agye (2012) and Awoke (2014), but contradicts that of Ajayi and Ajayi (2017). The result shows that among the variables used to index credit risk, only LLP conforms with our *a priori* expectation and is statistically significant. This indicates that financial performance of listed Nigerian banks is influenced by credit risk measured using LLP in the different periods.

The HCE was negative and statistically insignificant with ROA. This means that a percentage increase in HCE do not significantly increase or decrease ROA of banks in Nigeria. This means that, banks in Nigeria were not utilising their human capital investments effectively. This finding is supported by Chan (2009), Yu *et al.* (2010), Mehralian *et al.* (2012) as well as Purohit and Tandon (2015). It however, contradicts the work of Ting and Lean (2009), Clarke *et al.* (2011), Carrington (2013), Nimtrakoon (2015), Meles, Porzio, Sampagnaro and Verdoliva (2016), Sardo and Serrasqueiro (2016) as well as Nawaz and Haniffa (2017), who reported a significant positive impact of human capital efficiency on financial performance. It also contradicts the findings of Bontis (1998), Shiu (2006), Chan (2009) as well as Ghosh and Maji (2014), who found a significantly negative impact of HCE on stock market performance.

The SCE was negative and statistically insignificant. This means that, banks in Nigeria were not utilising their structural capital investments effectively. This finding is consistent with the works of Phusavat *et al.* (2011), Sardo and Serrasqueiro (2016), but contradicts that of Chan (2009), Yu *et al.* (2010) and Carrington (2013) who found a significant positive impact of SCE on ROA.

Similarly, CEE was positive but statistically insignificant, this is in line with the work of Chan (2009), Yu *et al.* (2010), Komnenic and Pokrajcic (2012), Carrington (2013), Nimtrakoon (2015), Sardo and Serrasqueiro (2016) as well as Nawaz and Haniffa (2017). It however contradicts the findings of Ting and Lean (2009), Gigante and Previati (2011) as well as Purohit and Tandon (2015), who established an insignificant positive effect of CEE on ROA. Thus, CEE does not significantly influence ROA of banks in Nigeria.

The MNPL which stands as the value of moderated NPL is positive but statistically insignificant. However, the moderated LLP (MLLP) is positive and statistically significant at 1%. The moderated CLR (MCLR) is statistically significant but negatively related with ROA. The results indicate that among the variables that were used to measure the impact of IC on credit risk management, only MLLP and MLOR appear to have the expected sign and is statistically significant. Thus, IC impact on the credit risk which subsequently affects financial performance of listed Nigerian banks in Nigeria.

The CAR was positive and statistically significant at 10% significance level. This finding is similar to those of Sensarma and Jayadev (2009), Lake (2013), Muteti (2014), Bertin, Moya and Perales (2014), Lalon (2015), Ishtiaq (2015) and Musa (2015), but contradicts the findings of Hosna, Manzura & Juanjuan (2009) as well as Yijun Zou (2014), who found a statistically negative and insignificant association between CAR and ROA. However, Bizuayehu (2015), found a statistically negative and significant association between CAR and ROA. Thus, CAR has positive and significant impact on ROA.

BAS was negative and statistically insignificant. The result tallies with those of Scholtens (2000), Vander (2002), Yu *et al.* (2010), Komnenic and Pokrajcic, (2012), Tan (2013) and Nimtrakoon (2015), but contradicts those of Boahene, Samuel and Agye (2012), Lake (2013), Bertin, Moya and Perales (2014), Awoke (2014), Musa (2015), Bizuayehu (2015), Menicucci and Paolucci (2016), Sardo and Serrasqueiro (2016), Muriithi *et al.* (2016) as well as Nawaz and Haniffa (2017), who found positive and significant association between BAS and ROA.

EFR was negative and statistically significant with ROA at 5% significance level. This finding is supported by Bourke (1989) and Jiang *et al.* (2003), but contradicts that of Molyneux and Thornton (1992), Guru *et al.*, (2002) and Naceur (2003), who found significant positive relationship between profitability and expenses.

The result provides evidence that DIV has positive but has insignificant impact on ROA. This result is supported by Bertin, Moya and Perales (2014), but contradicts that of Demirguc-Kunt and Huizinga (1999).

INF has negative and insignificant impact on ROA. This result is supported by the findings of Abreu and Mendes (2002), Lake (2013) and Bizuayehu (2015), but against the conclusion of Guru *et al.* (2002), Jiang *et al.* (2003), Kosmidou et. al (2008), Sufian and Habibullah (2009), Garcia-Herrero *et al.* (2009), Kapur and Gualu (2011), Damena (2011), Tan and Floros (2012), Tan (2013) as well as Bertin, Moya and Perales (2014), who reported positive and significant association between inflation and profitability.

GDP has positive and insignificant effect on ROA. The finding is inconsistent with Sufian (2010), Tan and Floros (2012) and Tan (2013), who found negative and significant impact of GDP on ROA.

Post estimation tests were conducted to ensure the reliability and validity of the instruments used in the study. In order to ascertain the validity of the instruments used in the GMM estimation, Arrelano & Bond (1991), autocorrelation test and Hansen J-statistic are presented in Table 4. Arrelano and Bond autocorrelation test revealed that there was first-order but no second order autocorrelation. This is evidenced by AR (2) 0.252. Hansen J Statistic revealed that the instruments are valid with a value of 1.000.

Conclusions and Recommendations

The study concludes that credit risk measured as LLP ratio reduces the financial performance of listed deposit money banks in Nigeria. The increased exposure to credit risk reduces ROA as well as financial performance of banks. The credit risk reflects health of loan portfolio which affects banks' financial performance. Similarly, it was also observed that credit risk moderated by intellectual capital affects financial performance of listed Nigerian DMBs. Other variables that influence financial performance of listed Nigerian DMBs include CAR and DIV. The finding is in line with modern portfolio theory which advocate diversification and avoiding credit risk concentration.

Therefore, the study recommends that in order to ensure the competitiveness, soundness, profitability and financial stability of the Nigerian banking industry, Nigerian DMBs should strengthen their credit risk management culture including credit policies, assessment, analysis, monitoring, control, approval and administration to ensure prompt repayment of loans. Management of banks should also ensure that policy on loan approvals are strictly adhered, to reduce both LLP ratio, improve the asset quality management and consequently increase profitability. CBN policies should also be further strengthened to ensure sound and well-articulated credit risk management policies. CBN should ensure that DMBs define and strictly adhere to their risk appetite and tolerance limits as well as risk acceptance criteria within the context of their specific defined strategic plans. To enhance interaction of IC on credit risk, Banks should increase investment in HC and improve on its management via training, recruitment, promotion, adequate compensation, motivation and placement of employees. Banks should also have an effective management of information technology infrastructure to enable efficient, cost effective service delivery to customers for optimum financial performance. To ensure prudent lending, stability and soundness of banking business, banks should maintain higher capital ratio, specifically in line with CBN requirements of having minimum CAR of 10% and 16% for tier 2 banks and tier 1 (systemically important) banks respectively. The banks should also continue to diversify their sources of income in order to mitigate risk.

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