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Evaluation of Nigerian Deposit Money Banks' Soundness: Bankometer Model

Ezekiel Oseni [a*]

[a] *Department of Banking & Finance, University of Lagos, Nigeria.*

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

The study examined the soundness of the Nigerian deposit money banks in view of stakeholders' increasing dependence on it as a catalyst for achieving individual and corporate prosperity (wealth, access to funding, improved standard of living, etc.). The study examined 13 banks over a period of 10 years (2013 - 2022) using both ordinarily least square (OLS) and the IMF's bankometer model for its analysis. The study observed that the IMF's bankometer model variables exert significant influence on the soundness of the banks and therefore the model was found appropriate to evaluate banks to determine their state of health. Secondly, the study observed 92.30% of the Nigerian banks examined between 2013 and 2022 had solvency-score (s-score) above IMF's model soundness minimum threshold of 70%. This implies that all the banks were healthy with the exception of one bank that had a negative s-score indicating a serious state of distress. The foreign affiliated banks were however found to be healthier than the 1st tier banks while three of the the 2nd tier banks had s-score higher than one of the 1st tier banks. The regulators should be proactive in their monitoring activities, rather than depending only on the historical performance review of the banks. Furthermore, the regulators should devise mechanisms to forecast future trends of each of the banks and for each of the measurement metrics to enable them take precautionary actions that would ensure financial stability and protect the interest of all the stakeholders.

**Corresponding author: E-mail: zikoseni@yahoo.com;*

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JEL Classifications: C12, C31, G01, G21, M21.

1. INTRODUCTION

Over the years and across the divides, studies appeared to have established consensus on the importance of banks in socio-economic development and growth of any economy. For instance, banks were described by several studies as the life of the economy without which no economy could survive [1-3]. Banks are also seen as the mechanism for effective allocation of resources between competing businesses, sectors and economies [4-7]. Financial institutions including banks are similar to public institutions that need to be protected by regulations and relevant government instruments for the benefits of all the stakeholders and the national economy. Banks are not just any kind of business ventures that serve only the interests of the shareholders, they are not too different from public institutions that need to be protected by regulations, government instruments for the sake of all the stakeholders.

The Nigerian banks have metamorphosed over the years right from the inception of the first set of banks in the country's colonial era. The introduction of the 1974 indigenization policy encouraged Nigerian's ownership of foreign-owned private sector institutions that were hitherto held by foreigners. Many Nigerians became owners of some of the pre-independence banks as the foreign investors divest. While other new banks were founded, some of the newly indigenized banks change their names to reflect the new ownership. With time, some of the banks became distressed and were either outrightly foreclosed, acquired or merged with others [8-10]. The Nigeria failed tribunal which operated from 1993 to 1998, under the regime of General Sanni Abacha investigated the numerous cases of failed banks, the causes of their failure and those that were found culpable for the failure were tried under the law [11].

In 2005 the Central Bank of Nigeria (CBN) which is the apex regulator of the nation's financial system introduced a policy for banks recapitalization. In 2005, the CBN policy on banks' recapitalization required all the commercial banks to shore up their minimum capital base to N25 billion from a previously minimum capital of a N2 billion in 2001 [12-15]. To also address transparency in the banks' audited financial statements, CBN imposed a uniform financial year end of 31st December for all the banks. The new policies revealed hidden weaknesses in many of the banks. For instance, the recapitalization policy revealed the inability of many banks to raise additional capitals from the public, private investors and their own shareholders. Some of the weak banks either merged with themselves, acquired by stronger ones or got liquidated as their licenses were revoke for non-compliance with the new minimum capital requirements. While the policies were seen as means of protecting the interests of depositors and investors, the larger economy benefited through attraction of foreign direct investments from investors across the globe, funding of big ticket transactions, advanced banking technologies including internet banking and improved banking operating environment that tamed bank robberies that were rampant prior to the consolidation [16-18].

The banks remained regulated by CBN while the Nigerian Deposit Insurance Corporation (NDIC) remained the loss insurers as fallbacks where depositors take priority over other creditors. Several studies have shown that many of the surviving commercial banks of the 2005 recapitalization era and those that came on board thereafter have grown over the years in terms of profitability, shareholders' fund, customer base, depositors' funds, branch networks, foreign presence and foreign capital attractions [18,12]. A probing question to ask is if the evidence of growth sufficient was to guarantee the soundness of the Nigerian deposit money banks?

Therefore, this paper is centered on the query by Zhou [19] that "are banks too big to fail" by examining the soundness of Nigerian deposit money banks from the quantitative analysis perspective. The study is pertinent in view of the 2023 collapse of Silver Valley Bank, Signature Bank and Credit Suisse which would ordinarily be considered better capitalized, governed and observers of best global practice as compared to what may be obtainable in third world economies. While this study did not suggest any likely collapse of any banks in Nigeria, it became necessary to examine the soundness of the current banking industry in view of the increasing

dependence on it by the public and other stakeholders as aids or catalyst to achieve individual and corporate prosperity (wealth, access to funding, improved standard of living, etc.).

1.1 The Conceptual Framework

There is a process that creates or leads to a banking and financial systems that is sound, reliable and resilient to shocks. The players in either systems must be individually and collective strong to produce a sound system. No doubt that industry players are not immune from threatening challenges that could be internal and external environments. While the internal environment is a single layer, the external environment is multi-dimensional and, in many cases, comprises of the sector, national and global economies. The conceptual framework for a sound banking system depicted in Fig. I below is based on the premise that the industry players would meet the minimum thresholds pre-determined by the regulators. The framework deployed the IMF bankometer model that define solvency score (S-Score) as the basis for determining the soundness of the banks. Below is a conceptual framework to explain the variables that are considered to impact the soundness of the banking system.

The Fig. I above depict the application of the IMF bankometer model's soundness evaluation metrics and the outcome of the evaluation. Based on the IMF's model, a bank is considered healthy with no financial difficulties if its s-score is at least 70%. Such a bank is perceived to have no signs of distress or any financial difficulties in the foreseeable future. Therefore, the probability of such a bank experiencing distress in the foreseeable future is lower than its likelihood to remain healthy or in the worst-case scenario becoming weak but not distressed.

A bank with s-score between 50% and 70% is considered weak but not distressed. Such a bank has a 50% likelihood to either recover and become healthy or become distressed and bankrupt. However, any bank with s-score below 50% is considered distressed and has a higher probability of becoming bankrupt at any moment. In other words, the probability of survival of any bank with s-score below 50% is lower than its probability of bankruptcy. According to Budiman, Herwany and Kristanti [20] a distressed institution would have challenges meeting its obligations as and when due and such obligations for a bank includes honouring its customers' and investors" demands, failure of which can trigger a run. It is therefore expected that the failure of banks to meet the soundness' minimum s-score of 70%, the relevant regulators should undertake necessary reforms to reposition the systems to assure the depositors and investors of the safety of their investments.

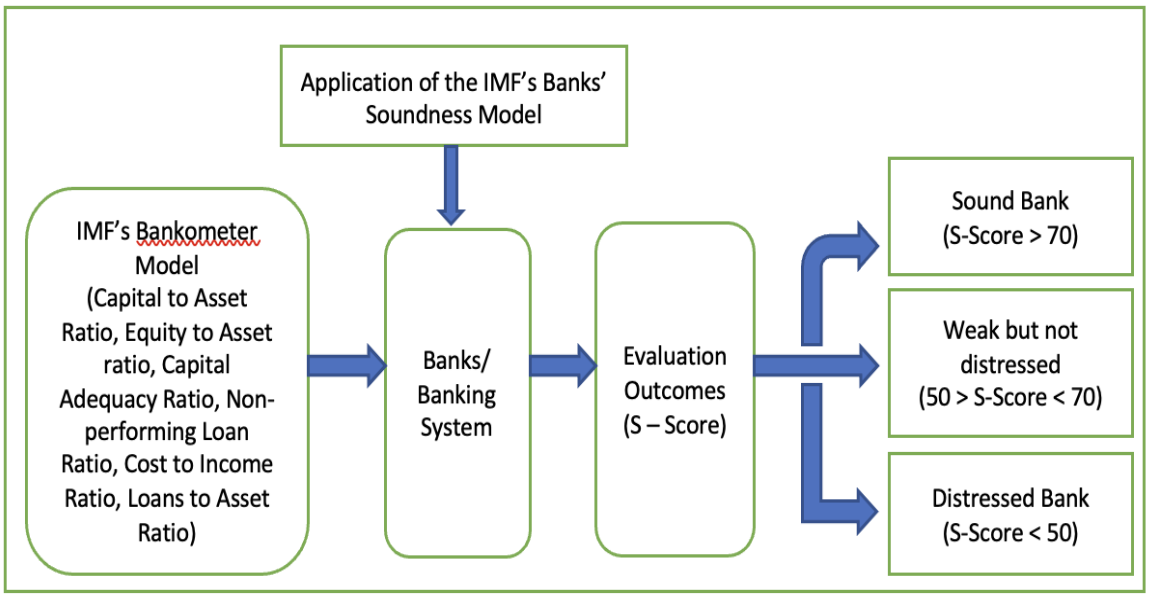

Fig. 1. Conceptualization of IMF's bankometer model on banks' soundness
Source: Author (2023)

2. LITERATURE REVIEW

Financial stability is a central focus of the apex (central) banks in many countries [21,22]. It may be impossible to achieve financial stability without the soundness of the financial system and especially the banks [23,24]. Though there are no widely adopted definitions of either financial stability or banks' soundness, however there are quite a number of studies that have made attempts in that regards [25,26]. For instance, Schinasi [25] describes financial stability as the ability to facilitate and enhance economic processes, manage risks and absorb shocks. Swamy [26] posits that a bank is considered sound when it is has the resilient ability to operate under difficult business environments.

In their study of banks' soundness, Joneidy and Ayadurai [27] and Ayadurai and Eskandari [28] argue that the various regulations that came out of Basel Accords which provide global standards for supervision and regulations of the banking sector were unable to guarantee banks' soundness. Nevertheless, some studies identified some requirements for a sound banking system in any economy [29] Lin and Yang, [30]. For instance, White and Morrison [31] identified capital adequacy as a requirement for a sound banking system. Regulations are key to a sound banking system, [29]. In their study of bank failures in East Asian countries, Lin and Yang [30] established that the elements of asset quality, liquidity, capital adequacy, profitability, management quality and conducive business environment are measures of the banks' soundness.

On the other hand, Demirguc-Kunt, Detragiache and Tressel [32] considered ratings as accurate determinants of banks' soundness as both quantitative and qualitative factors while the enabling environments are inputs in the assessment process. The arguments of Demirguc-Kunt, Detragiache and Tressel [32] was contradicted by Tatyana, Nina and Elena [33] when they opined that ratings do not significantly influence the soundness of the rated banks and the financial system. However, several studies support capital adequacy, asset quality, management quality, earnings, liquidity and sensitivity to markets (CAMELS) as the inputs for determining banks' soundness by regulators in several countries [34-38]. On the other hand, Boyd and Runkle [39] included some variations such as loan size and deposit size as factors required to determine the soundness of the financial system. In the study of the nexus between banks' soundness and financial stability in Jordan, Almahadin, Kaddumi and AL-Kilani [21] model consisted of capital adequacy, non-performing loan (asset quality), customer deposits and fraction of domestic credit facilities to Gross Domestic Product (GDP). Similarly, Pietrzak [40] argues that the indicators of financial soundness are good predictors of distress in the financial systems. According to Arzova, and Sahin [41] the measures and indicators of the banks' soundness affect the performance of the banks. The findings show that the correlation between the soundness indicators and the bank's performance are positive and significant.

Salina, Zhang and Hassan [42] examined the financial soundness of the Kazakh banks using cluster methodology and principal component analysis. The variables considered by the study were capital adequacy, return on asset, profitability, asset quality and liquidity. The study took two cut-off days of 1st January, 2008 and 1st January, 2014. It observed that as at 1st January 2008 there were no unsound banks in Kazakhstan, while 44% of the banks were considered risky and 56% were considered sound. However, as at 1st January, 2014 the financial soundness of the Kazakh banks was in a more dire situation as 24% of them were found to be sound, 60% were considered risky and 16% had become unsound.

Almahadin, Kaddumi and Al-Kilani, [21] examined the nexus between banking soundness and financial stability in Jordan. The study examined capital adequacy ratio, NPL ratio, growth rate of customer deposits and domestic credit facilitated by the banking sector as a proportion of GDP using fully modified OLS regression analysis technique. The study established a positive and significant nexus between banking soundness and financial stability. Also, capital adequacy ratio was discovered to have the most important positive influence on the soundness of banks while the NPL ratio was found to negatively affect the banks' soundness.

Tran, Nguyen and Nguyen [43] studied the relationship between corruption and the soundness of banking systems in middle-income countries. The variables examined by the study were NPL ratio, corruption index, interest rate

List 1. Results of empirical analysis of some previous studies

Areas of Studies	Scholars	Variables for measuring banks' soundness	Methodologies	Findings
An assessment of the financial soundness of the Kazakh banks	Salina, Zhang and Hassan [16]	Capital Adequacy, Return of Asset, Profitability, Asset Quality, Liquidity and Leverage	Cluster Methodology and Principal Component Analysis	As at January 1, 2008. i) No unsound banks in Kazakhstan ii) 44% of the banks were considered risky iii) 56% of the banks were sound As at January 1, 2014 i) 16% of the banks were unsound ii) 60% were risky iii) 24% were sound
Banking soundness-financial stability nexus: empirical evidence from Jordan	Almahadin, Kaddumi and Al-Kilani, [18]	Capital adequacy, NPL, growth rate of customer deposits, domestic credit facilitated by the banking sector as a proportion of GDP	Fully Modified OLS Regression Analysis	The study established a positive and significant nexus between banking soundness and financial stability. Also, capital adequacy ratio was discovered to have the most important positive influence on the soundness of banks while the NPL ratio was found to negatively affect the banks' soundness
Corruption and the soundness of banking systems in middle-income countries	Tran, Nguyen and Nguyen [35]	NPL, Corruption index, Interest rate spread, efficiency (i.e. overhead cost/total assets), liquidity capital adequacy, World governance indicators, political stability, regulatory quality, rule of law, deposit insurance, real GDP growth, inflation and house expenditure to GDP	Ordinary Least Square (OLS)	The relationship between corruption index and banks' soundness (NPL) was positive. The interest rate spread, efficiency ratio and liquidity were found to have significant effect on banks' soundness in the middle-income countries. No mention was made of the effects of other variables examined in the study on the banks' soundness.
Financial Soundness Evaluation of Selected Commercial Banks in Bangladesh: An Application of Bankometer Model	Rahman [36]	Capital to Assets ratio, Equity to Assets ratio, Capital Adequacy ratio, Non-performing Loans to Loans ratio, Cost to Income ratio, Loans to Assets ratio	Bankometer Model	The banks were found to be sound individually. Also, the financial system was found to be stable under the period of the study i.e. between 2010 and 2015.

Areas of Studies	Scholars	Variables for measuring banks' soundness	Methodologies	Findings
Key Drivers for Soundness of the Banking Sector: Lessons for Developing Countries	Vaithilingam, Mahendhiran and Muthi [37]	ICT infrastructure, Intellectual Capital, Institutions, Integrity (Governance), Strategic Partnership and Innovations	OLS	The development of the variables in the developing and underdeveloped countries were found to be significantly lower than what was obtainable in developed economies. However, the variables like governance and innovative capability of banks impacted positively on their soundness.
Bank-Specific Variables and Banks' Financial Soundness: Empirical Evidence from Nigeria	Salami, Uthman and Sanni [38]	Capital adequacy, Asset quality, management quality, earning capacity, liquidity and sensitivity to market risks (CAMELS)	OLS	Capital adequacy (gross revenue ratio), asset quality (NPL ratio), liquidity ratio and market sensitivity (interest expenses to total deposit) were found to be effective in measuring the soundness of the banks
Analysis of Performance and Financial soundness of financial institution (Banks): A Comparative Study	Qamruzzaman [39].	Financial ratios (current, quick, working capital, account receivable, etc. ratios), asset turnover ratios, collection period ratio, ROA, ROE, profitability and liquidity ratios	Multivariate Discriminate Analysis (MDA), mean, standard deviation (SD) and coefficient of variance (CV)	Overall financial soundness of banks in Botswana was found to be declining from "safety zone' between 2008 and 2012. Over 60% of the financial institutions had liquidity issues and could not meet their obligations.

spread, efficiency (i.e. overhead cost/total assets), liquidity and capital adequacy ratios. Other variables include the world governance indicators, political stability, regulatory quality, rule of law, deposit insurance, real GDP growth, inflation and house expenditure to GDP. The study employed OLS regression technique for its data analysis. The study found that the relationship between corruption index and banks' soundness (NPL) was positive. The interest rate spread, efficiency ratio and liquidity were also found to have significant effect on banks' soundness in the middle-income countries. No mention was made of the effects of other variables examined in the study on the banks' soundness.

Vaithilingam, Mahendhiran and Muthi [44] studied the key drivers for soundness of the banking sector in developing countries. The examined variables were non-regulatory and non-common variables contrary to most similar studies. These were ICT infrastructure, intellectual capital, institutions, integrity (governance), strategic partnership and innovations. The choice of the variable was informed by the need to establish that non-financial and non-regulatory factors influence the soundness and stability of financial institutions. The study observed that the impact of the variables examined in the developing and underdeveloped countries were found to be significantly lower than what was obtainable in developed economies. However, the variables like governance and innovative capability of banks impacted positively on their soundness.

Salami, Uthman and Sanni [45] examined the relationship between bank-specific variables and banks' financial soundness in the Nigerian financial system. The variables considered for the study were capital adequacy, asset quality, management quality, earning capacity, liquidity and sensitivity to market risks while OLS technique was used for data analysis. The study established that examined variables were found to be effective in measuring the soundness of the banks.

Qamruzzaman [46] did a comparative analysis of the relationship between performance and financial soundness of financial institutions in Botswana. The study used financial ratios (current, quick, working capital, account receivable, etc. ratios), asset turnover ratios, collection period ratio, ROA, ROE, profitability and liquidity ratios as variables. The study employed multivariate discriminate analysis including mean, standard deviation and coefficient of variance technique for its data analysis. The study observed that the overall financial soundness of banks in Botswana was found to be declining from "safety zone' between 2008 and 2012. Over 60% of the financial institutions had liquidity issues and could not meet their obligations.

The methods of measuring the soundness of the financial system also differ from one regulator to another as observed from an extensive study by IMF [47]. For instance, Bank of Finland uses a combination of banking sector variables and macroeconomic variables. The banking sector variables include bank's cost to income, non-performing loans and write-offs while the macroeconomic variables include interest rates, exchange rate, stock prices and balance of payments. Norges Bank uses capital to asset ratio, returns on assets, operating income trends, deposit and loan growth rates, debt servicing trends amongst others as banking sector variables. The Bank includes macroeconomic variables such as impact of changes in interest rate, asset prices, GDP growth rates and corporate debt levels among others. On the other hand, the Federal Reserves (US) focused only on the banking sector variables to determine the soundness of the banks. The variables it considers include tangible capital to asset ratio, overdue loans (in periods), reserves and net income to total assets.

From literature reviews, the composition of the indices for evaluating banks' soundness are not always the same for countries. The common indices are majorly regulatory, and these are capital adequacy, asset quality and liquidity ratios. Scholars like Vaithilingam, Mahendhiran and Muthi [44] looked beyond the traditional financial indices to measure the soundness of the banking system. They unlike many other studies focused on ICT infrastructure, Intellectual Capital, Institutions, Integrity (Governance), Strategic Partnership and Innovation to determine the soundness of the banking system in some developing economies in comparison to other developed economies.

The effects of collapsed banks on the depositors and the general economy are numerous and could be devastating [48,49]. They include loss of capital, disincentive to savings, decline in economic activities with impacts on economic growth and development, [50,51]. In their study

of the significance of bank specific and macroeconomic determinants on performance of Indian private sector banks, Aspal, Dhawan and Nazneen [52] posited that there is a very strong correlation between the health of the nation's financial system and its propensity for growth and development. Banks are indeed a significant part of any nation's financial system. They play vital roles in the economic growth and development of nations. Elliot [53] posits that the roles of banks are very central to modern financial systems and for those roles to be performed effectively the banks must not only be safe but must be perceived by all stakeholders to be both stable and safe.

2.1 Bankometer Model

There are several models that can be used to assess the soundness of banks and the financial systems. One of such methods are the CAMEL approach which could be as simple as examining the capital adequacy, asset quality and liquidity ratios against the minimum or maximum threshold of the regulators while the management quality and earnings are benchmarked against industry performance. The second approach is the IMF's bankometer model which was focused on what IMF described as the macro prudential indicators of financial system soundness [47].

Several earlier studies deployed bankometer model to test the soundness of banks. One of such is Africa [54] who examined 111 banks that were listed on the Indonesia Stock Exchange from 2014 to 2016. The sampled banks consisted of 60 foreign banks and 51 indigenous banks. The study established that bankometer can be used to evaluate the soundness of banks. Rahman [55] adopted the bankometer model in his study of the financial soundness evaluation of selected commercial banks in Bangladesh. The study examined capital to assets, equity to assets, capital adequacy, non-performing loans to loans, cost to income and loans to assets ratios. The study which covered 2010 to 2015 observed that each of the banks was individually sound and the financial system was also found to be stable. A similar study was conducted by Chauhan and Kumar [56] on commercial banks in india. The study examined 62 banks between the 2009 and 2018. The study established that foreign and privately owned banks were stronger than the government owned banks.

An evaluation of the financial soundness of the commercial banks using bankometer model was conducted by Yameen and Ali [57] in Jordan. The study which covered 2002 to 2011 established that all the banks were financially *supper sound*. The study concluded that the bankometer model can help banks to avoid insolvency issues through effective internal controls. A similar study was by Onyema, et, al [58] when they evaluated financial soundness of 10 commercial banks in Nigeria between 2000 and 2015 using the bankometer model. They observed that only two banks scored above the 70% minimum for soundness while eight banks scored below 50% an indication that 80% of the banks were distressed.

Bella and Radianto [59] deployed the model to predict bankruptcy for large, medium and small-sized banks on Indonesia Stock Exchange using market capitalization as the basis for categorization. The study which covered 2010 to 2018 observed that though all the banks had s-score above 70% which indicates that they were all healthy but there were differences between the bankruptcy predictions of large and medium banks. The smaller banks appeared more resilient than the bigger banks.

3. METHODOLOGY

3.1 Data Collection

The 13 banks considered for the study comprised five 1st tier banks, five 2nd tier banks, a 3rd tier bank and two banks with foreign ownership. The sampled banks are Zenith Bank, GT Bank, Access Bank, Stanbic-IBTC and Citibank. Others are FCMB, Union Bank, Fidelity Bank, Unity Bank, Sterling Bank, Wema Bank, First Bank and UBA. However, to avoid any misgivings about the soundness of any particular bank, the study deployed pseudo names to represent the banks and certainly not in the other they were listed above.

The sampled banks were randomly selected from a population of 22 deposit money banks that survived the 2005 recapitalization era and have their audited financials from 2013 to 2022.

3.2 Hypothesis

The study tested two hypotheses.

a) Hypothesis One

The study tested the relationship between banks' soundness and the explanatory variables defined

by IMF model for testing banks' soundness. The explanatory variables are capital to asset (CA), equity to asset (EA), non-performing loan (NPL), cost to income (CI) and loan to asset (LA). The proxy for banks' soundness is capital adequacy (CA).

Below is the tested hypothesis:

Ho: There is no relationship between variables defined by the IMF's bankometer with the soundness of the Nigerian banks

Ha: There is a relationship between variables defined by the IMF's bankometer with the soundness of the Nigerian banks

The model used to test hypothesis one (H1) was adapted from the study of the nexus between banking soundness and financial stability in Jordan by Almahadin, Kaddumi and Al-Kilani, [19]. The model is restated below.

$$ZS_t = \alpha_0 + \beta_1 CA_t + \beta_2 NPL_t + \beta_3 GD_t + \beta_4 DC_t + \beta_5 RIR_t + \beta_6 GDP_t + \pi 0\ Dummy_t + e \quad \text{...eqn(1)}$$

Where ZS represents financial stability and proxied by the product of return on assets and equity to asset ratio to the standard deviation. The banking soundness are represented by independent variables of capital adequacy (CA), non-performing loans ratio (NPL), customer deposit growth rate (GD), ratio of domestic loans to Gross Domestic Product (DC). Other independent variables are the real interest rate (RIR) and the annual GDP growth rate (GDP).

The adapted model for this study is:

$$CAR = \int (CA, EA, NPL, CI, LA) \quad \text{……. eqn (2)}$$

The model is restated as:

$$CAR = \alpha + \beta_1 CA + \beta_2 EA + \beta_3 NPL + \beta_4 CI + \beta_5 LA + € \text{ ----} \quad \text{eqn. (3)}$$

Where CAR = Capital Adequacy Ratio, ***CA*** = Capital to Asset Ratio**,** EA = Equity to Asset Ratio**,** NPL = Non-performing Loan Ratio, CI = Cost to Income Ratio and LA = Loans to Asset Ratio. The study used the Breusch-Pagan's Chi-Square model to test for the presence of heteroscedacity in the in the regression model. According to Okwonu, et. al [60], Malik and Hasan [61] and Winarno [62], if the observed probability of Chi-Square is lower than the level of significance, the alternative hypothesis (H_a) that heteroscedacity is present in the panel data should be accepted, otherwise the hypothesis would be rejected for the null hypothesis (H_o) on the premises that hereroscedacity is not present and the data has a normal distribution.

3.3 A Priori Expectation

The study expected a significant correlation between the explanatory variables and the banks' soundness. It is expected that the significant correlation would assist in validating the IMF's bankometer model as a good measure of the banks' soundness.

a) Hypothesis Two

The second hypothesis (H2) tested the soundness of each of the sampled bank using the Bankometer s-score model.

H2o: None of the 13 sampled banks were solvent over the period of the study.

H2o: None of the 13 sampled banks were insolvent over the period of the study.

Hypothesis two (H2) which required determining the solvency (s-score) of the sampled banks was tested using the bankometer model developed by International Monetary Fund (IMF). The summation of the composite ratios defined by the model must have s-score of > 70% for any bank or the banking industry to be considered solvent. Any bank with s-score > 50% and < 70% is considered challenged and have 50% probability of insolvency while any bank with s-score < 50% is considered to have a higher probability of collapse.

The model:

$$S = 1.5\ CA + 1.2EA + 3.5CAR + 0.6NPL + 0.3CI + 0.4LA. \quad \text{…eqn.} \quad (4)$$

Where:

		Implications for Solvency	
	Criteria	Higher Ratio	Lower Ratio
S = Solvency	= > 70%		
CA = Capital to Asset Ratio	= > 4%	Lower risk	Higher risk
EA = Equity to Asset Ratio	= > 2%	Lower risk	Higher risk
CAR = Capital Adequacy Ratio	= > 8%	Lower risk	Higher risk
NPL = Non-performing Loan Ratio	= < 15%	Higher risk	Lower risk
CI = Cost to Income Ratio	= < 40%	Higher risk	Lower risk
LA = Loans to Asset Ratio	= < 65%	Higher risk	Lower risk

The study conducted a *variance inflation factor (VIF)* analysis to determine the extent of correlation between the dependent and explanatory variables. The model used for theVIF is

$$VIF_i = 1/ (1-R^2_i) \quad \text{. . . . . eqn} \quad (5)$$

Where R^2_i is the unadjusted coefficient of determination of the dependent ith explanatory variables defined in eqn (3). The acceptance rule for absence and insignificant correlation between the dependent and explanatory variables is VIF < = 5 [63,64].

The study tested for the presence of heteroscedacity. The presence of heteroscedacity suggests abnormality in the data distribution and an indication that the variances between the variables over the period were not constant along the line of best fit. The Breusch-Pagan's test Chi-Square test was conducted to test for heteroscedacity.

3.4 The hypothesis

Ho= There is presence of homoscedacity in data distribution

H1 = There is no presence of homoscedacity in the data distribution

The Breusch-Pagan model adopted was the regression of the *CAR* residuals from eqn (3) depicted as follows:

$$g_i = \hat{e}^2_i \ / \eth^2, \eth^2 = \Sigma \hat{e}^2_i / n \quad \text{. . .} \quad \text{egn (6)}$$

The residual regression model at first difference is therefore

$$gi = \alpha + \beta 1Y2 + \beta 2Y3 + \beta 3Y3 + \beta 4Y4 + ei \text{ .. . eqn (7)}$$

The acceptance rule is to reject the null hypothesis (Ho) if the observed *p-value* < *0.05* at 5% level of significance.

4. RESULTS AND DISCUSSION

4.1 Descriptive Analysis

The study observed a sample mean of 10.87% for the industry's CAR against the minimum CBN threshold of 10% for every bank. The observed industry's buffer of 0.87% above the CBN's threshold would not be sufficient to provide additional shock absorber in the event of serious industry and economic challenge. A sample mean of 6.24% was observed for NPL which suggests that the CBN's threshold of 5% was breached by 1.24%. The minimum NPL ratio was zero.

Table 1. Results of descriptive analysis

Descriptions	*CAR*	*CA*	*EA*	*NPL*	*CI*	*LA*
Mean	10.87%	15.81%	6.62%	6.24%	52.66%	32.23%
Median	18.21%	15.21%	10.01%	4.00%	54.04%	35.43%
Standard De	37.55%	16.60%	21.77%	11.24%	15.20%	16.97%
Kurtosis	2237.67%	2917.19%	3176.64%	4454.62%	-101.06%	-116.92%
Skewness	-465.65%	-215.61%	-529.04%	626.00%	-4.38%	-28.44%
Minimum	-201.59%	-103.28%	-154.75%	0.00%	24.55%	1.43%
Maximum	39.88%	108.62%	51.25%	97.00%	82.92%	62.55%
Count	130	130	130	130	130	130

A maximum and minimum CAR of 39.88% and -201.59% were observed respectively. The deficit CAR is indicative of eroded shareholders' fund and a serious breach of regulatory requirement. The CAR and NPL are regulatory requirements, and as measures of resilient ability of the banks in the face of shocks, are considered key elements of the bankometer model.

The average ratio of equity to asset (EA) was 6.62% which implies that the industry's assets were largely funded by liabilities made of deposits and debt capital. This observation is not unusual for banks. The observed average cost to income (CI) and loan to asset (LA) were 52.66% and 32.23% respectively.

4.2 Multicollinearity Test

The multicollinearity test was to determine the quantum of influence that each of the examined variables in the model exerted on each other at 5% level of significance.

The results from Table 2 below shows that CA and EA were positively and insignificantly corelated at 0.048 at 5% level of significance. Similarly, the dependent variable CAR was also found to be positively and insignificantly correlated with both CA, EA and CI at 0.033, 0.153 and 0.137 respectively. Both NPL and LA were found to be negatively and insignificantly correlated to the dependent variable.

It was also observed hat LA had a negative but insignificant correlation with every variable with the exception of CI which was found to be positive though insignificant at 0.320. From the above findings, it can be concluded that each of the variables was sufficiently independent. They lacked presence of multicollinearity that could jeopardize the reliability of the outcomes of the study. A further test for the presence of significant correlation between the dependent and explanatory variables shows a VIF of 2.34 (Appendix II) which is < 5, beyond which is an indication of serious collinearity [63,64]. The model was considered good and the outcomes of the regression model unlikely to be spurious.

4.3 Heteroscedacity Test

The examined data comprised of both panel and time series data. The study tested the likelihood that the residual variance might not scale the normality probability test. The study tested for heteroscedacity using the Breusch Pagan model in which the residues from the initial regression analysis were examined against the independent variables to determine the extent of variance convergence and the extent to which the variables accounted for the residuals. The rule was to accept the presence of heteroscedacity if *p-value* < 0.05 based on the Breusch-Pagan model. However, the observed probability Chi-Square was found to be 58.09, higher than the the expected *p-value* of 0.05 which establishes that the variances were normally distributed. In other words, the data were homogenous and therefore lacked the elements of heteroscodacity.

4.4 Results of Regression Analysis for Hypothesis One (H1)

There regression analysis (Appendix 1) shows that the model has adjusted R-Square of 0.8912 which implies that the explanatory variables accounted for at least 89.12% behaviour of the dependent variable (banks' soundness). The constant coefficient was positive at 0.376. The calculated F-test$_{cal}$ of 61.70 > the critical F-Test of 3.106 at 0.05 level of significance. This implies that the independent variables collectively and significantly impacted on CAR which is the proxy for the soundness of the banks and the financial system.

The study observed that CA, EA and NPL exerted significant influence on the dependent variable, CAR at correlation coefficient of -1.588, 2.541 and -0.548 respectively, though the relationship was negative for CA and NPL. The correlation coefficient of CI and LA were found to be negative and insignificant at -0.237 and -0.783 respectively. With the exception of LA that has an observed *p-value* of 0.354, all the *p-values* of the other explanatory values were < 0.05.

In a nutshell, the observed *P-values* of other explanatory variables with the exception of CI were < 0.05 at level of significance, implying that the explanatory variables can be used to measure the soundness of the banks. Therefore, the null hypothesis that states that there is no relationship between the variables defined in the IMF's bankometer model and banks' is hereby rejected. The study agrees with the findings of Yameen and Ali [57] and Africa [54] that the explanatory variables as defined by IMF's bankometer model are valid measures of the banks' soundness.

Table 2 provides the summary of the Pearson's multicollinearity test at 0.05 level of significance.

Table 2. Results of multicollinearity test

	CAR	*CA*	*EA*	*NPL*	*CI*	*LA*
CAR	1					
CA	0.033	1.000				
EA	0.153	0.048	1.000			
NPL	-0.078	0.161	0.128	1.000		
CI	0.137	-0.037	0.140	-0.073	1.000	
LA	-0.257	-0.246	-0.257	-0.089	0.320	1.000

Table 3. Results of Bankometer Model of Nigerian Deposit Money Bank for 2013

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	18.51%	13.81%	26.00%	3.00%	57%	39%	169.93	2
2	Bank B	15.80%	9.20%	23.91%	3.58%	34%	48%	149.97	7
3	Bank C	$$$	10.61%	18.00%	2.70%	73%	44%	136.90	10
4	Bank D	13.29%	12.86%	24.50%	3.80%	68%	50%	163.96	4
5	Bank E	8.90%	7.38%	20.00%	1.20%	66%	36%	127.22	11
6	Bank F	12.19%	11.32%	17.70%	3.00%	63%	57%	137.10	9
7	Bank G	14.25%	13.73%	18.00%	3.90%	69%	45%	141.76	8
8	Bank H	19.88%	12.49%	25.00%	5.90%	71%	23%	166.45	3
9	Bank I	21.62%	15.12%	26.00%	3.72%	37%	6.50%	157.64	5
10	Bank J	15.12%	8.99%	14.00%	2.10%	44%	6.13%	99.25	12
11	Bank K	30.40%	13.00%	27.00%	3.90%	52%	17%	180.62	1
12	Bank L	20.45%	6.99%	-13.81%	25.50%	83%	13%	36.18	14
13	Bank M	17%	14.77%	28.62%	0.02%	39%	2%	155.87	6

Table 4. Results of Bankometer Model of Nigerian Deposit Money Bank for 2014

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	23.47%	12.30%	19.00%	1.80%	56%	46%	152.78	1
2	Bank B	15.48%	8.05%	21.40%	3.15%	38%	54%	142.69	6
3	Bank C	13.18%	9.82%	18.40%	2.20%	62%	53%	137.22	7
4	Bank D	12.77%	12.32%	20.40%	6.60%	55%	43%	143.18	5
5	Bank E	9.61%	7.65%	16.00%	1.60%	70%	41%	117.71	11
6	Bank F	12.06%	10.27%	15.80%	2.90%	67%	61%	131.72	9
7	Bank G	13.71%	12.96%	19.25%	3.60%	66%	53%	146.54	4
8	Bank H	21.91%	20.55%	16.40%	5.14%	62%	31%	148.92	3
9	Bank I	24.49%	9.90%	23.20%	4.40%	40%	14.58%	150.25	2
10	Bank J	16.33%	10.27%	13.60%	3.10%	40%	6%	100.84	12
11	Bank K	26.64%	11.44%	18.22%	1.97%	29%	15.20%	133.41	8
12	Bank L	29.46%	18.45%	2.02%	17.60%	40%	11%	100.51	13
13	Bank M	15%	13.08%	21.67%	0.03%	43%	1%	126.71	10

4.5 Results of Bankometer Model for Hypothesis Two (H2)

The outcomes of the model are presented in two parts below. The first part had to do with the outcomes for each of the sampled banks for each of the years under study while the second part dealt with the summation of the solvency-score (s-score) for the entire study period.

Tables 3 shows the results of the bankometer analysis for 2013, All the banks exceeded the minimum requirements for CA, EA and LA ratios. However, while every other bank attained thresholds for CAR and NPL ratios, Bank L fell short of both of them at -13.81% and 25.5% respectively. All the banks with the exception of Bank A (34%), Bank I (37%) and Bank M (39%) exceeded the maximum 40% benchmark for cost to income (CI) ratio.

The observed s-score from Table 3 for 2013 above shows that all the banks with the exception of Bank L were sound and had no signs of financial difficulties. Bank L's s-score of

36.18% indicates that the bank was distressed and risked bankruptcy.

Table 4 shows the bankometer model results for 2014. All the banks met the ratio requirements for CA, EA and LA. However, Bank L contravened the IMF's thresholds for CAR and NPL ratios at 2.02% and 17.60% respectively.
Only Banks B, I, J, K and L had cost to income (CI) ratio below 40%. The s-score shows that all the banks passed the solvency test in 2014.

Table 5 shows that in 2015, all the banks met the requirements for CA. EA and LA ratios. Bank L failed to meet the IMF's threshold for CAR with -21.46% and NPL with 77%.

The study observed that cost to income (CI) ratio remained a challenge for most of the banks in 2015 as only Banks B, I, J, L and M were able to operate below IMF's maximum threshold of 40%. Bank L was the only bank with s-score below 70% threshold for soundness. The poor result showed for the second time that the bank was weak and shows signs of financial difficulty.

Table 6 below shows that Bank L failed the both the CAR and NPL ratio requirements of 8% and 15% with a CAR of -46.98% and 97% respectively in 2016. The observed NPL ratio for Bank E was above the maximum threshold of 15% by 6.4%. Only Banks B, J, L and M operated below the CI ratio of 40%. All the banks were observed to be sound and had no financial difficulties solvent and strong to absolve market shocks in 2016 with the exception of Bank L with s-score of -19.69. A negative s-score is a serious signal for distress and bankruptcy.

From Table 7, the analysis for 2017 shows that Bank L failed to meet the IMF's threshold for CA, CAR and EA ratio requirements. The bank reported -103.28%, -154.75% and -198.07% for CA, EA and CAR respectively. The deteriorated CAR of the bank was an indication of deficit shareholders' fund. The study also observed that both Bank F and Bank H had NPL ratio above the threshold of 15%.

Table 5. Results of Bankometer Model of Nigerian Deposit Money Bank for 2015

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	24.39%	11.50%	20.00%	2.20%	55%	49%	157.98	1
2	Bank B	16.38%	7.50%	18.17%	3.21%	34%	54%	131.13	10
3	Bank C	14.19%	10.19%	19.50%	1.70%	62%	54%	143.14	6
4	Bank D	13.76%	13.20%	21.30%	8.50%	62%	41%	150.85	3
5	Bank E	12.08%	9.03%	20.00%	1.70%	67%	38%	135.24	9
6	Bank F	13.89%	12.02%	17.10%	18.10%	61%	53%	145.54	5
7	Bank G	14.00%	12.29%	16.88%	4.20%	75%	51%	140.25	7
8	Bank H	23.51%	22.24%	15.90%	6.67%	67%	33%	154.95	2
9	Bank I	25.15%	13.62%	19.00%	4.40%	40%	11.53%	139.89	8
10	Bank J	20.07%	11.95%	17.50%	4.80%	36%	8.11%	122.76	12
11	Bank K	24.79%	11.61%	15.09%	2.67%	46%	13.18%	124.71	11
12	Bank L	34.48%	18.63%	-21.46%	77.00%	38%	16%	62.91	14
13	Bank M	16%	13.73%	28.29%	1.70%	32%	2%	149.78	4

Table 6. Results of Bankometer Model of Nigerian Deposit Money Bank for 2016

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	24.68%	11.30%	23.00%	3.02%	50%	50%	167.91	1
2	Bank B	16.10%	7.23%	19.79%	3.70%	36%	51%	135.48	9
3	Bank C	13.05%	8.78%	20.77%	2.10%	59%	53%	143.00	5
4	Bank D	13.36%	13.01%	22.80%	5.20%	55%	35%	149.00	3
5	Bank E	12.79%	7.82%	20.00%	3.90%	63%	44%	137.25	8
6	Bank F	12.30%	10.33%	17.80%	24.40%	47%	53%	143.24	4
7	Bank G	15.19%	13.39%	17.60%	3.40%	50%	56%	140.09	7
8	Bank H	21.69%	12.45%	13.30%	6.91%	65%	40%	133.82	10
9	Bank I	26.53%	14.28%	17.20%	6.60%	77%	12.25%	149.19	2
10	Bank J	21.58%	10.22%	11.20%	9.90%	38%	11.37%	105.71	11
11	Bank K	18.47%	11.51%	11.07%	5.07%	46%	7%	99.87	12
12	Bank L	33.49%	16.87%	-46.98%	97.00%	31%	17%	-19.69	13
13	Bank M	14%	0.118849362	27.48%	0.00%	25%	2%	140.41	6

Table 7. Results of Bankometer Model of Nigerian Deposit Money Bank for 2017

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	30.00%	11.56%	27.00%	4.70%	44%	41%	185.78	1
2	Bank B	18.48%	7.78%	25.68%	7.70%	31%	43%	158.10	3
3	Bank C	12.57%	8.05%	20.06%	4.80%	62%	50%	140.35	10
4	Bank D	13.36%	13.13%	23.50%	6.60%	50%	28%	147.96	6
5	Bank E	12.97%	6.60%	22.00%	6.70%	58%	41%	142.23	8
6	Bank F	12.95%	9.67%	17.70%	22.80%	54%	52%	143.67	7
7	Bank G	15.80%	12.98%	16.89%	4.92%	61%	55%	141.55	9
8	Bank H	23.60%	12.73%	16.70%	20.80%	63%	36%	154.71	4
9	Bank I	30.20%	15.46%	16.00%	6.40%	68%	14.74%	149.84	5
10	Bank J	30.33%	9.51%	12.00%	6.20%	33%	20.82%	120.73	11
11	Bank K	22.40%	12.89%	14.32%	4.98%	41%	10%	118.27	12
12	Bank L	-103.28%	-154.75%	-198.07%	0.00%	27%	51%	-1005.13	13
13	Bank M	25%	0.149264727	29.54%	2.11%	25%	10%	171.85	2

Table 8. Results of Bankometer Model of Nigerian Deposit Money Bank for 2018

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	30.16%	10.28%	25.00%	4.98%	50%	35%	177.04	1
2	Bank B	17.53%	7.47%	23.39%	7.30%	32%	38%	146.34	3
3	Bank C	9.90%	7.43%	19.90%	2.66%	62%	43%	130.92	9
4	Bank D	14.41%	14.15%	21.00%	3.90%	32%	27%	134.55	8
5	Bank E	10.32%	5.83%	24.00%	6.50%	64%	36%	143.77	4
6	Bank F	9.53%	6.27%	17.30%	25.90%	63%	49%	136.64	6
7	Bank G	12.82%	10.78%	15.90%	5.90%	55%	44%	125.54	11
8	Bank H	15.41%	10.74%	16.40%	8.10%	83%	32%	136.08	7
9	Bank I	25.30%	11.30%	16.70%	5.70%	71%	14.00%	140.32	5
10	Bank J	26.42%	9.03%	13.40%	8.70%	34%	17.39%	119.84	12
11	Bank K	17.87%	10.67%	18.01%	4.98%	57%	7%	125.65	10
12	Bank L	-50.64%	-103.27%	-198.56%	0.00%	54%	53%	-857.55	13
13	Bank M	19%	0.1225685	30.25%	1.71%	29%	7%	161.40	2

In 2017, only Banks B, J, L and M operated below the IMF's threshold of cost to income ratio of 40%. The s-score for Bank L was negative at -1005.13%, a more devastating outcome than the previous year and a further indication that the bank was in more dire state compared with previous years. The bank was in distress and bankruptcy.

The results of 2018 analysis as depicted in Table 8 above shows that Bank L failed all the s-score components with the exception of LA ratio. Bank F was unable to meet the NPL ratio threshold while Banks B, D, J and M sustained their cost to income ratio below the 40% threshold.

The observed s-score reveals that all the analysed banks scored above the 70% threshold with the exception of Bank L that had an s-score of -857.55. The bank remained consistently distress and bankrupt for the 3rd time.

From Table 9, Bank L did not meet the IMF's threshold for CA, EA and CAR in 2019. The bank recorded deficits in all the three s-score components respectively. It was the only Bank that did not meet the LA threshold for the year. The study observed that Banks B, J, K and M maintained the cost to income ratio threshold of 40%.

Table 9. Results of Bankometer Model of Nigerian Deposit Money Bank for 2019

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	21.12%	10.54%	22.00%	4.30%	49%	41%	155.10	2
2	Bank B	18.29%	6.85%	22.51%	6.50%	30%	40%	143.23	3
3	Bank C	8.49%	6.63%	20.02%	5.80%	66%	43%	131.24	7
4	Bank D	16.11%	15.79%	19.40%	3.90%	35%	29%	135.26	6
5	Bank E	10.64%	5.35%	23.40%	5.30%	63%	39%	141.70	4
6	Bank F	10.66%	6.87%	15.50%	9.90%	63%	42%	120.01	10
7	Bank G	12.03%	9.56%	17.17%	3.70%	69%	43%	129.81	8
8	Bank H	13.48%	9.04%	15.76%	5.84%	74%	29%	123.84	9
9	Bank I	22.97%	11.07%	18.20%	3.30%	73%	9%	139.23	5
10	Bank J	20.71%	10.11%	14.70%	2.20%	38%	10.60%	111.57	11
11	Bank K	13.20%	7.85%	13.60%	7.38%	40%	5%	95.37	13
12	Bank L	-32.61%	-95.16%	-201.59%	0.90%	44%	63%	-829.93	14
13	Bank M	16.09%	7.26%	14.00%	3.04%	68%	9%	107.67	12

Table 10. Results of Bankometer Model of Nigerian Deposit Money Bank for 2020

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	25.58%	9.17%	23.00%	4.29%	50%	37%	162.24	2
2	Bank B	16.47%	6.72%	21.89%	6.86%	31%	34%	136.25	4
3	Bank C	8.65%	5.81%	20.61%	4.30%	63%	42%	130.33	7
4	Bank D	15.23%	14.92%	20.60%	4.00%	47%	25%	139.53	3
5	Bank E	9.41%	4.82%	22.40%	4.70%	61%	34%	133.18	5
6	Bank F	9.95%	6.43%	17.00%	7.70%	55%	42%	120.10	10
7	Bank G	11.03%	8.39%	17.70%	3.30%	66%	40%	126.22	9
8	Bank H	12.06%	7.83%	17.46%	4.00%	77%	32%	126.75	8
9	Bank I	19.38%	9.92%	18.20%	3.80%	65%	11.90%	131.24	6
10	Bank J	18.89%	10.14%	18.00%	1.90%	39%	8.75%	119.99	11
11	Bank K	12.57%	6.128%	15.01%	4.69%	47%	6.44%	98.15	12
12	Bank L	-2.14%	-55.98%	-101.47%	0.03%	26%	54%	-396.19	14
13	Bank M	18.47%	13%	40%	6.01%	26%	6%	196.34	1

Table 11. Results of Bankometer Model of Nigerian Deposit Money Bank for 2021

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	23.69%	9.36%	20.00%	4.19%	51%	39%	150.27	2
2	Bank B	16.25%	6.19%	23.83%	6.92%	42%	33%	145.34	5
3	Bank C	8.95%	7.29%	24.52%	4.00%	74%	38%	147.65	4
4	Bank D	13.74%	13.42%	21.10%	2.10%	62%	34%	144.18	6
5	Bank E	9.42%	5.29%	26.60%	3.60%	63%	33%	147.82	3
6	Bank F	9.85%	7.82%	17.39%	2.87%	56%	44%	121.11	9
7	Bank G	9.78%	7.55%	16.20%	4.10%	72%	43%	121.49	8
8	Bank H	10.28%	6.23%	14.61%	4.30%	79%	33%	113.73	10
9	Bank I	22.98%	8.70%	19.15%	2.90%	75%	14%	141.85	7
10	Bank J	17.29%	8.47%	14.82%	0.70%	40%	8.83%	104.03	12
11	Bank K	11.33%	6.04%	11.71%	4.88%	48%	5.29%	84.68	13
12	Bank L	108.62%	51.25%	-86.18%	0.01%	50%	57%	-39.28	14
13	Bank M	35%	13%	27.16%	0.78%	36%	22%	183.89	1

With the exception of Bank L with s-score of -829.93, all other banks remained sound and did not reflect any signs of financial difficulties. However, Bank L for the 4th unbroken stretch remained distressed and bankrupt.

From Table 10, the study observed that in 2020 all the banks complied with the IMF's thresholds for CA, EA, CAR and LA with the exception of Bank L that failed the threshold for CA, EA and CAR. The bank recorded deficits in all the three components of the bankometer model. The study observed that Banks B, J, K and M operated within the cost to income ratio threshold of 40%. Every other bank had s-score had s-score above 70% with the exception of

Bank L which indicates that the banks were sound and had no symptoms of financial difficulties. On the other hand, Bank L recorded s-score of -396.19 for the 5th consecutive time. The bank remained distressful and bankrupt.

In 2021, all the banks with the exception of Bank L surpassed the IMF's bankometer model thresholds for the CA, EA, CAR , NPL and LA with the exception Bank L that failed the CAR with -86.18%.

Only Banks J and M operated within the 40% threshold for cost to income (CI) ratio. All the banks report s-score above the threshold of 70%, an indication of soundness and absence of financial difficulties with the exception Bank L with -39.28%, For the 6th time the bank remained distressed and bankrupt.

The results of bankometer model for 2022 as contained in Table 12 below shows that Bank L was the only one that failed the IMF's threshold for EA and CAR. All the banks operated within the threshold for LA ratio while only Banks J and M stayed within the 40% threshold for cost to income ratio. All the banks' s-score with the exception of Bank L was > 70%, which implies that the banks were sound and had no signs of financial difficulties. On the other hand, Bank L s-score was -334 indicating a distress and bankruptcy for the 7th time consistently.

From Table 14, the study observed that all the banks met the minimum s-score of 70% with the exception of Bank L that had average negative s-score (-328.25%) over the 10 years the study covered. Bank L's s-score was below the threshold of 50% eight times and consistently for seven (7) years during the 10 year period of the study. In a nutshell, Bank L was distressed and bankrupt for eight years and consistently for seven years. In essence, 92.3% of the sampled population could be described as very healthy in accordance with the IMF's bankometer model while 7.7% was evidently insolvent. The study agreed with the findings of Chauman and Kumar (2019) but it was contrary to Onyema et. Al [58] who found only 20% bank healthy and the rest distressed. The discrepancy in the findings of the two studies were observed to be improved capitalization, management, regulatory oversights and time difference as their study coverage 2000 to 2015 while this study covered 2013 to 2022.

Table 14 shows the classification of the banks into three categories. The 1st tier banks have an observed collective average s-score of 142.26%. The observed highest score was 161.44% and the lowest was 131.91%.

Table 12. Results of Bankometer Model of Nigerian Deposit Money Bank for 2022

S/N	Banks	CA (≥ 4%)	EA (≥ 2%)	CAR (≥ 8%)	NPL (≤ 15%)	CI (≤ 40%)	LA (≤ 65%)	S Score (%) ≥ 70%	Rank
1	Bank A	20.76%	7.24%	19.00%	4.30%	48%	35%	137.34	5
2	Bank B	14.44%	5.48%	24.08%	5.20%	49%	29%	141.96	3
3	Bank C	8.53%	6.22%	19.65%	3.10%	82%	35%	129.47	6
4	Bank D	13.46%	13.19%	21.20%	2.38%	54%	40%	143.78	2
5	Bank E	8.49%	5.02%	28.30%	3.10%	60%	32%	150.45	1
6	Bank F	9.41%	7.62%	16.57%	2.14%	62%	47%	119.99	7
7	Bank G	9.25%	6.70%	16.24%	3.97%	65%	40%	116.64	8
8	Bank H	10.62%	6.88%	14.42%	4.02%	71%	35%	112.21	11
9	Bank I	14.44%	7.88%	18.14%	2.90%	79%	53%	141.29	4
10	Bank J	16.96%	8.34%	14.67%	3.90%	40%	40%	117.23	9
11	Bank K	10.04%	5.76%	12.74%	6.08%	45%	4%	85.55	13
12	Bank L	4.40%	-53.90%	-89.69%	0.16%	47%	58%	-334.36	14
13	Bank M	19%	1%	19.68%	0.02%	28%	18%	114.41	10

Table 13. Summary of Sampled Banks' S-Score (2013-2022)

Banks / Years	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average S Score (%) ≥ 70%	Rank
Bank A	169.93	152.78	157.98	167.91	185.78	177.04	155.10	162.24	150.27	137.34	161.64	1
Bank B	149.97	142.69	131.13	135.48	158.10	146.34	143.23	136.25	145.34	141.96	143.05	5
Bank C	136.90	137.22	143.14	143.00	140.35	130.92	131.24	130.33	147.65	129.47	137.02	8
Bank D	163.96	143.18	150.85	149.00	147.96	134.55	135.26	139.53	144.18	143.78	145.23	3
Bank E	127.22	117.71	135.24	137.25	142.23	143.77	141.70	133.18	147.82	150.45	137.66	6
Bank F	137.10	131.72	145.54	143.24	143.67	136.64	120.01	120.10	121.11	119.99	131.91	10
Bank G	141.76	146.54	140.25	140.09	141.55	125.54	129.81	126.22	121.49	116.64	132.99	9
Bank H	166.45	148.92	154.95	133.82	154.71	136.08	123.84	126.75	113.73	112.21	137.15	7
Bank I	157.64	150.25	139.89	149.19	149.84	140.32	139.23	131.24	141.85	141.29	144.07	4
Bank J	99.25	100.84	122.76	105.71	120.73	119.84	111.57	119.99	104.03	117.23	112.20	12
Bank K	180.62	133.41	124.71	99.87	118.27	125.65	95.37	98.15	84.68	85.55	114.63	11
Bank L	36.18	100.51	62.91	-19.69	-1005.13	-857.55	-829.93	-396.19	-39.28	-334.36	-328.25	14
Bank M	155.87	126.71	149.78	140.41	171.85	161.40	107.67	196.34	183.89	114.41	150.83	2

Table 14. Classifications of the Banks

Category	Combined S-Score (%)		
1st Tier	142.26		
2nd Tier	128.21		
Foreign- Ownership	148.03		

All the 2nd tier banks have an observed collective s-score of 128.21% with the highest and the least scores being 144.07% and 112.20% respectively. The study further observed that three of the 2nd tier banks had s-score higher than one of the 1st tier banks. The foreign banks's observed average s-score was 148.03 higher than the 1st tier banks which suggest that the latter were more resilient than the latter.

5. CONCLUSION

The study examined the soundness of the Nigerian deposit money banks in view of stakeholders' increasing dependence on it as a catalyst for achieving individual and corporate prosperity (wealth, access to funding, improved standard of living, etc.). The study examined 13 banks over a period of 10 years (2013 - 2022) using both ordinarily least square (OLS) and the IMF's bankometer model for its analysis.

The study observed that the IMF's bankometer model variables exert significant influence on the soundness of the banks and therefore the model was found appropriate to evaluate banks to determine their state of health. Secondly, the study observed 92.30% of the Nigerian banks examined between 2013 and 2022 had solvency-score (s-score) above IMF's model soundness minimum threshold of 70%. This implies that all the banks were healthy with the exception of one bank that had a negative s-score indicating a serious state of distress. The foreign affiliated banks were however found to be healthier than the 1st tier banks while three of the the 2nd tier banks had s-score higher than one of the 1st tier banks.

The regulators should be proactive in their monitoring activities, rather than depending only on the historical performance review of the banks. Furthermore, the regulators should devise mechanisms to forecast future trends of each of the banks and for each of the measurement metrics to enable them take precautionary actions that would ensure financial stability and protect the interest of all the stakeholders.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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APPENDIX

Appendix I. Results of the Regression Analysis

Linear regression

Number of obs	=	130	
F(5, 124)	=	61.70	
Prob > F	=	0.0000	
R-squared	=	0.8912	
Root MSE	=	.12636	

CAPITALADEQUACYRATIO~R	Coefficient	Robust std. err.	t	P>|t|	[95% conf.	interval]
CAPITALTOASSETSRATIOCA	-1.587678	.484255	-3.28	0.001	-2.546154	-.6292018
EQUITYTOASSETSRATIOEA	2.541151	.2937393	8.65	0.000	1.959759	3.122544
NPLRATIO	-.5477293	.1028397	-5.33	0.000	-.7512779	-.3441807
COSTTOINCOMERATIOCI	-.2372769	.0757842	-3.13	0.002	-.3872751	-.0872787
LOANSTOASSETSRATIOLA	-.0783434	.0842494	-0.93	0.354	-.2450965	.0884098
_cons	.3759357	.0957518	3.93	0.000	.1864161	.5654553

Appendix II. Results of the Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
EQUITYTOAS~A	4.18	0.239397
CAPITALTOA~A	3.94	0.253733
COSTTOINCO~I	1.30	0.767870
LOANSTOASS~A	1.25	0.800982
NPLRATIO	1.03	0.968485
Mean VIF	2.34	

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