The Nexus between Liquidity and Credit Risks and Their Impact on Bank Stability

Abstract

This study examines the nexus between liquidity and credit risks and their impact on bank stability in Nigeria. In order to achieve the research objectives, this study utilizes secondary data, which covers 12 Nigerian banks from 2010 to 2021. The Generalized Method of Moment (GMM) was estimated using the Arellano and Bond estimation technique. The results revealed that credit and liquidity risks negatively and significantly impacted bank stability individually and jointly in Nigeria. Furthermore, we deduced a positive correlation between credit and liquidity risks, with the correlation result statistically significant. Further investigation using the Pairwise Dumitrescu-Hurlin Panel Causality Tests indicated a one-way (uni-directional) causality from liquidity to credit risk. Further analysis showed that other internal bank-related indicators significantly impact bank performance. Bank Size, Equity, and Capital Adequacy positively and significantly impact bank performance. Likewise, macroeconomic indicators such as economic growth positively and significantly impact bank performance. In contrast, the inflation rate has a negative but insignificant impact on bank stability in Nigeria. Based on the findings, the study recommends joint management of credit and liquidity risks since a rise in liquidity risk will increase credit risk, resulting in bank instability. Thus, the results support bank regulation emphasizing the reduction of credit and liquidity risks in the banking sector since credit and liquidity risks have an attendant adverse effect on bank stability. The study will help bank managers balance liquidity, profit maximization, and risk minimization.

Keyword: Bank stability, Credit risk, Liquidity risk, Z-score

Introduction

The banking sector continues to be a significant driver of economic growth in any country. Moreover, globalization and the drive for global economic integration have reaffirmed banks' vital role in a country's economic growth (Abba et al., 2019). Banks promote economic growth by mobilizing financial resources from various sectors of the economy and channeling them into productive businesses through lending to investors and consumers. However, sustainable economic growth that positively impacts citizens' well-being requires a sound and stable financial system (Batayneh, 2021). In addition, the effects of the 2007-2009 global financial crisis, which led to the failure of banks worldwide, has revived policy measures that engender banking stability (Ghenimi et al., 2017). Banks, like other institutions, operate in an economic system fraught with risks and uncertainties. Therefore, a stable macroeconomic environment is critical for stability in the financial services sector (Didier & Schmukler, 2014; Tinoco Zermeño et al., 2018).

Over time, some studies have shown that lending leverages a bank's liquidity position, creating a strong link between liquidity, credit, and profitability. Nevertheless, granting loans and other financial assets may expose banks to liquidity risk. Although banks derive a significant proportion of their revenues from lending to deficit sectors of the economy, it is challenging to mitigate credit risk. Thus, the higher the exposure of a bank to credit risk, the higher the bank's tendency to experience financial crisis and vice-versa (Joshua & Oluoch, 2018). As identified by the Basel Committee, effective credit risk management will help banks increase profitability, contributes to financial system stability, and better allocate capital in the economy (Sang Tang My, 2022).

Bank failure may result from insufficient liquidity since it can damage the institution's reputation and erode depositor confidence (AL-Ardah & Al-Okdeh, 2022). Furthermore, insufficient liquidity may affect the performance and stability of banks, which is why the global financial crisis of 2007-2009 was also referred to as a liquidity crisis (Ahmad et al., 2019). Accordingly, Basle III (2013) specified banks' liquidity coverage ratio (LCR). This ratio requires all commercial banks to maintain sufficient liquid assets that will enable them to remain under market pressure for thirty days (AL-Ardah & Al-Okdeh, 2022). In order to effectively manage liquidity, Matis and Matis (2015) suggested the diversification of funding sources and longer average debt maturities.

In addition, the 2007-2009 global financial crisis demonstrated that market liquidity is an essential systematic risk globally, with severe impacts on banks' performance (Liang & Wei, 2012). The consequences of the crisis led to global tension in the financial sector. Moreover, inadequate liquidity in Nigeria has led to increased interbank rates and default risk, leading to

regulatory intervention in the banking sector. Therefore, to ensure the continued existence of banks, bank managers must balance liquidity, profit maximization, and risk minimization (Abwao, 2018).

The instability of banks in Nigeria dates back to the period between 1994 and 2003, and hence, a sudden wave of banking distress severely impacted the economy during the period (Abe, 2012). Afterward came different levels of banking distress in the country, negatively impacting bank employees, depositors, and the economy. Consequently, these continuing banking failures require prophylactic measures to stem the tide (Olaniyi & Olabisi, 2011). The CBN and the federal government have taken several measures to ensure the relative stability of the Nigerian financial system, including:

1. an increase in the capital base of banks from twenty billion naira to seventy-five billion naira,
2. the introduction of a risk-adjusted capital ratio, and
3. the commencement of risk-based audits.

To further support banks, the Federal Government established the Asset Management Corporation of Nigeria (AMCON) to take over banks' "*toxic assets*" or non-performing loans. This economic bail-out by AMCON provides banks with the liquidity and capital they need to strengthen their operations and position them for future success and stability (Owojori et al., 2011).

Several studies on credit and liquidity risks and their impact on banking stability showed inconsistency across countries. Some studies found a negative effect (Imbierowicz & Rauch, 2014; Mensi & Labidi, 2015; Hakimi & Zaghdoudi, 2017; Matey, 2021), while others were positive (Ghenimi et al., 2017; Setiawan et al., 2021; Siyanbola & Adebayo, 2021). Likewise, some studies have found no significant impact of risk on bank stability (Adusei, 2015; Tan, 2016). The divergent results provide the foundation for this study. Consequently, this study intends to achieve the following goals:

1. Assess whether liquidity and credit risk are interdependent.
2. Examine the relationship between liquidity risk and credit risk.
3. Determine whether credit risk and liquidity risk jointly contribute to bank stability.

This study offers two vital contributions to the existing literature on the nexus between liquidity and credit risk and its impact on bank stability. Firstly, this study adds to the body of knowledge regarding the relationship between liquidity and credit risks and how that relationship affects bank stability because the empirical findings are still controversial. Secondly, the paucity of studies on the impact of liquidity and credit risks on bank stability in Nigeria underscores the

relevance of this study. Thirdly, this study uses Z-score (Roy, 1952) to proxy bank stability as an index that adequately captures a bank's overall risks rather than the return on assets or equity.

The Concept of Liquidity Risk

Liquidity is the lifeline of any banking institution, and its unavailability will impact the smooth running of banking activities. Thus, liquidity is paramount for banks' efficiency, sustainability, and stability (Sekoni, 2015). As a result, a bank can be illiquid if it is not in a position to meet its maturing obligations without incurring a substantial loss. Therefore, liquidity measures the cash and other assets banks have at their disposal to quickly discharge their short-term trade and financial obligations as they mature. In other words, it is the ease with which a bank’s non-cash assets can be converted to cash to meet its maturing obligations with little or no loss.

The absence of liquidity is illiquidity, and if it persists over time, it may lead to the solvency and eventual liquidation of the bank. Hence, a bank should implement safeguards against the mismatch of maturities between its assets and liabilities. Nigerian banks must hold a minimum 30% liquidity ratio to avoid liquidity problems. Liquid assets are highly rated securities whose market value and liquidity do not decline during adverse market conditions. Some authors have identified different types of liquidity – central bank liquidity, market liquidity, and funding liquidity; however, this paper focuses on funding liquidity. Liquidity risk arises from an institution’s inability to purchase or otherwise obtain the necessary funds, either by increasing liabilities or converting assets, to meet on- and off-balance sheet obligations as they come due without incurring unacceptable losses (CBN, 2008).

The Concept of Credit Risk

Banks' financial dealings include interbank dealings, swaps, bonds, equities, options, foreign exchange trading, acceptances, and guarantees. All these activities expose banks to credit risk in the ordinary course of business; however, lending is the most prominent. The prominence of lending arises from the fact that for most banks, loans form the most significant proportion of their risk asset portfolio and hence a primary source of credit risk. Therefore, banks must create an appropriate framework to effectively manage the credit risks inherent in their risk asset portfolio. Interest on loans, no doubt, forms a substantial portion of banks’ earnings. In the same vein, exposure to credit risk also continues to be a leading concern for banks. Hence, the goal of credit risk management is to minimize risk and lift the risk-adjusted rates of return of the bank by assuming and retaining credit exposure within appropriate parameters (Kanchu & Kumar, 2013). Consequently, banks must adhere to the risk

management frameworks recommended from time to time by the Basel Committee to ensure long-term profitability and stability.

Credit risk is the probability that a borrower will not fulfill their contractual obligations on time and under the agreed terms. In other words, a borrower may default on paying back the amount borrowed when due (Rehman et al., 2019). Therefore, credit risk emanates from exposure to loss due to the borrower, counterparty, or an obligator's failure to honor the terms of the contract (CBN, 2008The ratio of non-performing loans to loans and advances is the proxy for credit risk in this study.

The Concept of Bank Stability

Although frequently used interchangeably, bank stability and profitability concepts are distinct. According to Pessarossi et al. (2020), profitability does not reduce the occurrence of bank distress. High profitability could predict banking distress over three to four years because the push for more profitability could expose the banks to credit and liquidity risks (Pessarossi et al., 2020). However, there is little proof that increased profitability causes a rise in bank distress.

Bank stability refers to the long-run survival of the bank. At the same time, profitability focuses on the return on investment per time without taking cognizance of the inherent risks in the firm’s operations (Bencharles & Nwankwo, 2021). This view aligns with the risk-return trade-off concept, which states that a higher return is associated with higher risk. Any bank making risky investments with the expectation of high profitability without adequate focus on risk management may be courting banking distress in the long run. According to Ozili (2019), banking stability refers to the ‘absence of abnormal disruption in credit supply, payment systems, and banking services. The stability of any bank will therefore hinge on its ability to put in place an efficient framework to manage all the inherent risks in its operations to sustain greater profitability in the long run.

Empirical Review

Extensive literature exists on the topic of risks and their impact on bank stability across the world, with mixed or different results. Diaconu and Oanea (2015) examined the factors affecting bank stability and discovered that the liquidity ratio impacts profitability. Similarly, they found that credit activity has a significant positive impact on profitability and a significant negative impact on stability. They also observed that higher profitability does not imply higher stability. Similarly, Setiawan et al. (2021) identified two fundamental risks affecting bank

stability: liquidity and credit risk. The results showed that credit risk had a negative impact on default probability while liquidity risk had a positive impact. In contrast, Matey (2021) found that liquidity risk had a statistically negative relationship with bank stability, emphasizing the need to invest in interest-earning securities to increase bank profitability and improve bank stability. On the other hand, credit risk revealed an insignificant negative relationship between credit risk and bank stability.

Imbierowicz and Rauch (2014) investigated the link between liquidity and credit risks and how it impacted banks' probability of default in the United States. The results showed no economically significant reciprocal contemporaneous or time-lag relationship between the two risk categories**.** Nevertheless, they influence banks' probability of default as both risks increase the probability of default separately. Moreover, Amara and Mabrouki (2019) found no statistically significant, contemporaneous, reciprocal, or time-lagged relationship between credit and liquidity risks**.** However, both risks separately affect bank stability, and their interaction contributes to bank instability. Similarly, Ghenimi et al. (2017) used a sample of some banks operating in the MENA region to analyze the relationship between credit and liquidity risks and their impact on bank stability. The findings revealed no economically significant reciprocal contemporaneous or time-lagged link between credit and liquidity risks. However, both risks separately influence bank stability, and their interaction contributes to bank instability.

Zaghdoudi (2019) examined the effects of risks on the stability of Tunisian banks and found a significant positive relationship between liquidity risk and bank stability. Although, credit risk has no significant impact on bank stability. However, the interaction of credit and liquidity risks significantly and negatively impacts bank stability. Likewise, Bencharles and Nwankwo (2021) examined the impact of credit risk on banks' stability using a sample of deposit money banks in Nigeria from 2009 to 2019. The results showed that, as measured by non-performing loans, credit risk had an insignificant negative relationship with bank stability.

Ahmad et al. (2019) examined the link between credit and liquidity risks and their impact on the financial performance of banking institutions in Pakistan. They found that the impact of credit and liquidity risks on bank performance is negative, increasing the tendency for bankruptcy. The results showed that credit risk and bank performance are inversely related, which implies that bank stability decreases as credit risk increases. Furthermore, the study found the influence of liquidity risk on bank stability to be negative and significant, indicating that banks with adequate liquidity are more stable than those with inadequate liquidity. Similarly, the impact of the interrelationship between credit and liquidity risks on bank stability was significantly negative. On the other hand, Didigu et al. (2022) found that the long-run impact of

liquidity ratio on banks' stability index was positive and significant. Also, the short-run effect of the liquidity ratio on bank stability was positive but insignificant.

Ejoh et al. (2014) observed a positive relationship between liquidity and credit risks. The study also found that liquidity risk and credit risk jointly contribute to bank default risk. In their study on bank stability determinants, Al Hussaini (2019) looked at the relationship between credit risk and financial stability and observed that credit risk significantly impacts financial stability. Furthermore, Siyanbola and Adebayo (2021) examined the effect of credit risk on the financial sustainability of banks in Nigeria. The result showed that credit risk management significantly and positively affects the financial sustainability of banks in Nigeria. Recently, Sang Tang My (2022) investigated the influence of credit risk on bank financial stability of Vietnamese commercial banks. The result revealed that credit risk positively impacts bank financial stability.

Adegbie and Adebanjo (2020) investigated the effect of credit risk management on Nigerian banks' performance, and the result showed a significant relationship between credit risk and bank stability. In a recent study to ascertain the effect of credit risk on bank stability in Vietnamese commercial banks, Anh and Phuong (2021) found that credit risk has a negative effect on bank stability. The results further re-emphasize commercial banks' need to improve credit risk management capacity.

Theoretical Framework

The theoretical framework for this study hinges, among others, on the following theories:

***Shiftability Theory*:** Developed by Harold G. Moulton in 1915, the theory states that a bank can meet its liquidity needs if it holds significant assets easily convertible to meet maturing financial obligations (Chinweoda et al., 2020). These assets can quickly be sold to other banks or investors for cash without waiting until maturity and with no material loss in asset value. In other words, these assets could be sold to the Central Bank or other financial institutions for cash instead of depending on maturing loans to solve their liquidity problems. This theory applies to short-term financial market instruments like Treasury Bills and Certificates.

***Liability Management Theory*:** The theory contends that banks can refrain from concentrating on granting self-liquidating loans or holding idle funds in liquid assets. The theory asserts that investing in liquid assets or focusing on short-term lending is irrelevant because banks can borrow from the money market when necessary. The banks should concentrate on increasing their deposit liabilities, borrowing from other commercial banks or the Central Bank, raising money by issuing shares, and reinvesting profits to meet their liquidity needs.

***Commercial Loan Theory*:** First propounded by Adam Smith in 1976, the theory states that a commercial bank should focus on providing short-term commercial lending to support entrepreneurs through a business cycle (Chinweoda et al., 2020). By financing short-term self-liquidating transactions that will mature within a short term, banks are well-positioned to meet their liquidity needs. In essence, banks should only create loans where the source of repayment is derived directly from the funds generated by the transactions financed by the loans. Consequently, these loans offer the bank liquidity and low credit risk.

Methodology

The study employed the analytical research design using the panel data econometrics analysis. For data analysis, the study used data obtained from the annual report and Factbook publications of the Nigerian stock market (obtained from www.nse.com.ng), the listed companies' annual financial statements, and the statistical bulletin of the Central Bank of Nigeria for 2021. The research data is a micro panel with a time interval of 2010 - 2021 and a cross-section of twelve banks.

Model specification

To accomplish the prime objective of this paper, we used the panel regression model from the study of Ahmad et al. (2019), which examined the nexus between credit risk and liquidity risk and their impact on bank financial performance of banking institutions in Pakistan from 2008 to 2018. This study broadens Ahmed et al. (2019) model to explore the impact of the independent variables on dependent variables over time using the following models:

$$Y_{it} = \alpha_i + \beta X_{it} + \lambda W_{it} + \delta Z_{it} + \mu_{it} \quad (1)$$

Y represents the dependent variable Bank stability of *i* bank cross-section, time-series *t* from 2010 through 2021; *αi* is the unobservable time-invariant effect of each variable that can decompose into fixed individual effect and random effect. X is a vector of explanatory variables, which includes Credit Risk (CR) and Liquidity Risk (LR). *W* represents other internal banking variables that may influence bank stability, and this includes Bank Size (BS), Capital Adequacy Ratio (CAR), and Equity. *Z* represents macroeconomic variables that may also affect bank stability, which include the Gross Domestic Product Growth Rate (GDPGR) and Inflation Rate (INFL). B, λ, δ are parameters that show the coefficients of the relationship, and μi is a random unobserved component that reflects unobserved shocks affecting bank stability. Explicitly, the model is stated as:

$$Y_{i,t} = \alpha_i + b_1 CR_{it} + b_2 LR_{it} + b_3 CAR_{it} + b_4 Equity_{it} + + b_5 Size_{it} + b_6 GDPGR_{it} + b_7 INFL_{it} + \epsilon_{i,t} \quad (2)$$

Where; α_i represents the individual cross-section unobserved latent variable, which could be fixed or random, and the stochastic term follows a two-way error component for the time interval and cross section given as:

$\epsilon_{it} = \mu_i + V_{it}$ (3)

μ_i and V_{it} are error components representing time interval and cross sections residuals.

The Wald test will be used to determine if credit risk and liquidity risk jointly impact bank stability. This is tested as follow;

$H_0: b_1 = b_2 = 0$ (Jointly Statistically Insignificant)

$H_1: b_1 = b_2 \neq 0$ (Jointly Statistically Significant)

According to financial literature such as Ahmad et al. (2019); Setiawan et al. (2021); Amara and Mabrouki (2019) amongst others, bank stability can be measured using the z score which is computed as;

$z\ score = \frac{(u+k)}{\sigma}$ (4)

Where; *u* is defined as bank asset which is measured in terms of Return on Assets (ROA). *K* is the capital ratio which is measured as equity as a percentage of total asset. σ represents volatility of returns which is measured as the standard deviation of ROA. An increase in the Z-score implies a better bank stability and thus the likelihood of bankruptcy decreases.

Liquidity Risk = Bank financing gap/Total Assets. Bank financing gap is the difference between bank loans and deposits of customers.

Credit risk = ratio of non-performing loans to total loans

The study carried out the dynamic panel analysis using Arellano and Bond's (1991) dynamic panel data estimation. In contrast to static panel data models, dynamic panel data models incorporate lagged levels of the dependent variable as regressors. The inclusion of a lagged dependent variable as a regressor violates strict exogeneity since the lagged dependent variable may be correlated with random effects or general errors (Baltagi, 2006).

$$\Delta Y_{it} = \alpha_i + \sum_{j=1}^{p-1} \beta_{ij}^{*} \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} \phi_{ij}^{*} \Delta X_{i,t-j} + u_{it} \quad (5)$$

Y_{it} (Represents Z-score) X_{it} is a k-dimensional vector of explanatory variables (credit risk, liquidity risk, bank size, capital adequacy ratio, equity, Gross Domestic Product Growth

Rate, Inflation Rate) for group i; α_i represent the time invariant effects; the coefficients of the lagged dependent variables, λ_{ij}, are scalars; and δ_{ij} are k dimensional coefficient vectors. In the following, we assume that the disturbances uit, *i = 1, 2, . . . ,N ; t = 1, 2, . . . , T,* are independently distributed across *i* and *t,* with zero means, variances σ^2_i, and are distributed independently of the regressors X_{it}.

Panel Causality Test

The Dumitrescu-Hurlin (DH) test will be used to test for causality. DH provides an extended test designed to detect causality in panel data. The underlying regression writes as follows:

$$Y_{i,t} = \propto_i + \sum_{K=1}^{K} \beta_{ik} Y_{i,t-k} + \sum_{K=1}^{K} \lambda_{ik} X_{i,t-k} + e_{i,t} \quad (6)$$

Where $X_{i,t}$ and $Y_{i,t}$ are the observations of two stationary variables for individual *i* in period *t*. Coefficients are allowed to differ across individuals (note the *i* subscripts attached to the coefficients) but are assumed time-invariant. The lag order *K* is assumed to be identical for all individuals and the panel must be balanced.

The procedure to determine the existence of causality is to test for significant effects of past values of *X* on the present value of *Y*.

The null hypothesis is therefore defined as:

H0 : $\lambda_{i1} = \lambda_{i2} = \ldots\ldots = \lambda_{ik} = 0$ $\forall$ I = 1,2,……..,N

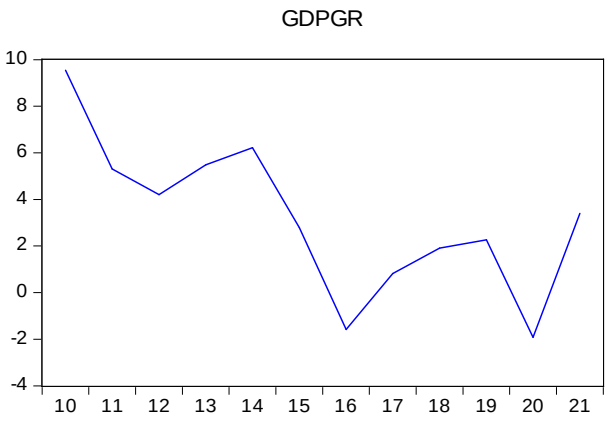
Which corresponds to the absence of causality for all individuals in the panel. The test assumes there can be causality for some individuals but not necessarily for all. The alternative hypothesis thus writes:

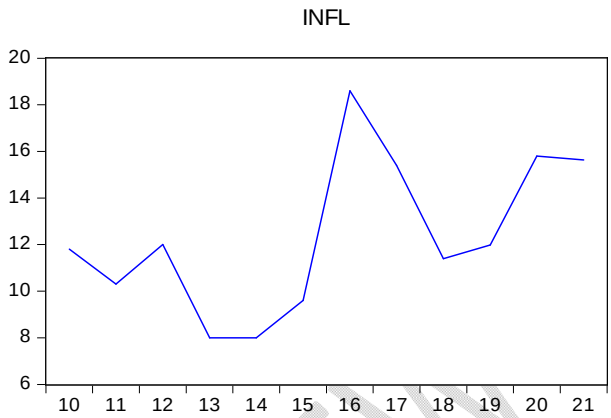
H1 : $\lambda_{i1} = \lambda_{i2} = \ldots\ldots = \lambda_{ik} \neq 0$ $\forall$ I = 1,2,……..,N

$\lambda_{i1} \neq 0$ or…….or $\lambda_{ik} \neq 0$ $\forall$ I = N_1 +1, ……..,N

Where, $N_1 \in [0;N-1]$ is unknown. If $N_1 = 0$, there is causality for all individuals in the panel. N_1 is strictly smaller than N, otherwise there is no causality for all individuals and H_1 reduces to H_0.

Data Analyses and Interpretation of Results





Graphical analyses were carried out in order to observe trends' flows in the variables under consideration.

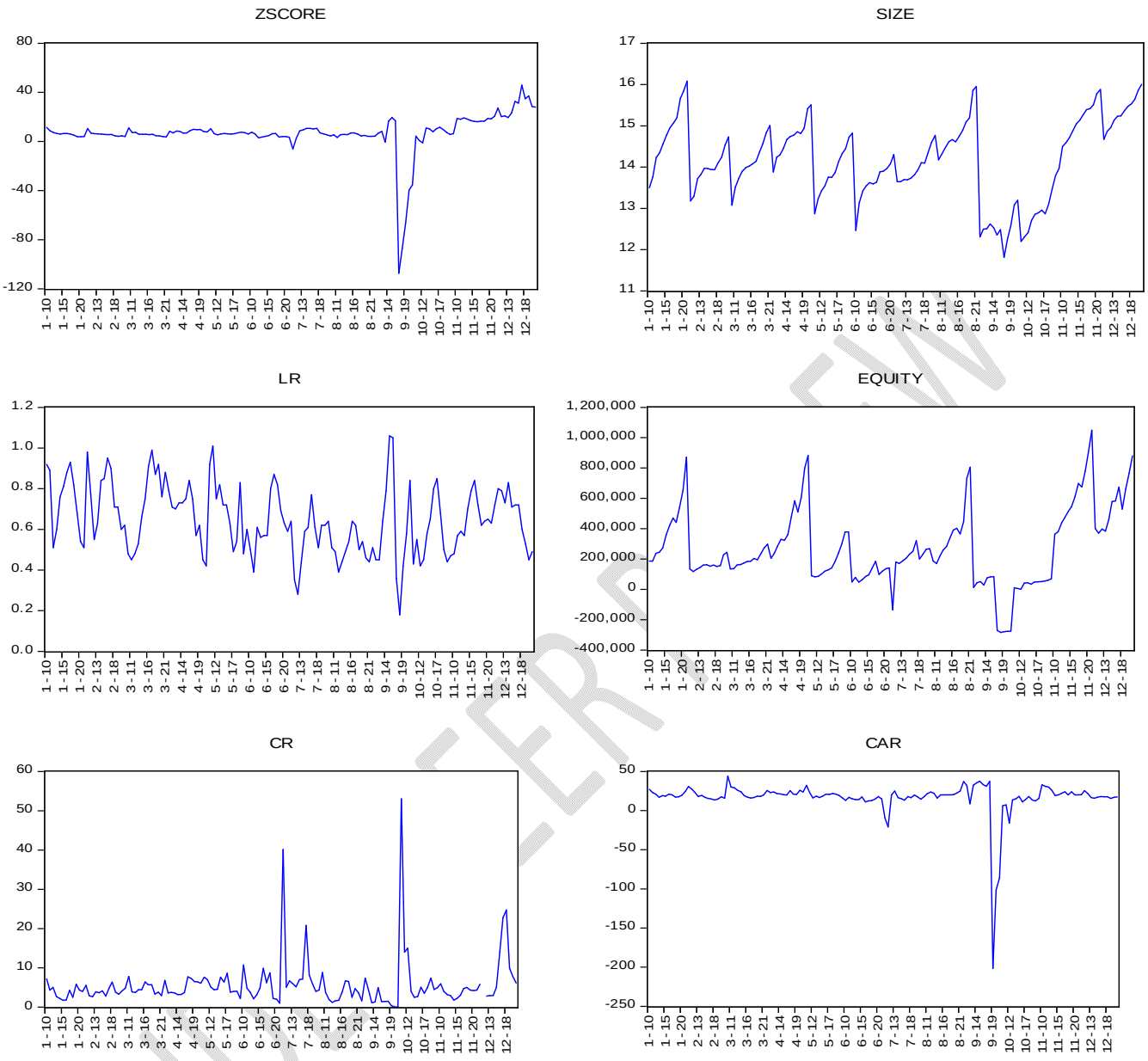


Figure 1: *Periodogram*

Graphically, the analysis showed that all the variables under study were volatile at one point or the other during the period under review. The volatility can be attributed to government policies and global financial events that would have affected some of the variables.

Descriptive Analysis

Variable	Mean	SD	CV	J-B
ZSCORE	6.747552	16.82585	4.020151	3389.897
SIZE	14.16305	0.969310	1.334179	2.753611***
LR	0.648881	0.169332	4.071621	1.681870***
EQUITY	268688.6	252096.2	9.021312	12.62884
CR	5.596014	6.141995	5.356823	6221.296
CAR	16.40350	24.09727	8.245637	16537.34
INFL	12.39035	3.207351	1.460768	7.683849
GDPGR	3.190280	3.146084	1.405494	1.355916***

Table 1: Descriptive Statistics

****** p < 0.001; ** p < 0.01; * p < 0.05***

Table 1 shows the descriptive statistics for the Z-score credit risk, liquidity risk, bank size, capital adequacy ratio, equity, Gross Domestic Product growth rate, and inflation rate, respectively. The first column shows the mean values for the variables and is all positive. The second column shows the standard deviations, while the third column shows the coefficient of variation, which shows the relative dispersion of the variables. It is possible to deduce from the coefficient of variation that Size has a slight variation than the other variables, followed by GDPGR and INFL. The coefficient of variation predicts the high degree of instability of Equity. The Jarque-Bera probability values in the fourth column are significant for GDPGR, LR, and Size, indicating that these variables follow a normal distribution.

Correlation Probability	ZSCORE	SIZE	LR	EQUITY	CR	CAR	INFL	GDPGR
ZSCORE	1.000000 -----							
SIZE	0.446122 0.0000	1.000000 -----						
LR	0.262095 0.0016	0.031722 0.7068	1.000000 -----					
EQUITY	0.557118 0.0000	0.889832 0.0000	0.003102 0.9707	1.000000 -----				
CR	0.165763 0.0479	-0.084704 0.3145	0.102901 0.0013	-0.016014 0.8494	1.000000 -----			
CAR	0.433274 0.0000	0.172029 0.0399	0.091580 0.2767	0.315829 0.0001	-0.006901 0.9348	1.000000 -----		
INFL	-0.048293 0.5668	0.233778 0.0050	0.124536 0.1384	0.230410 0.0056	0.065682 0.4357	-0.079075 0.3478	1.000000 -----	
GDPGR	0.067602 0.4224	-0.322598 0.0001	-0.108950 0.1952	-0.250370 0.0026	0.157478 0.0603	0.110683 0.1882	-0.689619 0.0000	1.000000 -----

Table 2: Correlation Analysis

The table shows the pairwise correlation between the variables. There is a significant positive association between the Z-score (bank stability) and size; Z-score and LR; Z-core and Equity; Z-score and CR; Z-core and CAR. There exist a positive but insignificant correlation between Z-score and GDPGR. There is a negative correlation between Z-score and inflation; however, the result is statistically insignificant. From the result, credit risk (CR) and liquidity risk (LR) are positively related. The relationship is statistically significant. The result implies that credit risk is independent of liquidity risk.

Relationship Between Credit Risk and Liquidity Risk

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
LR does not homogeneously cause CR	9.94280	11.8211	0.0000
CR does not homogeneously cause LR	2.04595	0.97145	0.3313

Table 3: ***Pairwise Dumitrescu Hurlin Panel***

From the causality test result, if can de deduced that Liquidity Risk (LR) causes Credit Risk (CR) as indicated from the low probability given as 0.0000. on the other hand, Credit Rsk does not cause Liquidity risk as indicated in the result.

This implies a one-way (uni directional)causality that runs from liquidity risk to credit risk.

Panel Test of stationarity

The unit root test is essential to determine the stationarity property of the variables used to carry out the panel data analysis. Panel unit root tests were conducted with Levin Lin Chu (LLC) and Breitung's test statistic. Using a multiple-unit root test allows for comparing the results of both tests to identify the actual stationarity property of the variables and avoid spurious regression.

Variable	LLC Statistic	Prob	Decision	IPS Statistics	Prob	Decision
ZSCORE	-2.71519	0.0032	I(0)	-4.38401	0.0000	I(0)
SIZE	-2.02608	0.0214	I(0)	-5.83892	0.0000	I(0)
LR	-4.94594	0.0000	I(0)	-4.08175	0.0000	I(0)
EQUITY	-2.30939	0.0105	I(0)	-4.32903	0.0000	I(0)
CR	-1.70736	0.0439	I(0)	-2.39773	0.0047	I(0)
CAR	-3.12090	0.0009	I(0)	-2.41458	0.0079	I(0)
INFL	-2.99242	0.0014	I(0)	-2.53255	0.0057	I(0)
GDPGR	-5.29956	0.0000	I(0)	-2.84688	0.0022	I(0)

Table 4: *Panel Unit Root Test*

From the unit root test, all the variables were stationary at all levels, as shown by LLC and IPS test statistics. The LLC and Breitung's unit root tests yield similar results for all the variables. All the variables are integrated at order zero, which implies that the variables were all stationary at level.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CR	-0.264357	0.143642	-1.840390	0.0481
LR	-22.18115	5.251887	-4.223463	0.0000
INFL	-0.398315	0.337813	-1.179100	0.2407
GDPGR	1.011249	0.389641	2.595334	0.0106
EQUITY	0.000102	1.18E-05	8.670334	0.0000
CAR	0.051634	0.003800	13.58567	0.0000
SIZE	6.950818	3.191423	2.177968	0.0313
C	-115.3869	44.77495	-2.577042	0.0112
Model Diagnostics				
R-squared	0.767158			
Adjusted R-squared	0.728987			
F-statistic	17.30281			
Prob(F-statistic)	0.000000			

Table 5: GMM Result - *Dependent Variable: ZSCORE*

The result presented the GMM analysis from Table 5, a unit increase in CR on average will lead to a 0.264357 unit decrease in Z-score (bank stability). The result is statistically significant at a 5 percent level of significance, as indicated by the probability value of 0.0481, which is lower than 0.05. A unit increase in LR on average will lead to a 22.18115 unit decrease in Z-score. The result is statistically significant at a 5 percent level of significance, as indicated by the probability value of 0.000, which is lower than 0.05. A unit increase in INFL on average will lead to a 0.398315 unit decrease in Z-score. However, the result is statistically insignificant at a 5 percent level of significance, as indicated by the probability value of 0.2407, which is higher than 0.05.

Furthermore, a unit increase in GDPGR on average will lead to a 1.011249 unit increase in Z-score. The result is statistically significant at a 5 percent level of significance, as indicated by the probability value of 0.0106, which is lower than 0.05. Also, a unit increase in Equity, CAR, and Size will lead to 0.000102, 0.051634, and 6.950818 increase in Z-score. The variables are statistically significant due to their low probability value. In the same vein, the coefficient of determination (R^2) shows that 76% of the variations in bank stability are explained by the explanatory variables in the model, which is above 50%. Moreover, even after taking into consideration the degree of freedom, the adjusted coefficient of determination (adjusted R^2) still shows that a 72% variation in bank stability is explained by the explanatory variables. The F-statistic 17.30281 (0.000000) confirmed the fitness of the coefficient of the model and shows an overall significant level of the explanatory variables jointly in explaining bank stability.

Joint impact of Credit and Liquidity Risks

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	10.44922	(2, 122)	0.0001
Chi-square	20.89844	2	0.0000

Null Hypothesis: C(2) = C(1) = 0

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-22.18115	5.251887
C(1)	-0.264357	0.143642

Restrictions are linear in coefficients.

Table 6: ***Wald test for joint significance of Credit Risk and Liquidity Risk***

From Table 6, the result showed that credit risk and liquidity risk jointly impact bank stability in Nigeria. The Wald test statistics and its probability show that the result is significant, which implies that both credit and liquidity risks jointly impact bank stability negatively.

Conclusion and Recommendations

The primary objective of this study is to analyse the impact of credit and liquidity risks on bank stability in Nigeria. The various econometrics analyses from this study revealed that credit and liquidity risks negatively and significantly impact bank stability individually and jointly in Nigeria. The results are consistent with previous studies such as Ahmad et al. (2019), Setiawan et al. (2021), and Amara and Mabrouki (2019), who also observed a negative and significant impact of credit and liquidity risks on bank stability.

Moreover, we deduced a positive correlation between credit and liquidity risks, with the correlation result statistically significant. Further investigation using the Pairwise Dumitrescu Hurlin Panel Causality Tests indicated a one-way (unidirectional) causality from liquidity to credit risk. This study, therefore, provides evidence that there is a link between liquidity risk and credit risk, such that liquidity risk causes credit risk in Nigeria. The findings are consistent with the study of Zaghdoudi (2019), who also observed some relationship between credit risk and liquidity risk in Tunisia. However, other studies like Imbierowicz and Rauch (2014)**,** Amara and Mabrouki (2019) Ghenimi et al. (2017) could not find any economically deduced relationship between credit risk and liquidity risk.

Further analysis showed that other internal bank-related indicators significantly impact bank stability. Bank Size, Equity, and Capital Adequacy positively and significantly impact bank stability. Likewise, macroeconomic indicators such as economic growth positively and significantly impact bank stability. In contrast, the inflation rate has a negative but insignificant impact on bank stability in Nigeria.

Based on the findings, the study recommends that regulatory authorities direct banks to have a robust risk management framework that focuses on reducing credit and liquidity risk in the banking sector. Furthermore, bank managers should closely monitor and control critical financial indicators such as capital adequacy, size, and equity to improve bank stability. Additionally, the Central Bank should implement policy measures that will help achieve moderate inflation rates consistent with economic growth and development.

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