

## Effect of Liquidity Risk on the Financial Performance of Listed Deposit Money Banks in Nigeria

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### Abstract

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This study investigates the effect of liquidity risk on the performance of listed deposit money banks in Nigeria. The research adopts ex post facto research design. The target population comprised of the 13 deposit money banks listed on the Nigeria Exchange Limited (NGX) between 2006 - 2021. Secondary data was collected from the audited annual reports of the listed deposit money banks and the Central Bank of Nigeria. The study measure liquidity using loan-to-deposit-ratio, loan to assets ratio, and cash reserve ratio on the financial performance of listed deposit money banks in Nigeria. The study measured financial performance using return on equity (ROE) while panel data analysis technique and OLS method was used to analyse the data with the aid of STATA Version 15. The result of the study revealed that, loan to asset ratio and cash reserve ratio have significant positive effect on return on equity of listed deposit money banks in the long-run and short-run. However, loan-to-deposit-ratio was not significant. The study concluded that loan to asset ratio and cash reserve ratio had a positive and significant effect on the financial performance of listed deposit money banks in Nigeria. Amongst others, the study recommended that, listed deposit money banks should identify and maintain optimal levels of cash reserve to gauge against unanticipated medium to long-term liquidity funding to maximize their profitability.

**Keywords:** *Liquidity risk, Loan-to-deposit-ratio, Loan to asset ratio, Cash reserve ratio, Return on equity, and Financial performance.*

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### **Background to the Study**

The main role of banks in the financial system is to provide liquidity through intermediation. Banks intermediate between depositors and investors and provide loans to borrowers which are funded with liquid deposits from the depositors. In performing this role, banks transform short maturities into longer maturities in order to create funding liquidity for investors and to promote the efficient allocation of resources in the system (Musembi et al., 2016). This leaves the banks exposed to the risk of maturity mismatch. This mismatch can cause instability in the bank in its role as provider of liquidity upon demand to depositors, through deposit transactions, or borrowers, through committed lines of credit (Musembi et al., 2016). Therefore, liquidity risk arises from the fundamental role of banks in the maturity transformation of short-term deposits into long term loans. It is the inability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses (Musembi et al., 2016).

Liquidity risk and bank performance are key factors in determining the development, survival, sustainability, growth and performance of a banking system and the ability to handle the trade-off between the two is a source of concern for bank managers (Edem, 2017). For instance, banks make loans that cannot be sold quickly at a high price and also issue demand deposits that allow depositors to withdraw at any time (Edem, 2017). Such a mismatch of liquidity, in which a bank's liabilities are more liquid than its assets, causes problems for banks when too many depositors attempt to withdraw at the same time as it affects bank liquidity position (Edem, 2017). Many banks have investment in safe and high yielding illiquid assets but are tied up in loans. Some banks despite having a lot of assets, the sudden withdrawals, and the lack of liquid funds lead to a huge loss as a result of taking out emergency loans. This, alongside with inability to make adequate profit, have been identified as the major cause of bank failures (Edem, 2017).

The attempts by bank managers to increase return tend to have negative impact on liquidity which might be dangerous to the banks as this can lead to loss of bank's patronage, goodwill, deterioration of bank's credit standings and might lead to forced liquidation of bank's assets on one hand and maintaining excess liquidity to satisfy customers' demands might affect the returns on the other hand (Edem, 2017). The mistakes in liquidity planning and implementation can affect bank operations and might exhibit long term effect on the economy. Profitability does not translate to liquidity in all cases. A bank may be profitable without necessarily being liquid. So, liquidity risk should be managed in order to obtain an optimal level that avoids excess liquidity. At the same time liquidity level should not fall below minimum requirement as it will lead to the inability of the organization to meet short term obligation that are due (Edem, 2017). Consequently, this research investigates the effect of liquidity risk on the return on the performance of deposit money banks in Nigeria.

The hypothesis that would be tested in this study are stated in their null forms:

**H<sub>0,1</sub>:** Loan-to-deposit-ratio has no significant effect on financial performance of listed deposit money banks in Nigeria.

**H<sub>0,2</sub>:** Loan to asset ratio has no significant effect on financial performance of listed deposit money banks in Nigeria.

**H0<sub>3</sub>:** Cash reserve ratio has no significant effect on financial performance of listed deposit money banks in Nigeria.

## **Literature Review**

### **Concept of Liquidity Risk**

The liquidity risk of banks arises from funding of long-term assets by short-term liabilities, thereby making the liabilities subject to rollover or refinancing risk. Liquidity risk refers to the risk that the institution might not be in position to generate sufficient cash flow to make payment, withdrawal and other financial obligations in time (Edem, 2017). Liquidity risk in DMBs is basically the risk of being unable to either meet their obligations to depositors or to fund increases in assets as they fall due without incurring unacceptable costs or losses. It indicates the ability of the bank to deal with deposit withdrawals and loan demands (Million et al., 2014). The higher amount of loans against per dollar deposit increases bank liquidity risk (Samad, 2015). Liquidity risk is the possibility of negative effects on the interests of owners, customers and other stakeholders of the financial institution resulting from the inability to meet current cash obligations in a timely and cost-efficient manner. Liquidity risk usually arises from management's inability to adequately anticipate and plan for changes in funding sources and cash needs. Efficient liquidity management requires maintaining sufficient cash reserves on hand while also investing as many funds as possible to maximize earnings (Ogol, 2011).

CBN (2014) opined that liquidity risk arises when cash cannot be realized in a timely and economic fashion to meet any and all forecast and unpredictable flows. This type of risk arises from the type and nature of the asset and liability mix or bank liquidity. In the financial sector, DMBs routinely experience mismatch between their asset and liabilities during intermediation. This occurs when banks take funds on short-term deposit (liabilities), pool them together, and lend them on longer maturity (loans). The risk here is the lack of certainty concerning a bank's capacity to meet its commitments as they occur. Liquidity risk can also emanate from conditions in which an assets holder wants to sell his assets, but is unable to do so, because he cannot get buyer on those assets. More precisely, this type of risk stems from the lack of marketability of an asset that cannot be purchased or sold fast enough to prevent or minimize a loss. Liquidity risk can harm the financial position of the bank. So, the administrator of the bank has the priorities to ensure the availability of the funds at a reasonable cost to fulfill the unanticipated demand of borrower and investors. The performance and reputation of the bank are affected by liquidity risk. Accountholder maybe fails to keep the confidence on banks when the bank does not supply the amount on time. The bank should have to pay the penalties as per the regulation entail. High liquidity risks deter the banks ability to meet its liabilities, which in turn affects the creditworthiness of the banks, banks lose their customers and start defaulting, and hence it exacerbates the financial crisis of the bank (Naseem, 2021).

A DMB has adequate liquidity potential when it can obtain needed funds (by increasing liabilities, securitising, or selling assets) promptly and at a reasonable cost. Liquidity risk is considered the main risk in deposit money banks. Generally, a bank's liabilities include all the

banks sources of funds (Greuning & Bratanovic, 2020). Efficient liquidity risk requires maintaining sufficient cash reserves on hand while also investing as many funds as possible to maximize earnings (Greuning & Bratanovic, 2020).

### **Loan-to-Deposit-Ratio (LDR)**

Loan to deposit ratio (LDR) or Liquidity level is measured as total loans relative to the total liabilities. A higher ratio means less liquidity position which may affect bank lending while a lower ratio signifies good liquidity position which enables banks to lend and invest. Loan to deposit ratio measure of liquidity risk has been criticised for ignoring quality and maturity of bank assets and for treating bank assets as having equal degree of maturity. Recently, financial analysts argued that off balance sheet funding which offers better benefits have made loan to deposit ratio of liquidity measure unpopular. Other forms of loan ratios include loan to liabilities, Loan losses to net loans and reserve for loan losses to net loans (Musembi et al., 2016; Edem, 2017; Ebenezer et al., 2019).

### **Loan to Asset Ratio (LTR)**

Loan to total asset ratio (LTR) measures the exposure level of the banks to liquidity risk, it is thus a liquidity risk variable. The loans to assets ratio measure the total loans outstanding as a percentage of total assets. The higher this ratio indicates a bank is loaned up and its liquidity is low. The higher the ratio, the more risky a bank may be to higher defaults (Isedu & Erhabor, 2021). Banks that have a relatively higher loan-to-assets ratio derive more of their income from loans and investments, while banks with lower levels of loans-to-assets ratios derive a relatively larger portion of their total incomes from more-diversified, noninterest-earning sources, such as asset management or trading. Banks with lower loan-to-assets ratios may fare better when interest rates are low, or credit is tight. They may also fare better during economic downturns (Erhabor & Ofiafoh, 2020). Loans are larger percentage of interest earning asset of a bank. Therefore, when the LTR ratio increases, a bank's profits increases. On the other hand, a bank liquidity risk increases when LTR ratio increases. In other words, banks with higher loan to total asset ratio have high exposure to liquidity risk (Isedu & Erhabor, 2021).

### **Cash Reserve Ratio (CRR)**

Cash reserved to total deposits ratio is another measure of bank liquidity risk. It has advantage over other variables in that the liquid assets are directly related to deposits rather than to loans and advances which form the most illiquid of banks assets. Cash reserve ratio is particularly effective for sterilizing excess liquidity at the banking system as it can be effectively monitored by the regulatory authorities (Edem, 2017). The main measures of liquidity risk in Nigeria are the cash reserve ratio (CRR), the loan to deposit ratio (LDR) and the loan to total asset ratio (LTR). These are also called liquidity ratio (LR). Hence, these three variables are included in the measuring variables to further appreciate their effect on financial risks of deposit money banks (Isedu & Erhabor, 2021). However, the problem of cash reserve ratio is that a significant part of the cash assets is not available for financing of liquid assets (Edem, 2017).

### **Concept of Financial Performance**

Financial performance is used as a general measure of a firm's overall financial status over a given period of time. The financial performance is measured using accounting key performance indicators such as return on assets, return on equity, earnings before interest and tax, and economic value added. The advantage of these measurements is their general availability, since every profit-oriented organization produces these figures for their yearly financial statements (Chenhall & Langfield-Smith, 2007). This study adopted the use of return on equity (ROE) as an indication of a firm's overall financial health (Bodie et al., 2011).

ROE is commonly used to measure the profitability of banks. ROE represents the rate of return received from equity invested in banks. It is the amount of net income returned as a percentage of shareholders equity. ROE measures profitability by revealing how much profit a bank can generate with shareholders' investment. Thus, ROE measures how much the bank is earning on their equity investment. In general, financial analysts consider return on equity ratios in the 15 - 20% range as representing attractive levels of investment quality (Richard, 2015). ROE also hinges on the capital management activities. If the banks use capital more efficiently, they will have a better financial leverage and consequently a higher ROE. Because a higher financial leverage multiplier indicates that banks can leverage on a smaller base of stakeholder's fund and produce higher interest-bearing assets leading to the optimization of earnings (Hosna, et al 2009).

The reasons for the growing popularity of ROE is, simply that it is not asset-dependent. ROE can be applied to any line of business or any product. This flexibility allows deposit money banks with differing asset structures to be compared to each other, or even for banks to be compared to other types of businesses. The asset-independency of ROE also allows a bank to compare internal product line performance to each other. Perhaps most importantly, this permit looking at the comparative profitability of lines of business-like deposit services (Hosna et al., 2009).

### **Empirical Review**

#### **Liquidity Risk and Financial Performance**

Ahmed and Nauman (2012) analyzed liquidity risk and performance of banking system in Pakistani banks. Data was obtained from the financial reports of twenty-two (22) Pakistani banks during 2004 to 2009. The study uses multiple regressions analysis to assess the impact of liquidity risk on banks' profitability. Deposits, cash, liquidity gap and non-performing loans, (NPLs) were considered as the independent variables regressed with profitability proxied by ROE and ROA as the dependent variable. Multiple regressions result showed that liquidity risk affects bank profitability significantly, with liquidity gap and non-performing loan as the two factors exacerbating the liquidity risk as they have a negative relationship with profitability. The study recommended that contemporary risk managers should mitigate liquidity risk by having sufficient cash resources to reduce the liquidity gap and dependence on repo market and that economic factors contributing to liquidity risk should be considered for further studies. However, the study fails to delve into the effect of net stable funding on the financial performance of Nigerian banks. This study takes care of this critical omission in their study.



Tabari et al. (2013), examine the impact of liquidity risk on the performance of 15 commercial banks in Iran from 2003 to 2010. A multiple regression model with two macroeconomic variables - gross domestic product and inflation, and bank-specific variables - bank's size and bank's asset, credit risk (non- performing loans ratio) and liquidity risk (current ratio) was used as independent variable for the study. The dependent variables are return on assets (ROA) and return on equity (ROE). Their study results show that gross domestic product, inflation, bank's size and bank's asset have a positive effect on the performance of banks. However, both the credit risk (non- performing loans ratio) as well as the liquidity risk (current ratio) have negative impact on the performance of banks. The result of their finding shows that, liquidity risk has led to a decline in the performance of selected banks in Iran during the period of the study. Tabari et al. (2013) study excluded critical liquidity risk variables such as liquidity coverage ratio which is a key determinant of liquidity risk in the banking sector. This current study incorporates these variables to further examine their effect on ROE.

Musembi et al. (2016), examined effect of liquidity risk determinants on the financial performance of commercial banks listed at the Nairobi Securities Exchange. The research used a descriptive survey research design. The target population comprised 11 listed commercial banks. The study made use of primary and secondary data. A questionnaire was used to collect the primary data. A sample of 42 members of the assets and liabilities management committee was used. Secondary data was obtained from the bank's annual reports. Stratified sampling technique was used to select members of the sample. The bank performance was proxied by return on asset (ROA). While the liquidity risk was proxied by liquidity level (LIQ) and capital adequacy (CAR). The study findings indicated that capital adequacy and liquidity levels have significant positive effect on return on assets for commercial banks listed on the Nairobi Securities Exchange.

Edem (2017), investigated liquidity risk and performance of deposit money banks in Nigeria. The study involve the 24 deposit money banks from 1986 to 2011. Secondary data were collected and analysed using SPSS. The study uses descriptive, correlations and inferential statistics. Bank performance in terms of profitability is measured by its return on equity (ROE). While liquidity risk was proxied by liquidity ratio, loan to total deposit ratio and cash reserve ratio. The formulated model was tested using multiple linear regression analysis. Findings showed that, there is a significant relationship between liquidity risk and the performance of deposit money banks in Nigeria. Furthermore, there is a positive impact between return on equity and liquidity risk variables, whereas loan to deposit ratio shows negative impact. However, the key results indicate that only the banks with optimum liquidity were able to maximize returns.

Muriithi and Waweru (2017), examined liquidity risk and financial performance of commercial banks in Kenya. Their study consists of 43 commercial banks over 10-years from 2005 to 2014. Liquidity risk was measured by liquidity coverage ratio (LCR) and net stable funding ratio (NSFR) while financial performance by return on equity (ROE). Secondary data was obtained from commercial banks' financial statement. The study used quantitative research design. Panel data techniques of random effects estimation and generalized method

of moments (GMM) were used to purge time-invariant unobserved firm specific effects and to mitigate potential endogeneity problems. Findings indicate that NSFR is negatively associated with bank profitability both in long run and short run while LCR does not significantly influence the financial performance of commercial banks in Kenya both in long-run and short-run. However, the overall effect was that liquidity risk has a negative effect on financial performance of commercial banks in Kenya. It is therefore recommended for bank's management to pay the required attention to the liquidity risk management. Muriithi and Waweru's study use robust proxy variables of liquidity risk and the GMM method is plausible but provided conflicting results. The current study employed common variables and wider scope to assess and compare the results of the study.

Ebenezer et al. (2019), studied the effects of liquidity risk and interest-rate risk on profitability and firm value among banks in ASEAN-5 Countries. Panel data estimation technique was employed in the study based on secondary data extracted from 63 commercial banks in ASEAN-5 countries over 9-years period from 2009 to 2017. The performance indicators are return on asset (ROA) and return on equity (ROE) while firm value (FV) is proxied by ratio of enterprise value-to-operating performance (EV/EBITDA). The independent variables are liquidity risk measured by loan to deposit ratio (LD) and liquid asset to total asset (LATA) of bank, while interest-rate risk is measured by net interest margin (NIM) and asset interest yield ratio (AIY). Control-variables includes bank size (SIZE), GDP growth and inflation (INFL). Findings revealed that, liquidity risk have a negative significant effect on ROE, positive significant impact on ROA, while the interest rate risk have a positive significant effect on ROE, significant negative effect on ROA and FV, bank size have a significant negative effect on ROE, FV and ROA while inflation rate have a positive significant impact on return on equity and ROA. They recommended on the need for banks to adhere to prudential and regulatory guidelines and ensure corporate management with respect to liquidity exposure that is capable of critically affecting banks profitability and firm value.

Madhuwanthi and Morawakage (2019), assessed the effect of liquidity risk on the performance of commercial banks in Sri Lanka. They analyze six systemically important banks, which include two (2) state banks and four (4) largest domestic private commercial banks, out of the existing 26 commercial banks from 2006 to 2016. The annual financial statements of the selected commercial banks are the source of secondary data used for their study. The nature of data is panel data, and the researchers developed the cross-sections and annual time series data into balanced panel data. Deposits to total assets (DTA), cash reserves to total assets (CRTA), liquidity gap (LG), non-performing loan ratio (NPLR) are proxies for liquidity risk, while return on average assets (ROAA), return on average equity (ROAE), net income (NI) and net interest margin (NIM) are proxies for the performances of banks. NIM is a top line performance, and the balance represents the bottom-line performance. The researchers run the panel multiple regression with the generalized least square (GLS) estimation technique using E-views and STATA software. The researchers find that liquidity gap and non-performing loan ratio are the significant proxies for liquidity risk and that liquidity risk negatively and significantly affects bottom lines return on average assets (ROAA) and return on average equity (ROAE), while positively affects the top line performances which

is measured by net interest margin (NIM) of the commercial banks. They recommended that; expenses of the banks should be properly controlled with better liquidity management to enhance bottom line performances.

Oganda et al. (2020), evaluated effect of liquidity risk on the financial performance of commercial banks in Kenya. The study adopted a correlational research design with a comparative analysis approach which is quantitative in nature and utilized panel data for 10-years from 2007 to 2016. Secondary data was obtained from two commercial bank's annual reports. Data analysis was conducted using both descriptive and inferential statistics. SPSS version 21 software was used to analyse the data and STATA version 11 software was used to test for stationarity. The bank performance was proxied by return on assets (ROA). While bank liquidity risk was proxied by customer deposits and total assets. Findings indicate a statistically significant negative relationship between customer deposits and performance of commercial banks in Kenya and as customer deposits increase, profitability decreases. While asset base had a positive relationship. They recommended that commercial banks should be aggressive in identifying viable ways to invest the customers' deposits to generate.

## **Theoretical Framework**

### **Shiftability Theory of Liquidity**

The shiftability theory was formally developed by Moulton (1918), and the theory held that deposit money banks could most effectively protect themselves against massive deposit withdrawals by holding, as a form of liquidity reserve, credit instruments for which there existed a ready secondary market. The theory is based on the proposition that deposit money banks liquidity is maintained if it holds assets that could be shifted or sold to other lenders or investors for cash. Also, these assets could be shifted to the central bank for cash without material loss in case of necessity than relying on maturities to solve their liquidity problems (Ngwu, 2006). This theory assumes that assets need not be tied on only self-liquidating bills, but also held in other shiftable open-market assets, such as government security. The thrust of the shiftability theory holds that the liquidity of a bank depends on its ability to shift its assets to someone else at a predictable price. Thus, for example, it would be quite acceptable for a bank to hold short-term open market investments in its portfolio of assets (Moti et al., 2012).

According to Hosna et al. (2009), that shiftability theory had a profound effect on banking practices can hardly be denied. What it did, basically was to redirect the attention of bankers and the banking authorities from loans to investments as a source of bank liquidity. This theory posits that a deposit money bank's liquidity is maintained if it holds assets that could be shifted or sold to other lenders or investors for cash. This point of view contends that a bank's liquidity could be enhanced if it always has assets to sell and provided the Central Bank and the discount market stands ready to purchase the asset offered for discount. Thus, this theory recognizes and contends that shiftability, marketability or transferability of a deposit money bank's assets is a basis for ensuring liquidity. This theory further contends that highly marketable security held by a bank is an excellent source of liquidity.



### **Finance Distress Theory**

Baldwin and Mason (1983) stated that when a firm's business deteriorates to the point where it cannot meet its financial obligation, the firm is said to have entered the state of financial distress. The first signals of financial distress are violations of debt payments and failure or reduction of dividends pay-outs. Whitaker (1999) defines entry in financial distress as the first year in which cashflows are less than current maturities' long-term debt. The firm has enough to pay its creditors as long as the cashflows exceeds the current debt obligations. The key factor in identifying firms in financial distress is their inability to meet contractual debt obligations. However, substantial financial distress effects are incurred well prior to default. Wruck (1990) stated that firms enter into financial distress as a result of economic distress, declines in their performance and poor management especially on risks. Boritz (1991) depicts a process of a financial distress that begins with an incubation period characterized by a set of bad economic conditions and poor management which commits costly mistakes. In the case of deposit money banks, inability to provide cash to depositors and loans to borrowers as and when demanded may constitute a liquidity crisis. Other creditors also need to be taken into account when firms are putting in place risk management measures. Credit risks in banks also need to be addressed since it may lead to financial distress. Loan portfolio management is an important determinant of the firm's liquidity. The deposit money banks should manage the credit and liquidity risk in order to avoid financial distress.

### **Methodology**

This study adopted the ex-post facto research design. The population of this study comprised of all the thirteen (13) DMBs listed on the floor of the Nigerian Exchange Limited (NGX) as of December 31, 2021 (CBN, 2022). These thirteen (13) DMBs are currently trading on the floors of the NGX. The data obtained covered the period of 16 years from 2006 to 2021 post consolidation period. Hence, the expected financial year observation is 208 (i.e.,  $13 \times 16 = 208$ ). This study employed secondary data which were sourced from the audited annual financial statement and reports of the listed DMBs and Nigerian Exchange Limited (NGX). The Panel data was employed because it helps to study the behaviour of each bank over time and across space (Gil-García & Puron-Cid, 2013). The balanced panel data collected was analysed quantitatively using panel data analysis technique. The specified static panel regression model is essentially estimated using the pooled regression method, fixed effects (FE) method or random effects (RE) method using the Hausman specification test to decide the appropriateness between fixed and random effects that best fits the panel regression data. The short run model was estimated using Generalized Method of Moments (GMM) estimator to check the dynamism and how the performance of the immediate previous period affects the current period performance. The formulated model was then estimated using the ordinary least squares (OLS) and panel data analysis technique. The statistical tool for analysis was done using STATA Version 15 software.

The functional form of the model for the study is presented below:

$$\text{ROE} = f(\text{LDR}, \text{LTR}, \text{CRR}) \quad (1)$$

Upon linearization and parametrization the long run model for functional form (1) was specified as:

$$ROE_{it} = \lambda_0 + \lambda_1 LDR_{it} + \lambda_2 LTR_{it} + \lambda_3 CRR_{it} + \theta_i + \varepsilon_{it} \quad (2)$$

And the short run model as:

$$ROE_{it} = \lambda_0 + \beta ROE_{it-1} + \lambda_1 LDR_{it} + \lambda_2 LTR_{it} + \lambda_3 CRR_{it} + \theta_i + \varepsilon_{it} \quad (3)$$

In which  $ROE_{it}$  represents the performance of bank  $i$  at time  $t$ ,  $\lambda_0$  stands for the model constant or intercept,  $\lambda_1$  stands for the coefficients of the independent variables.  $ROE_{it-1}$  is lagged bank performance,  $LDR_{it}$  is the loan to deposit ratio of bank  $i$  at time  $t$ ,  $LTR_{it}$  is the loan to asset ratio of bank  $i$  at time  $t$ , and  $CRR_{it}$  is the cash reserve ratio of bank  $i$  at time  $t$ .  $\theta_i$  is the bank specific effect that is assumed to be normally distributed with a constant variance.  $\varepsilon_{it}$  is the error term which is assumed to have a normal distribution.

**Table 1:** Measurement of Variables

Variable	Proxy	Measurement	Source	Study replicate
Financial performance	Return on equity (ROE)	<u>Net income</u> Total equity capital	Annual financial reports of DMBs	Muriithi & Waweru (2017), Edem (2017), Tabari et al. (2017)
Liquidity risk	Loan-to-deposit-ratio (LDR)	<u>Total loan</u> Total deposit	Annual financial reports of DMBs	Ebenezer et al. (2019), Gambo et al. (2019), Fadun and Oye (2020).
	Loan to asset ratio (LTR).	<u>Total loan</u> Total asset	Annual financial reports of DMBs	Muraina (2018), Erhabor and Ofiafoh (2020).
	Cash Reserve Ratio (CRR)	<u>Cash reserve</u> Total deposit	Annual financial reports of DMBs	Mukolu and Adeleke (2020), Isedu and Erhabor (2021).

**Source:** Author's Compilation, 2023.

## Results and Discussions

This section presents the results of the various statistical analyses carried out to achieve the purpose of this study. While descriptive statistics reveal mean, standard deviation, minimum and maximum values of all variables of the study, the correlation analysis and unit root test seek to find the nature of relationship and stationarity of the variables. The panel data and OLS analyses depict the impact of each of the explanatory variables on DMBs' financial performance (Measured by return on assets ROE) in Nigeria.

### Descriptive Statistics

Descriptive statistics is the term given for the analysis of data that helps describe, show or summarize data in a meaningful way such that, for example, patterns might emerge from the data. The result of the descriptive statistics for this study is presented in table 2 below:

**Table 2:** Descriptive Statistics

Variable	Mean	Std. Dev.	Min.	Max.
ROE	8.52	39.36	-358.57	122.19
LDR	62.37	40.92	0.07	575.96
LTR	38.11	11.21	0.10	60.70
CRR	27.56	33.77	0.00	406.77

**Source:** STATA Output, 2023.

The descriptive statistics of all variables used in this study are presented in Table 2. This summarizes the data used, mean as a measure of central tendency and standard deviation, minimum and maximum as a measure of variability. The mean value of return on equity for the period is 8.52; this shows average return on equity value of the deposit money banks for the period, while the standard deviation is 39.36%. This suggests that the value for return on equity from 2006 to 2021 varies across the deposit money banks with a standard deviation figure of 39.36. The maximum value is 22.19 and the minimum value is -358.57. The higher standards deviation value and the wide variation in the minimum and maximum values show significant differences in financial performance (ROE) between the deposit money banks in this study. The First predictor variable loan to deposit ratio (LDR) showed a mean value of 62.37 and a standard deviation of 40.92. The minimum percentage of LDR is 0.07 against a maximum value of 575.96. The second predictor variable loan to asset ratio (LTR) showed a mean value of 38.11 and a standard deviation of 11.21. The minimum percentage of loan to asset ratio is 0.10 against a maximum value of 60.70. The third and last predictor variable cash reserve ratio (CRR) which is measured gave 0.00 and 406.77 as minimum and maximum respectively for the study period. The average cash reserve ratio for the study period is 27.56 with a standard deviation of 33.77.

### **Correlation between Liquidity Risk Components and Performance of DMBs**

In the broadest sense correlation is any statistical association. Though it is commonly referred to the degree to which a pair of variables are linearly related. Therefore, this study discuss correlation as the degree of association between the financial performance (ROE) of deposit money banks and each of the liquidity risk components examined, namely, loan to deposit ratio (LDR), loan to asset ratio (LTR) and cash reserve ratio (CRR) and among the independent variables themselves on the other hand. The correlation between these dimensions themselves and return on equity is shown in table 3 below.

**Table 3:** Correlation Matrix

Variable	ROE	LDR	LTR	CRR
ROE	1			
LDR	0.077 [0.271]	1		
LTR	0.142 [0.041]	0.394 [0.000]	1	
CRR	0.091 [0.192]	0.688 [0.000]	-0.089 [0.200]	1

**Source:** STATA Output, 2023.

**Notes:** P-values are in parenthesis, ROE is return on equity, LDR is loan-to-deposit-ratio, LTR is loan to asset ratio, CRR is cash reserve ratio.

Table 3 indicates that return on equity is significantly positively correlated with loan to asset ratio and insignificantly positively correlated with loan-to-deposit ratio and cash reserve ratio. Loan-to-deposit-ratio is significantly positively correlated with loan to asset ratio with correlation coefficient of 0.394 with a corresponding *p*-value of 0.000 and also significantly positively correlated with cash reserve ratio with correlation coefficient of 0.688 with a corresponding *p*-value of 0.000 while loan to asset ratio is insignificantly negatively correlated with cash reserve ratio with correlation coefficient of -0.089 with a corresponding *p*-value of 0.200.

**Empirical Findings**

The study presents the findings as follows; (1) each long run model is presented separately and its post-estimation diagnostics discussed to establish the reliability of the findings (2) the study discriminates between the long run equation using Hausman test (3) the study presents the naïve OLS and fixed effects estimates of the short run specification to establish the range where the coefficient of lagged return on equity should lie in the GMM specification (4) the study estimates and presents the GMM specification while presenting the instruments used and discussing the postestimation diagnostics of the GMM model. Finally (5) the study presents a comparative summary of all the equations and tests the hypotheses both in the short and in the long run.

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**The Hausman Test**

The Hausman specification test was conducted to determine between the fixed and random effect models that is more appropriate for interpretation.

The Hausman test result is presented in table 4.

**Table 4:** Hausman Test

Test Statistic Chi <sup>2</sup> (3)	<i>p</i> -value
7.362	0.000***

**Source:** STATA Output, 2023.

Table 4 shows the result of the Hausman test, and the test statistics have a chi<sup>2</sup> statistics of 7.362 with three degrees of freedom and a corresponding *p*-value of 0.000. Therefore, the null hypothesis that the regressors and individual heterogeneity are strictly exogenous is rejected at one percent level of significance. Therefore, the fixed effect (FE) is preferred over random effect (RE) specification. In the long-run, interpretation will be done on fixed effect specification.

To test the hypothesis the long run and the short run equation (1) were estimated. The long run specification consisted of the fixed and random effects model. The fixed effects estimates are shown in table 6.

**Table 5:** Fixed Effect Estimates for the Effect of Liquidity Risk on Performance

<b>Dependent variable</b>	<b>ROE</b>	
<b>Explanatory Variable</b>	<b>Coefficient</b>	
LDR	-0.172	
LTR	0.876**	
CRR	0.233*	
Constant	-20.521*	
<b>Post Estimation Diagnostics</b>		
R-square	Within	0.036
	Between	0.061
	Overall	0.039
	Rho	0.131
F-test (3, 192)	2.35*	
Chow test F(12, 192)	2.37***	

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Source:** STATA Output, 2023.

Table 5 shows the fixed effect estimates for the effect of liquidity risk on the performance of deposit money banks in Nigeria. The analysis shows that the F-statistic is 2.35 and is lesser than the critical value at ten percent level of significance. Therefore, the variables of liquidity components are jointly significant in explaining the variations in return on equity (ROE). The interclass correlation (rho) is 13.1 percent implying that 13.1 percent of the variations in return in equity are due to differences across the banks. The within and between R square is 3.6 percent and 6.1 percent respectively. Thus, 3.6 percent of variations in the return on equity are due to differences within individual banks and 6.1 percent of the variations are due to differences between the banks. The chow test statistic is 2.37 and is less than the critical value at one percent level of significance. Therefore, the null hypothesis that the fixed effects are equal to zero is rejected at 1 percent level of significance.

To establish the bound where the coefficient of lagged profits would lie in the short run specification of equation (3), the OLS was estimated. The OLS estimates overstate the coefficient of lagged profits by attributing to it some explanatory power of the error term. Thus, the OLS estimate provides the upper bound of the coefficient as indicated in table 6.



**Table 6:** OLS Estimates for the Effect of Liquidity Risk on Performance with lag of ROE

<b>Dependent variable</b>	<b>ROE</b>
<b>Explanatory Variable</b>	<b>Coefficient</b>
ROE(-1)	0.138*
LDR	-0.133
LTR	0.759**
CRR	0.215
Constant	-19.610*
<b>Post Estimation Diagnostics</b>	
R-square	0.434
F-test chi2(4)	11.79**
*** $p < 0.01$ , ** $p < 0.05$ , * $p < 0.1$	

**Source:** STATA Output, 2023.

The OLS estimates in table 6 shows that the coefficient of lagged return on equity is 0.138. Therefore, the upper bound for the coefficient of lagged return on equity in the GMM specification of the short-run model should be 0.138. To get the lower bound the fixed effect estimates of the short-run specification are used. Fixed effect estimation understates the coefficient by denying the lagged dependent variable some of its explanatory power, thus providing the lower bound. The fixed effect estimates of the short-run specification are shown in table 7.

**Table 7:** Fixed Effect Estimates for the Effect of Liquidity Risk with lag of ROE

<b>Dependent variable</b>	<b>ROE</b>	
<b>Explanatory Variable</b>	<b>Coefficient</b>	
ROE(-1)	0.015	
LDR	-0.152	
LTR	0.886**	
CRR	0.203	
Constant	-21.986*	
<b>Post Estimation Diagnostics</b>		
R-square	Within	0.034
	Between	0.094
	Overall	0.042
	Rho	0.128
F-test (4, 178)	1.55	
Chow test F(12, 178)	1.90**	
*** $p < 0.01$ , ** $p < 0.05$ , * $p < 0.1$		

**Source:** STATA Output, 2023.

Table 7 shows the fixed effects estimates of the short-run specification. The coefficient of lagged return on equity is 0.015. Thus, the lower bound of lagged return on equity in the GMM specification should be 0.015. Specifically, if the estimate is , it should lie in the interval 0.015

0.138. To obtain consistent estimates of the short-run specification one step system GMM is used. The estimates are shown in table 8.

**Table 8:** One Step System GMM Estimates for the Effect of Liquidity Risk of lag of ROE

<b>Dependent variable</b>	<b>ROE</b>
<b>Explanatory Variable</b>	<b>Coefficient</b>
ROE <sub>(t-1)</sub>	0.138***
LDR	-0.133
LTR	0.760
CRR	0.215*
cons_	-19.610
<b>Post Estimation Diagnostics</b>	
Hansen J test	10.24
AR (1)	-1.68*
AR(2)	-0.64
*** $p < 0.01$ , ** $p < 0.05$ , * $p < 0.1$	

**Source:** STATA Output, 2023.

Table 8 shows the one step system GMM estimates for the short-run specification. The coefficient of the lagged return on equity is 0.138. The coefficient, therefore, lies in the acceptable range of 0.015 – 0.138 established by the naïve OLS estimates and fixed effects estimates of the short-run model. This points to consistency of estimates.

#### **Hansen J Test of Over-Identification Restrictions**

The Hansen J statistic is 10.24 with a corresponding  $p$ -value greater than 0.1. Therefore, the null hypothesis of the validity of the overidentifying restrictions for the instruments is not rejected at ten percent level of significance. Therefore, the instruments employed by the model are appropriate and lead to precise consistent estimates.

#### **Arrellano and Bond test of Autocorrelation**

The  $AR(1)$ , first order autocorrelation, test statistic is -1.68 and is lesser than the critical value at 10 percent level of significance. Therefore, the null hypothesis that disturbance term (error term) has no first order serial correlation is rejected at 10 percent level of significance. The test statistic for second order serial correlation in the error term is -0.64 with a corresponding  $p$ -value that is greater than 0.1. Therefore, at 10 percent level of significance the null hypothesis that there is no second order serial correlation in the disturbance term is not rejected at 1 percent level of significance. This permits the use of instruments from the second lag and differences further supporting the argument of correct short-run specification of model using the one step GMM estimates.

The summary of the first hypothesis in the short-run and in the long-run is depicted in table 9.

**Table 9:** Effect of Liquidity Risk on Performance in Long-Run and Short-Run

Variable	Long Run Model		Short-Run Model		
	Fixed Effect	Random Effect	OLS	Fixed Effect	GMM
ROE <sub>(t-1)</sub>			0.138*	0.153	0.138***
LDR	-0.172	-0.170	-0.133	-0.152	-0.133
LTR	0.876**	0.850***	0.759**	0.886**	0.760
CRR	0.233*	0.246*	0.215	0.203	0.215*
CONS_	-20.521*	-20.091*	-19.610*	-21.986*	-19.610
Observations	208	208	208	208	208
R-squared	0.061	0.070	0.434	0.094	
Hausman Chi2(3)	9.14**				
Wald statistic		7.84**			
F-statistic	2.37*		11.79**	1.90**	98.73***

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

**Source:** STATA Output, 2023.

Table 9 shows the effect of liquidity risk on deposit money banks performance in long-run and short-run. The magnitude of the coefficients is comparable for the long-run model but significantly differs in the short-run specification as expected. The appropriate model that will be interpreted in both the short-run and long-run is fixed effect and GMM specification.

In the long run, the results show out of the three variables used as the measure of liquidity risk that loan to asset ratio and cash reserve ratio have significant relationship with bank profitability, with a coefficient of 0.876 and 0.233 respectively. Loan to asset ratio is statistically significant at 5 percent level of significance and cash reserve ratio is statistically significant at 10 percent level of significant. This means that the coefficient of loan to asset ratio is significantly different from zero at 5 percent level of significance and the coefficient of cash reserve ratio is significantly different from zero at 10 percent level of significance. Therefore, a 1 percent increase in both loan to asset ratio and cash reserve ratio will increase return on equity by 0.876 and 0.233 percentages points in the long run holding other factors constant. Therefore, increased risk associated with loan to assets is another way of achieving optimal profitability. However, the LDR is negatively insignificant to DMBs performance with a coefficient of -0.172

The result of fixed effect in the short-run shows that only loan to asset ratio is statistically significant in determine return on equity. Loan to asset ratio has a coefficient of 0.886 and it is statistically significant at five percent level of significant. Therefore, a one percent increase in the loan to asset ratio will increase return on equity by 0.886 percentage points in the short-run holding other factors constant. The GMM result shows that lagged return on equity and cash reserve ration are statistically significant in determine return on equity. Lagged return on equity has a coefficient of 0.138 and it is statistically significant at one percent level of significant. Therefore, a one percent increase in the lagged return on equity will increase return on equity by 0.138 percentage points in the short run holding other factors constant. This

implies that, the past profitability of DMBs in Nigeria have a positive effect on their future performance. Also, cash reserve ratio has a coefficient of 0.215 and it is statistically significant at ten percent level of significant. Therefore, a one percent increase in the cash reserve ratio will increase return on equity by 0.215 percentage points in the short run holding other factors constant. In this case, cash reserve provides the needed cushioning effect in a situation where short-term asset values are not sufficient to match short term liabilities or unexpected outflows and therefore increase profitability.

To jointly test whether the components of liquidity risk influenced the financial performance of deposit money banks in Nigeria F-test was used to test the joint significance of the coefficients in the fixed effects model in the long run and the short run. F test was used in the short run. The test has a null hypothesis that all the coefficients of the components of liquidity risk are jointly equal to zero. The analysis shows that the F-statistic is 2.37 and is lesser than the critical value at ten percent level of significance. In the short run the F statistic is 1.90 and is greater than the critical value at one per cent level of significance. Therefore, the variables of liquidity risk components are jointly significant in explaining the variations in return on equity.

These results are in line with the results of studies by studies by Akhtar et al. (2011) and Wambu (2013) that liquidity risk has a positive relationship with profitability. The results are attributed to the fact that banks hold liquid assets as an obligation to the requirements imposed by the authorities. Liquidity is the protection of the deposit money banks. When a bank has adequate liquidity, it can obtain sufficient funds, either by increasing liabilities or by converting assets promptly, at a reasonable cost, thereby affecting profitability positively.

### **Conclusion and Recommendations**

The results for this study show that loan to asset ratio is statistically significant at 5 percent level of significant and cash reserve ratio is statistically significant at 10 percent level of significant both in the long-run and in the short-run. Therefore, cash reserve balances at the disposal of DMBs provide buffer to meet DMBs unanticipated liquidity requirements and therefore have the effect of boosting DMBs performance in the short-run and in the long-run. Also, the short-run, result shows that lagged return on equity is statistically significant in determining DMBs performance. However, the LDR is negatively insignificant to DMBs performance both in the long-run and in the short-run. This insignificant inverse relationship between loans to deposits ratio and profitability implies that DMBs increased exposure to liquidity risk reduces banks' profits. Overall, the findings revealed that liquidity risk measured by LTR and CRR have significant positive effect on the financial performance of deposit money banks in Nigeria both in the short run and in the long run. The conclusion of the study is that liquidity risk if unchecked may adversely affect a given bank's performance, capital and under extreme circumstances, it may cause the collapse of an otherwise solvent bank. In addition, a bank facing liquidity risks may experience difficulties in meeting the demands of depositors, however, this liquidity risk may be mitigated by maintaining sufficient cash reserves, raising deposit base and decreasing the liquidity gap. Availability of adequate cash reserve ratio will improve the bank's profitability.

### **Recommendation**

1. It is recommended that deposit money banks should engage in controlling loan concentrations, and through diversification, securing credit lines or other back-up funding to improve profitability.
2. To decrease liquidity gap, it is vital for the management of the deposit money banks to ensure that long-term deposits are used for financing long-term loans and short-term deposits are utilised for short term loans.
3. That deposit money banks in Nigeria should identify and maintain optimal levels of cash reserves and raising deposit base to gauge unanticipated medium to long-term liquidity funding as a way of maximising their performance.

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