“Determinants of liquidity risk: Empirical evidence from Indian commercial banks”

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DETERMINANTS OF LIQUIDITY RISK: EMPIRICAL EVIDENCE FROM INDIAN COMMERCIAL BANKS

Abstract

Liquidity risk is a significant financial threat that must be handled carefully. Underestimation or mismanagement of liquidity risk may lead to severe financial losses or even bank failures. Therefore, timely and adequately estimating liquidity risk and examining factors that affect liquidity risk are essential. On that account, this paper aims to examine the determinants of liquidity risk for Indian commercial banks from 2013 to 2022. For this purpose, the study has employed a panel data regression model with pooled OLS, fixed effect, and random effect methods and has considered bank-specific and macroeconomic variables. The findings show that liquidity risk is affected by both bank-specific variables and macroeconomic variables. Bank-specific variables, such as bank age, have a negative impact on liquidity risk at the 1 percent significance using pooled OLS, FE, and RE models. In contrast, bank size and bank capitalization positively impacted liquidity risk. However, the operational efficiency of banks was found to have no significant impact on liquidity risk using both the liquid asset to total assets ratio and the loan to deposit ratio. In addition, the results show that macroeconomic variables such as GDP and inflation have a positive impact on liquidity risk. The study's findings are expected to assist various stakeholders in making appropriate policies, decisions and managing their liquidity risk.

Keywords liquidity risk, determinants, bank-specific, macroeconomic, panel data, India

JEL Classification G21, G32, C23

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INTRODUCTION

Liquidity risk can be understood as the inability of a bank to fulfil its obligations as and when they become due without jeopardizing the bank's financial health. It is a type of financial risk wherein a particular financial asset or commodity cannot be transacted quickly enough in the market without impacting its price. Due to a shortage of buyers or weak demand, the investors or entity may be unable to turn assets into cash by forfeiting their capital and income. In such a case, losses may be incurred due to a failure to meet payment commitments on time or a failure to do so cost-effectively. Although a liquidity crisis may affect only a single institution, it can have systemic implications. The financial crisis of 2007–2008 has demonstrated how liquidity risk brought on by market players' collective action may worsen economic instability. Effective liquidity risk management ensures that a bank can fulfil its commitments as and when they become due and reduces the possibility of an adverse situation.

Even though liquidity creation by banks plays a major role in the economy, bank liquidity risk management has not yet been examined empirically in the Indian banking sector. Thorough research is needed to assess the extent of the adverse effects that negative market scenarios or economic crises can have on the liquidity of Indian banks. Nevertheless, it is evident from prior research and past global

trends that unmanaged liquidity risk can lead to financial distress, bank runs, and even bank failures. Therefore, it is pertinent to understand the determinants of liquidity risk, ensure effective liquidity risk management, and ultimately assure bank stability and success.

1. LITERATURE REVIEW

Liquidity risk refers to a situation where an investor, business, or financial institution is not able to fulfil its short-term debt commitments. Matz (2007) highlights the significance of liquidity risk management by stating that inadequate liquidity can destroy the bank suddenly, whereas excess liquidity will destroy it slowly. To manage and control banks' liquidity risk, researchers have focused on various bank-specific determinants of liquidity risk, such as profitability, bank size, operational efficiency, ownership concentration, and capitalization. Previous studies have also explored the impact of macroeconomic factors such as GDP, inflation, and government effectiveness.

Studies on the impact of liquidity risk on bank profitability give conflicting results. Examination of the effect of liquidity risk on the profitability of systematically important Nigerian banks shows that liquidity risks positively impact bank profitability (Aluko et al., 2019). Abdul-Rahman et al. (2018) also indicate that the higher the banks' profitability (ROA), the greater will be the liquidity risk for conventional banks (CB) and Islamic banks (IBs). Further, Molyneux and Thornton (1992) indicate that liquidity risk is positively linked with bank profitability. The findings that exhibit a positive association between liquidity risk and profitability align with the "high risk-high return" investment theory, which states that banks must take higher risks to get greater returns. However, Demirguc-Kunt and Huizinga (1998) reveal a negative link between liquidity risk and profitability. Results also indicate that higher levels of liquidity in banks result in reduced net interest margins (Demirguc-Kunt & Huizinga, 1998). Chen et al. (2018) reveal that liquidity risk lowers profitability when ROAA and ROAE proxies profitability. However, liquidity risk increases bank profitability when the net interest margin measures profitability.

Researchers have also assessed the impact of bank size on liquidity risk. Mohammad et al. (2020) reveal a negative relationship between the size and liquidity risk of banks, and the results are in accordance with the studies of Dinger (2009), which revealed that large banks maintain less liquid assets compared to small banks. On the contrary, Abdul-Rahman et al. (2018) show an insignificant association between bank size and the short-term liquidity risk of CBs. The study also indicated a positive link between the size and liquidity risk of IBs, implying that the larger the IBs, the greater their short-term liquidity risk. Examining the determinants of liquidity risk of Vietnamese banks revealed that a larger loan size is linked with higher liquidity risk (Tran et al., 2019). An assessment of the effect of securitization on the liquidity risks of Italian banks during the financial crisis revealed that securitization positively and significantly impacted bank liquidity risk prior to and at the time of the crisis (Battaglia & Mazzuca, 2014).

Studies examined the impact of bank specific variables, such as operational efficiency, bank stability, capitalization, and diversification, on liquidity risk. Sharma et al. (2015) indicated an insignificant negative association between liquidity and operational efficiency. Hassan et al. (2019) indicated that liquidity risk and bank stability are positively associated (proxied by z-score) and they are negatively associated when bank stability was proxied by Merton's Distance to Default during the financial crisis period for CBs. During the post-financial crisis period, liquidity risk and bank stability were significantly and positively associated. For IBs, studies found negative associations between liquidity risk and bank stability, using both z-score and Merton's Distance to Default score during and after financial crisis periods, indicating that higher liquidity risk lowers bank stability.

Studies also show that banks with greater capitalization hold more liquid assets. However, the findings indicated that the deposit rate is negatively linked with liquidity risk as banks may make fewer investments in low-return liquid assets when deposits become expensive. Studies have also shown that CAR is positively linked with short-term liquidity risk in the case of IBs, whereas CAR

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is insignificantly and negatively associated with CBs (Dinger, 2009). Findings also revealed that increased real estate funding leads to an increase in the long-term liquidity risk of the IBs, but not CBs. In contrast, real estate funding negatively affects the short-term liquidity risk of both CBs and IBs (Abdul-Rahman et al., 2018). In addition, it was found that liquidity risk and bank capital regulation stringency are negatively associated (Mohammad et al., 2020). Examining if competition affects a bank's liquidity risk indicated that banks with greater market power take greater liquidity risk (i.e., increased competition reduces liquidity risk-taking behavior). However, it was found that at the time of crisis, the effect of market power on liquidity risk differs based on the liquidity risk measure used, i.e. when credit lines were used as a measure, the positive association between market power and liquidity risk is intensified, however, when liquidity lines and liquidity creation is used as a measure the positive link between market power and liquidity risk is weakened (Kim, 2018).

Comparison of liquidity risk differences among IBs, CBs and transnational banks also revealed interesting results. A comparative analysis of liquidity risk and its determinants in IBs, CBs and hybrid banks revealed that IBs are more prone to liquidity risk and hybrid banks are least vulnerable to liquidity risk (Mohammad et al., 2020). IBs have more significant country, liquidity, operational, residual, and settlement risks than CBs (Abu Hussain & Al-Ajmi, 2012). Studies have also shown that transnational banks' liquidity behavior varies from local banks. It was found that while transnational banks typically retain smaller liquid reserves compared to local banks during normal circumstances, during periods of aggregate liquidity shortages, transnational banks may raise their liquid reserves compared to local banks (Dinger, 2009). Mohammad et al. (2020) indicate that ownership concentration is negatively linked to the liquidity risk exposure of banks. It was also found that there is a negative association between M&As and liquidity risk, as merged banks are more inclined to fund their liquidity requirements (Carletti et al., 2003). However, studies also reveal that banks engaged in M&As appear to have lesser liquidity in comparison to banks that are not engaged in M&As (Battaglia & Mazzuca, 2014).

Studies have also explored the effect of certain macroeconomic determinants, such as inflation, GDP, and political stability, on the liquidity risk of banks. For IBs, a negative association was found between short-term liquidity risk and inflation, i.e., as inflation increases, liquidity risk decreases. These findings suggest that banks will lower liquidity risk to protect depositors and implement the required safeguards to prevent bank runs when inflation is high. However, in contrast, a positive association was found between short-term liquidity risk and inflation rate in CBs, showing that banks are indirectly exposed to increasing liquidity risk and must reduce their liquidity position due to growing costs. Further, a negative relationship was observed between long-term liquidity risk and inflation for IBs. An insignificant association was found between inflation and long-term liquidity risk in the case of CBs (Abdul-Rahman et al., 2018). It was found that GDP is negatively linked to the liquidity risk of banks (Mohammad et al., 2020). Studies have indicated that per capita GDP growth is negatively related to liquidity, thereby revealing that banks hold fewer liquid assets during high economic growth. This association may be because aggregate liquidity shocks are less likely during economic growth (Dinger, 2009). On the contrary, studies also revealed that GDP and short-term liquidity risk are positively associated in the case of CBs and IBs. As the economy expands, banks increase their liquidity risk by increasing the supply of financing and undertaking investment to increase their profits. Further, studies have shown an insignificant association between GDP and long-term liquidity risk for IBs and CBs (Abdul-Rahman et al., 2018). Political stability, regulatory quality and the rule of law are negatively linked with the bank's liquidity risk. However, government effectiveness is positively linked to the liquidity risk exposure of banks (i.e., as government performance increases, liquidity risk exposure also increases) (Mohammad et al., 2020).

Studies have also analyzed the determinants of liquidity risk of banks in the old European Union and the new European Union. The findings indicated that the effect of certain determinants of liquidity risk, such as effectiveness level, bank size, financial leverage, inflation, and GDP, varies for banks operating in New European Union and

Old European Union. However, the study indicated that certain indicators such as margin volume, credit risk level, and participation in the interbank market impact the liquidity risk of banks, irrespective of the country where they operate (Wójcik-Mazur & Szajt, 2015).

The literature review reveals that while the factors affecting bank liquidity risk have been the focus of a few studies, they have certain limitations. In the literature up to this point, all the factors that influence liquidity risk for banks have not been thoroughly explored. The effect of bank age and diversification on liquidity risk has not been explored in prior studies. More importantly, there is a dearth in the number of studies focusing on liquidity risk management in Indian banks. To bridge this gap, this study aims to examine the various bank-specific and macroeconomic determinants of liquidity risk in Indian banks.

2. METHOD

The study has used financial data retrieved from Database on Indian Economy, published by RBI. The variables included in the study are detailed in Table 1. The study included all the Indian commercial banks, a total of 33 banks. In this, two banks with insufficient data to construct all proxy measures were excluded from the data, and the final sample included 31 Indian commercial banks from 2013–2022. Data were analyzed using Python 3.10.7.

The two primary methods for analyzing both time series and cross-sectional data in panel data research are the fixed-effects (FE) model and the random-effects (RE) model (Gujarati, 2003). Accordingly, this study has employed pooled OLS (POLS), FE, and RE linear regression models. After considering all the assumptions necessary for linear regression, using linear regression will help obtain reliable and comparable estimates. The study employs the panel data structure model that was applied by Masood and Ashraf (2012), which is described below:

$$\gamma_{nt} = \alpha + \beta x_{nt} + \varepsilon_{nt}, \quad (1)$$

where γ_{nt} denotes the dependent variable (liquidity risk), α is the intercept, β is a $k \times 1$ vector of the to be estimated, and vector of observations is x_{nt}, which is $1 \times k$, $t = 1, \ldots, T$; $n = 1, \ldots, N$.

The practical and operational form, the aforementioned model can be described as follows:

$$Liquidity\ Risk = \\ = f\begin{pmatrix} Bank-specific\ variables; \\ Macroeconomic\ variables \end{pmatrix}. \quad (2)$$

Liquidity risk is proxied by LTA and LDT. Bank-specific variables include profitability (ROA), bank age (BGE), bank size (BSZE), operational efficiency (OEI), capitalization (CAP), bank diversification (BDF), bank ownership (OWN), and mergers and acquisitions (MAQ). The macroeconom-

Table 1. Definitions of commercial banks' liquidity risk variables

Variables	Risk	Ratio	Paper
Risk Variables	LTA(LTA)	Liquid Asset/ Total Assets	Liao et al. (2009), Godlewski (2006)
	LDT(LDT)	Loan/ Deposit	Liao et al. (2009), Godlewski (2006)
Bank-specific Variables	ROA(ROA)	Net Profit / Total Assets	Masood and Ashraf (2012)
	Age (BGE)	Age of the bank	Misman and Bhatti (2020)
	Size (BSZE)	Natural logarithm of total assets	Battaglia and Mazzuca (2014), Masood and Ashraf (2012)
	Efficiency (OEI)	Operating expenses/Operating Income	Bougatef (2017)
	Capitalization (CAP)	Equity/Total Assets	Salike and Ao (2018), Ferhi (2018), Bougatef (2017), Menicucci and Paolucci (2016)
	Bank diversification (BDF)	Noninterest income/ Total income	Lepetit et al. (2008)
	Ownership (OWN)	Public /Private Sector Banks	Sivasankaran et al. (2020), Gupta and Mahakud (2020)
	Mergers & Acquisitions(MAQ)	Merger/Acquisition in a given year	Battaglia and Mazzuca (2014)
Macro-economic Variables	GDP (GDP)	Annual GDP growth rate	Twum et al. (2021), Garcia and Guerreiro (2016)
	Inflation (INF)	Annual inflation rate	Twum et al. (2021), Masood and Ashraf (2012)

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ic variables considered are inflation (INF) and GDP. To examine the determinants of liquidity risk in Indian banks, two models are developed by expanding the variables employed in Equation 2. The models hypothesized that the liquidity risk of banks in India is influenced by following bank-specific and macroeconomic factors:

Model 1

$$LTA = \alpha_i + \beta_1 ROA_{it} + \beta_2 BGE_{it} + \\ + \beta_3 BSZE_{it} + \beta_4 OEI_{it} + \beta_5 CAP_{it} + \\ + \beta_6 BDF_{it} + \beta_7 OWN_{it} + \beta_8 MAQ_{it} + \\ + \beta_9 GDP_{it} + \beta_{10} INF_{it} + \varepsilon_{it}, \quad (3)$$

Model 2

$$LDT = \alpha_i + \beta_1 ROA_{it} + \beta_2 BGE_{it} + \\ + \beta_3 BSZE_{it} + \beta_4 OEI_{it} + \beta_5 CAP_{it} + \\ + \beta_6 BDF_{it} + \beta_7 OWN_{it} + \beta_8 MAQ_{it} + \\ + \beta_9 GDP_{it} + \beta_{10} INF_{it} + \varepsilon_{it}, \quad (4)$$

where i indicates an individual bank; t indicates year; β_1-β_{10} are the coefficients of dependent variables, ε is the error term, and all other variables are exhibited in Table 1.

The models are developed using POLS, RE, and FE regression. The choice of a FE model instead of RE one has been established with Hausman test as P.value is less than 0.05 (P.value = 0.00 < 0.05).

3. RESULTS

Table 2 reports the descriptive statistics for all the variables used in the analysis. The banks' mean value of LTA and LDT during the study period is 0.281 and 0.743, respectively. The mean ROA during the study period was 0.004, and the values varied from a minimum of –0.064 to a maximum of 0.020. Table 2 shows that the mean value of BGE, BSZE, OEI, CAP, BDF, OWN and MAQ is 79.435, 12.007, 3.606, 0.079, 0.128, 0.406 and 0.023, respectively. The mean value of macroeconomic variables GDP is 5.458, and INF is 6.224.

Table 3 presents the correlation between the dependent variables and independent variables. Table 3 shows a negative correlation between LTA and ROA and a positive correlation between LDT and ROA. The results also show that BGE, OEI, OWN and MAQ are positively linked with LTA. It was also found that BSZE, CAP, BDF, GDP and INF are negatively associated with LTA. It was also found that LDT is positively associated with BSZE, CAP, BDF, GDP and INF. It is also clear that there are no multicollinearity problems present in the dataset, i.e., a low correlation exists between the dependent variables.

The lack of correlation between independent variables demonstrates the absence of multicollinearity issues. The variance inflation factor (VIF) test, shown in Table 4, also examines if multicollinearity issues are present. Since VIF values do not exceed 7.586 and are below the threshold of 10, it can be understood that the dataset is free from multicollinearity.

Table 2. Summary statistics

Variables	Obs.	Mean	Std. dev.	Minimum	Median	Maximum
Dependent variables						
LTA	310	0.281	0.055	0.158	0.269	0.547
LDT	310	0.743	0.129	0.459	0.744	1.627
Bank-specific variables						
ROA	310	0.004	0.011	–0.064	0.005	0.020
BGE	310	79.435	32.754	9	89	128
BSZE	310	12.007	1.460	8.371	12.219	15.422
OEI	310	3.606	43.882	–115.328	0.973	761.501
CAP	310	0.079	0.024	0.035	0.072	0.169
BDF	310	0.128	0.045	0.043	0.124	0.313
OWN	310	0.406	0.492	0	0	1
MAQ	310	0.023	0.149	0	0	1
Macro-economic variables						
GDP	310	5.458	4.254	–6.596	6.625	8.681
INF	310	6.224	2.225	3.084	5.544	10.429

Table 3. Pearson correlation matrix

Variables	LTA	LDT	ROA	BGE	BSZE	OEI	CAP	BDF	OWN	MAQ	GDP	INF
LTA	1	–	–	–	–	–	–	–	–	–	–	–
LDT	–0.719	1.000	–	–	–	–	–	–	–	–	–	–
ROA	–0.220	0.306	1.000	–	–	–	–	–	–	–	–	–
BGE	0.209	–0.573	–0.277	1.000	–	–	–	–	–	–	–	–
BSZE	–0.314	0.211	–0.068	–0.238	1.000	–	–	–	–	–	–	–
OEI	0.031	–0.053	–0.116	0.019	–0.105	1.000	–	–	–	–	–	–
CAP	–0.189	0.501	0.456	–0.585	–0.037	–0.090	1.000	–	–	–	–	–
BDF	–0.212	0.468	0.119	–0.530	0.405	–0.088	0.535	1.000	–	–	–	–
OWN	0.095	–0.348	–0.398	0.424	0.541	–0.047	–0.605	–0.185	1.000	–	–	–
MAQ	0.042	–0.058	–0.012	0.060	0.184	–0.009	–0.050	0.052	0.139	1.000	–	–
GDP	–0.092	0.083	0.033	–0.031	–0.065	0.031	–0.087	–0.144	0.015	–0.235	1.000	–
INF	–0.080	0.104	0.188	–0.052	–0.119	–0.008	–0.081	–0.276	0.005	–0.071	–0.004	1

Table 4. VIF

Features	VIF
ROA	1.654
BGE	7.586
BSZE	2.917
OEI	1.043
CAP	2.456
BDF	1.961
OWN	6.204
MAQ	1.129
GDP	2.506
INF	5.424

Table 5 reports the regression models for liquidity risk when LTA measures liquidity risk. The findings of the diagnostics show that ROA is positively associated with LTA, based on the FE and RE model at 10 percent significance, indicating that with an increase in profitability, liquidity risk decreases. This result is because a rising LTA indicates a declining liquidity risk. However, the result using the POLS model reveals that ROA is positively linked with liquidity risk, though the result is not significant. Nevertheless, the finding aligns with the popular theory that the return increases with risk.

The study also indicates that bank age has a negative impact on liquidity risk at a 1 percent significance, i.e., as banks age, their liquidity risk decreases. This result was found to be consistent using POLS, FE and RE models. The results also indicate that larger banks face greater liquidity risk, and this is in accordance with the results of Abdul-Rahman et al. (2018). There was no significant association between operational efficiency and liquidity risk using POLS, FE and RE. Bank capitalization was found to impact liquidity risk positively, i.e., as capitalization increases, liquidity risk also increases. Bank diversification was found to negatively impact liquidity risk at 10 percent significance using FE and RE models. It was also found that when the government owns banks, it negatively impacts liquidity risk, based on the POLS model; however, it positively impacts liquidity risk based on FE and RE models. It was also found that banks that had undergone a merger or acquisition (M&A) in a certain year were more likely to face lower liquidity risk than banks that had not undergone M&A.

Regarding the macroeconomic variables, the results indicated that inflation positively impacts liquidity risk at 1 percent significance. However, this result was true only using the POLS method. Using FE and RE models, inflation did not significantly affect liquidity risk. GDP was found to impact liquidity risk positively. However, FE and RE model results indicated that GDP does not significantly affect liquidity risk.

Table 6 reports the regression models for liquidity risk as measured by LDT. The findings indicate that ROA is negatively and significantly linked with LDT, at 1 a percent level using the FE model and a 10 percent level using the RE model, indicating that liquidity risk decreases with increased profitability. This result is because an increase in LDT indicates an increase in liquidity risk. However, the study's findings that used pooled OLS show that profitability has an insignificant effect on liquidity risk.

Studies also indicate that bank age negatively affects liquidity risk at a 1 percent significance, i.e., as banks become older, their liquidity risk decreases.

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Table 5. Estimations results (dependent variable is LTA)

Variables	Pooled OLS				Fixed Effect				Random Effect			
	Coef.	Sd.Err.	T.stat.	Prob.	Coef.	Sd.Err.	T.stat.	Prob.	Coef.	Sd.Err.	T.stat.	Prob.
const	0.324	0.015	21.253	0.000	–0.050	0.113	–0.445	0.657	–0.050	0.113	–0.445	0.657
ROA	–0.436	0.311	–1.399	0.163	0.471	0.223	2.117	0.035**	0.471	0.223	2.117	0.035**
BGE	0.000	0.000	–2.934	0.004***	0.005	0.001	3.337	0.001***	0.005	0.001	3.337	0.001***
BSZE	–0.026	0.003	–8.019	0.000***	–0.027	0.009	–3.020	0.003***	–0.027	0.009	–3.020	0.003***
OEI	0.000	0.000	–0.429	0.668	0.000	0.000	–0.588	0.557	0.000	0.000	–0.588	0.557
CAP	–0.046	0.186	–0.247	0.805	–0.699	0.189	–3.700	0.000***	–0.699	0.189	–3.700	0.000***
BDF	–0.008	0.090	–0.091	0.928	0.142	0.077	1.850	0.065*	0.142	0.077	1.850	0.065*
OWN	0.057	0.011	5.315	0.000***	–0.064	0.022	–2.969	0.003***	–0.064	0.022	–2.969	0.003***
MAQ	0.025	0.019	1.278	0.202	0.024	0.012	1.944	0.053**	0.024	0.012	1.944	0.053*
GDP	–0.002	0.001	–2.575	0.011**	–0.001	0.000	–1.299	0.195	–0.001	0.000	–1.299	0.195
INF	–0.004	0.001	–2.887	0.004***	–0.001	0.001	–0.680	0.497	–0.001	0.001	–0.680	0.497
R^2	0.268	–	–	–	0.177	–	–	–	–	0.147	–	–
F-statistic	10.927	–	–	–	5.746	–	–	–	–	5.160	–	–
P.value	0.000	–	–	–	0.000	–	–	–	–	0.000	–	–
Hausman	–	–	–	–	0.000	–	–	–	–	–	–	–

Note: *, **, and *** – significant at 90%, 95%, and 99%, respectively.

Results also indicate a positive link between bank size and liquidity risk, i.e., larger banks face greater liquidity risk. This result was found to be the same using pooled OLS, FE and RE models, at 1 percent significance. Operational efficiency did not significantly affect liquidity risk using pooled OLS, FE and RE models. Bank capitalization was found to have a positive impact on liquidity risk, i.e., as capitalization increases, liquidity risk also increases. Bank diversification was found to impact liquidity risk significantly and positively, i.e., as the bank diversifies, liquidity risk increases. It was also found that if banks are owned by the public sector, this negatively influences liquidity risk, based on the POLS model; however, it has a positive impact on liquidity risk based on the FE model. Findings also indicate that whether or not banks had undergone a merger or acquisition in a particular year did not impact the liquidity risk of Indian banks, based on POLS and RE models. However, based on FE models, banks undergoing mergers or acquisitions in a given year showed a lesser liquidity risk in a given year.

Regarding the macroeconomic variables, the results indicated that inflation positively and significantly affects liquidity risk at a 1 percent level. Using

Table 6. Estimations results (dependent variable is LDT)

Variables	Pooled OLS				Fixed Effect				Random Effect			
	Coef.	Sd.Err.	T.stat.	Prob.	Coef.	Sd.Err.	T.stat.	Prob.	Coef.	Sd.Err.	T.stat.	Prob.
const	0.731	0.030	24.081	0.000	2.343	0.264	8.881	0.000	0.836	0.041	20.398	0.000
ROA	0.371	0.620	0.598	0.550	–2.582	0.521	–4.953	0.000***	–0.938	0.557	–1.685	0.093*
BGE	–0.001	0.000	–2.391	0.017**	–0.022	0.003	–6.716	0.000***	–0.002	0.000	–4.225	0.000***
BSZE	0.027	0.007	4.195	0.000***	0.144	0.021	6.808	0.000***	0.022	0.010	2.274	0.024**
OEI	0.000	0.000	–0.064	0.949	0.000	0.000	–0.159	0.874	0.000	0.000	0.016	0.988
CAP	0.717	0.371	1.932	0.054*	1.597	0.443	3.610	0.000***	0.443	0.425	1.041	0.299
BDF	0.580	0.180	3.222	0.001***	0.366	0.180	2.035	0.043**	0.063	0.176	0.357	0.721
OWN	–0.084	0.021	–3.917	0.000***	0.186	0.051	3.670	0.000***	–0.026	0.033	–0.784	0.434
MAQ	–0.015	0.039	–0.393	0.695	–0.056	0.028	–1.970	0.050**	–0.029	0.032	–0.920	0.359
GDP	0.004	0.001	3.118	0.002***	0.001	0.001	1.372	0.171	0.003	0.001	2.496	0.013**
INF	0.011	0.003	4.123	0.000***	0.006	0.002	2.628	0.009***	0.008	0.002	3.360	0.001***
R^2	0.468	–	–	–	0.287	–	–	–	0.209	–	–	–
F-statistic	26.333	–	–	–	10.762	–	–	–	7.914	–	–	–
P.value	0.000	–	–	–	0.000	–	–	–	0.000	–	–	–
Hausman	–	–	–	–	0.000	–	–	–	–	–	–	–

Note: *, **, and *** – significant at 90%, 95%, and 99 %, respectively.

pooled OLS, GDP was found to positively impact liquidity risk at 1 percent significance. This finding does not align with the study by Mohammad et al. (2020), which indicated that GDP is negatively linked with the liquidity risk of banks.

4. DISCUSSION

The study clearly indicates that both bank-specific and macro-economic variables affect the liquidity risk of Indian banks. Results of the analysis that used both LTA and LDT to measure liquidity risk indicate that profitability is negatively linked with liquidity risk. This result is in line with the studies by Demirguc-Kunt and Huizinga (1998), Chen et al. (2018), and Kosmidou (2008) and is contrary to the results of Aluko et al. (2019) and Abdul-Rahman et al. (2018), which indicates a positive association between liquidity risk and profitability. The findings also revealed that bank age is negatively associated with liquidity risk when both LTA and LDT are employed as proxies of liquidity risk.

Further, bank size was found to affect liquidity risk positively. This result may be because as banks become larger, they may be less averse to taking risks, as compared to smaller banks with fewer assets. However, this result disagrees with the findings of Mohammad et al. (2020) and Dinger (2009). Operational efficiency did not significantly affect liquidity risk using POLS, FE and RE models when LTA and LDT were used to proxy liquidity risk. This result is in accordance with the study by Sharma et al. (2015). Bank capitalization was found to have a positive impact on liquidity risk, i.e., as capitalization increases, liquidity risk also increases. Bank diversification was found to affect liquidity risk positively, i.e., as a bank diversifies, its liquidity risk also increases. This result is possibly because, as a bank diversifies, the bank will need more funds, which in turn increases the bank's liquidity risk. Studies also reveal that the type of ownership has an impact on the extent of liquidity risk faced by banks and is in line with the study by Mohammad et al. (2020).

Regarding macroeconomic factors, the findings revealed that GDP has a positive impact on liquidity risk using both LTA and LDT as indicators of liquidity risk. This result may be because banks are likely to take more liquidity risks during good economic growth, as economic growth indicates favorable market conditions and less likelihood of an economic or financial crisis. However, this finding contradicts the results of Abdul-Rahman et al. (2018), which reveals an insignificant association between GDP and liquidity risk, and Dinger (2009), which indicates a negative link between GDP and liquidity risk. Inflation was also found to positively affect liquidity risk using both LTA and LDT as measures of liquidity risk. However, this finding contradicts the results of Abdul-Rahman et al. (2018), which reveals an insignificant association between inflation and liquidity risk.

CONCLUSION

The study examines the main determinants of liquidity risk of Indian banks during 2013–2022. Bank-specific and macroeconomic factors were examined to identify the most significant factors that impact liquidity risk. Regarding the bank-specific variables, the findings indicated that profitability is negatively linked with the loan to deposit ratio based on the fixed effect model. Studies also indicate that bank age negatively affects liquidity risk, i.e., as banks age, their liquidity risk decreases. Results also revealed a positive relationship between bank size and liquidity risk, i.e., larger banks face greater liquidity risk. Operational efficiency did not significantly affect liquidity risk employing pooled OLS, fixed effect, and random effect models. Bank capitalization and bank diversification were also found to have a positive impact on liquidity risk. Regarding macroeconomic factors, the results show that both GDP and inflation positively affect liquidity risk.

The overall findings of this study demonstrated that multiple internal and external factors impact the liquidity risk of Indian banks. The study comes with limitations, especially in terms of variables selected for the study, as certain relevant variables, such as corporate governance and ownership concen-

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tration, have not been considered. Future studies can be undertaken by considering more macroeconomic variables, such as the financial crisis and unemployment. Studies can also be undertaken with an extended time frame. Nevertheless, the above findings are expected to benefit various stakeholders, including regulatory authorities, bank managers, and even shareholders, as the study indicates that controllable bank-specific factors can be used to manage liquidity risk and avoid situations of liquidity stress. Consequently, regulatory authorities and decision-makers can make appropriate decisions and adequate control measures to avoid excess liquidity risk.

AUTHOR CONTRIBUTIONS

Conceptualization: Tisa Maria Antony.
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Formal analysis: Tisa Maria Antony.
Investigation: Tisa Maria Antony.
Methodology: Tisa Maria Antony.
Resources: Tisa Maria Antony.
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Supervision: Tisa Maria Antony.
Validation: Tisa Maria Antony.
Visualization: Tisa Maria Antony.
Writing – original draft: Tisa Maria Antony.
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