

RESEARCH PAPER

An Empirical Study on Bank Liquidity in India- Panel Data Approach

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ABSTRACT

Liquidity is critical for the smooth functioning of the banking industry. The study aims to investigate the impact of deposits, profitability, bank size, net interest margin, capital, non-performing assets, gross domestic product, interest rate, statutory liquid ratio, and cash reserve ratio on bank liquidity in India. The **research methodology** includes balanced panel data of 49 banks for analysis from 2008 onwards. A generalized method of moment technique has been employed to inspect the specified purpose. The **results** exhibit that non-performing assets, profitability, and deposits have positively influenced bank liquidity. In contrast, bank size, capital, net-interest margin, gross domestic product, interest rate, and cash reserve ratio negatively impact bank liquidity. The statutory liquid ratio has an insignificant effect on the liquidity of banks. The results would be helpful to bank managers, policymakers, and academics to make appropriate policies to preserve bank liquidity without suffering any loss or undefined costs.

HIGHLIGHTS

- ❶ Banks maintain higher liquidity to manage cash flow when NPAs increase.
- ❷ Profitable banks hold more liquidity to cover potential losses from risky investments.
- ❸ Smaller banks maintain higher liquidity due to limited access to alternate funding sources.
- ❹ Higher NIM indicates efficiency and profits, enabling banks to reduce liquidity, and a high capital ratio also decreases bank liquidity.
- ❺ Higher interest rates and CRR reduce banks' borrowing abilities, negatively affecting liquidity.

Keywords: Bank Liquidity, Interest Rate, CRR, Profitability, Size, Panel data

The bank plays a crucial role in the economic development of the country. An influential financial institution is a driving force for growth. Thus, commercial banks have special attention from policymakers, managers, and researchers. As per the new concept of financial intermediary, banks carry out two significant functions: liquidity creation and transform risk. These are two vital economic system functions (Sahyouni & Wang, 2018). According to Tesfaye (2012) banks are an essential component of the economy as they serve as a conduit for transferring funds from the investor to the businessman. Banks can be the primary source of liquidity in the economy by receiving deposits,

advancing long-term debts, or holding low-liquid funds. A bank needs to maintain enough cash and liquid reserves in order to fulfil contractual requirements like cash withdrawals. A bank may be profitable and well-capitalized, but if creditors lose faith in the bank's capability to pay loans on demand, it may face massive withdrawals, which might bring down a stable institution (Bindseil, & Fotia, 2021). For banks with sufficient capital,

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low liquidity can be dangerous, as demonstrated by the events that transpired during the global financial crisis of 2007–2009. Banks relied on repos and asset-backed securities to maintain their commercial activities during the 2008 financial crisis since they were unable to accurately forecast their liquidity position. Banks invest considerable amounts of money in asset-backed securities, which can be dangerous when the economy is struggling (Caverzasi, Botta, & Capelli, 2019).

One of the most important functions of banks is liquidity management. The financial crisis of 2007–2009 highlighted the problems faced by financial institutions due to inadequate liquidity risk management and focused on the significance of liquidity for the effective operation of the financial sector, particularly the banking sector (Basel Committee on Banking Supervision, 2010; Roman and Sargu, 2015). As per Ferrouhi and Lehadiri (2013), the financial crisis revealed the significance of having a larger amount of liquidity to handle adverse circumstances. According to Umar and Sun (2016), weak bank performance has a negative impact on the health of the economy. They also conclude that bank liquidity is essential to the efficient and effective operation of an economy.

Numerous investigations have examined bank liquidity in several countries during different time-frames (El- Chaarani, 2018; Mashamba, 2022; Sopan & Dutta, 2018; Delechat *et al.* 2012). These studies concluded that a deep comprehension of the different elements influencing bank liquidity is required to reduce and manage the banking sector's liquidity issue. Though these studies examined in the context of other nations, their conclusion and implication might not be appropriate to the Indian banking industry. After the financial crisis of 2007–2009, studies show that this situation also influenced commercial banks in India, though such research is scarce. To address the gap in the literature in the context of empirical research investigating the influence of liquidity on commercial banks in India. This study examines the effects of capital, deposits, return on asset (ROA), net interest margin (NIM), non-performing assets (NPA), bank size, GDP, statutory liquid ratio (SLR), cash reserve ratio and interest rate on liquidity in India by using a generalized method of moment estimates.

The following highlights the study's distinctive contributions:

- ♦ Few studies have looked at the factors influencing the liquidity of Indian banks. The current study examines how ten factors affect liquidity of banks in India, providing in depth understanding of the association between specified variables and liquidity.
- ♦ Few researchers have looked at the influence of NIM, CRR, and SLR on bank liquidity. The current study examines how the above variable affects bank liquidity in India, providing a thorough understanding of these variables' effect on bank liquidity.

LITERATURE REVIEW

Previous research has looked at bank liquidity in various nations and regions (Kasana *et al.* 2022; Loan *et al.* 2021; Sopan & Dutta, 2018; Ghosh, 2016; Chen & Phuong, 2014; Lee *et al.* 2013; Al-Khourri, 2012; Arif & Anees, 2012; Aspachs *et al.* 2005). Mashamba (2022) explores the bank liquidity dynamics in emerging countries by taking 91 banks from eleven nations. Banks in developing nations must adhere to a target ratio of liquidity, which may vary to some extent due to market frictions. In developing countries, the evolution of bank liquidity is mostly determined by prudential and risk-averse behavior. Loan *et al.* (2021) investigates the factors influencing Vietnam's commercial banks' liquidity from 2007 to 2017 by employing a dynamic panel on 20 banks. The findings reveal that profitability, total assets, and inflation were negatively associated with bank liquidity, while financial market liquidity and national saving had a positive impact. Pham and Pham (2021) examined the elements of bank liquidity in Vietnam by employing 30 banks from 2007 to 2018. The result indicates that capital, bank size, and ROE significant adversely impact bank liquidity, while loss loan provision, ROA, inflation, and GDP have a significant impact. Sopan and Dutta (2018) looked into the macroeconomic and bank variables that influence liquidity risk in India. The results showed an adverse relationship between funding costs, asset quality, profitability, and size of banks and liquidity. Among external variables, Liquidity was positively impacted by inflation whereas GDP had an inverse effect. El-Chaarani (2018) highlights the factors that affected

bank liquidity in the Middle East between 2014 and 2016. This study used loans to deposits and loans to assets as bank liquidity proxies. Banks size, capital, performance level, and asset quality are bank-specific factors, while unemployment, economic growth and inflation rate are considered as macroeconomic factors. The finding shows that size, asset quality, capital, and economic growth significantly influence liquidity. Al-Harbi (2017) uses ordinary least square regression to investigate the primary factors influencing bank liquidity in developing nations between 1989 and 2008. The results demonstrate that all the parameters have a significant association with liquidity except concentration. Bank liquidity was adversely impacted by credit risk, foreign ownership, capital ratio, monetary policy, deposit insurance, and inflation. On the other side, positive association between liquidity and concentration, off-sheet balance sheet activity, and size. De Young and Jang

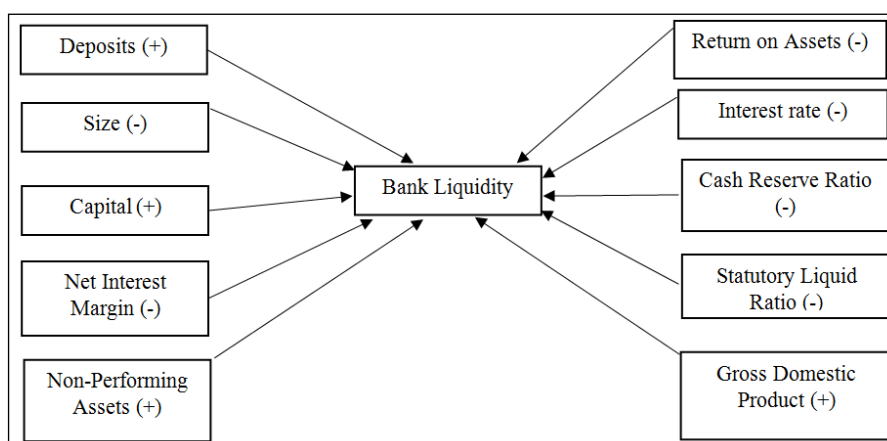
(2016) looked on the proactive maintenance of US banks' liquidity positions before the execution of Basel III liquidity regime. The research discovered evidence of net stable financing ratios and loan-to-core deposit ratios targeted at banks of all sizes. As banks grow, they typically reduce their liquidity goals, perhaps going against Basel III regulations. However, they successfully and effectively manage these liquidity goals. Trabelsi (2015) investigated the effects of the financial crisis on bank profitability throughout the recovery period as well as the influence of liquidity issues on bank profitability in Bahrain. Bank liquidity has been positively and significantly impacted by capital, deposits, GDP, and financial leverage; negatively impacted by size and the financial crisis.

Although studies have been on bank liquidity in different economies, extensive pragmatic evidence from emerging nations still needs to produce

Table 1: Research examines in different economies

Author	Period	Country	Methodology	Findings
Mashamba (2022)	2011 to 2016	11 countries	GMM Estimates	Banks in emerging nations have prioritized liquidity ratios and made partial adjustments in response to market volatility.
Pham <i>et al.</i> (2021)	2007 to 2018	Vietnam	Bayesian linear regression	ROA, GDP, Inflation, and loss loan provision positively influence while bank size, capital, and ROE adversely affect bank liquidity.
Singh and Sharma (2018)	2000 to 2014	India	Fixed Effect Estimates	Deposits, profitability, and cost of profitability impact positively, whereas NPA, size, and NIM negatively impacts liquidity in India.
Sopan and Dutta (2018)	2005 to 2016	India	Regression	Bank size, asset quality, profitability, and funding costs negatively relate to liquidity risk. In contrast to macroeconomic factors, inflation has a positive influence, and GDP harms liquidity.
El- Chaarani (2018)	2014 to 2016	Middle East Region	WLS Regression	Lebanese banks have substantial amounts of liquidity compared to Omani banks, Liquidity and capital, economic growth, asset quality, and bank size are significantly correlated.
Bonner, Lelyveld, & Zymek, (2013)		OECD countries	Pooled OLS (ordinary lest square)	Liquidity was positively impacted by deposit and profit. The capital ratio has little effect on liquidity size.
Lee <i>et al.</i> (2013)	2003 to 2012	Malaysia	Fixed effect model	Profitability, NPA, and GDP positively impact, while capital, bank size, interbank rate, and financial crisis negatively impact bank liquidity.
Malik and Rafique (2013)	2007-2011	Pakistan	Fixed effect model	NPL, total asset, and monetary policy interest rate positively influence, while inflation and financial crisis negatively impact.
Tesfaye (2012)	2000 to 2011	Ethiopia	Panel regression estimates	Size, Capital, NPA, interest rate, NIM, and inflation have positive influence, while GDP has an insignificant effect.

Source: Author's collected from different journals.



Source: Author's understanding.

Fig. 1: Hypothesis developed

more clear conclusions (Bhati *et al.* 2019; Singh & Sharma, 2018). There are not numerous research that investigates the issue of bank liquidity determinants in the Indian context. A study investigated by Singh and Sharma (2018) reveals that deposits, profitability, and cost of profitability positively impact bank liquidity, whereas NPA, size, and NIM negatively impacts liquidity in India. The study's limitation was not considering macroeconomic variables such as statutory liquidity ratios, cash reserve ratios, customer behaviors, and financial crises. Sopan & Dutta (2018) exhibit that size, profitability, asset quality, and funding costs negatively affect liquidity risk. In contrast to macroeconomic factors, inflation has a positive influence, and GDP negatively affects liquidity. The main limitation was that it did not consider reserve ratios and only one aspect of liquidity ratios. Bhati, Zoysa, & Jitaree (2019) investigate several regulatory, bank-specific, and external factors on four different liquidity ratios by executing a random effect from 1996 to 2016. The analysis's findings reveal divergent associations between the dependent and explanatory variables, as determined by four liquidity ratios. Table 1 represents the empirical studies investigated across different time-frames to explain how these factors affect bank liquidity.

Data

This section provided the details of the selected data to analyze the specified hypothesis. The present study includes 49 commercial banks during the time-frame work of 12 years from 2008 to

2021. All the selected variables considered in the regression model were extracted from the reserve bank database and CMIE economic outlook. The variables such as deposits, capital, size, ROA, NIM, NPA, CRR, SLR, and INT were extracted from the RBI database. The other variable, GDP, was collected from CMIE economic outlook. The bank included of 12 public banks, 19 private banks, and 18 foreign. The banks were selected depending on data availability during the study time-frame.

Research methodology

The present study examines scheduled commercial banks functioning in India during the time framework from 2008 to 2021 by taking balanced panel data. Bank size, deposit, net interest margin, capital, non-performing assets, return on assets, interest rate, statutory liquidity ratio, cash reserve ratio, GDP, and inflation are the independent variables whereas bank liquidity is the dependent variable. This study implements the Generalized Method of Moment established by Arellano-Bond and Blundell-Bover. The regression model for the investigation has been presented in the equation as follows:

$$LIQ_{it} = \alpha_{it} + \beta_1 DEP_{it} + \beta_2 CAP_{it} + \beta_3 LAS_{it} + \beta_4 ROA_{it} + \beta_5 NIM_{it} + \beta_6 NPA_{it} + \beta_7 INT_{it} + \beta_8 CRR_{it} + \beta_9 SLR_{it} + \beta_{10} GDP_{it} + \varepsilon_{it} \quad \dots(1)$$

Where LIQ is defined as a proxy of liquid assets over total assets, α_{it} indicates a constant term where i is the bank entity, t denotes the years, $t = 1, \beta$ denotes

Table 2: Description of Variables

Variable	Notation	Measurement	Expected sign
Liquidity	LIQ	Liquid assets to total assets	
Deposits	DEP	Deposits to total assets	Positive
Capital	CAP	Capital adequacy ratio	Positive
Bank Size	LAS	Log of total assets	Negative
Profitability	PR	Return on Asset	Negative
Net Interest Margin	NIM	Net-interest income to total assets	Negative
Non-performing Assets	NPA	Net non-performing assets to net advances	Positive
Interest rate	INT	Repo rate	Negative
Reserve Ratio	CRR	Cash reserve ratio	Negative
	SLR	Statutory liquidity ratio	Negative
Gross Domestic Product	GDP	GDP growth rate	Positive

Source: Author's collected from different journals.

the coefficient of variables, and ε represents error term. Table 2 provides the descriptions for each variable specified in the regression equation.

Data

Table 3 shows the mean, standard deviation, minimum, maximum, and observations to give an insight into variables distribution. The average value of LIQ is .822 percent over the study time-frame. A high standard deviation has been reported by capital showing that selected bank's capital vary. According to Table 3, the explanatory variables show that SLR has the highest mean value, i.e., 21.9; after that, CAP, INT, GDP, LAS, CRR, NIM, NPA, ROA, PR, and DEP at 17.54, 6.52, 5.43, 4.72, 4.55, 2.98, 2.05, .860, and .530 respectively.

Table 3: Summary Statistics

Variable	Observation	Mean	S.D	Mini.	Maxi.
PR	637	.8603	1.306	-9.62	4.92
NIM	637	2.985	.9449	.13	8.15
NPA	637	2.052	3.293	0.00	54.56
DEP	637	.5304	.3443	.0007	3.438
CAP	637	17.54	8.985	7.51	87.25
LAS	637	4.725	.8247	1.626	6.66
LIQ	637	.822	2.251	.0453	6.242
INT	637	6.526	1.137	4.2	7.94
CRR	637	4.550	1.095	3.25	7.325
SLR	637	21.91	2.232	18	24.5
GDP	637	5.438	3.840	-6.6	8.5

Source: Author's calculation.

Correlation matrix

Table 4 displays the correlation matrix, which indicates the association among independent variables. There is no issue of multicollinearity, as none of the predicting variables are strongly correlated. The concern of multicollinearity exists if the correlation degree exceeds 0.8. The multicollinearity problem was also examined using the variation inflation factor (VIF). The data set appears to be free of multicollinearity, as indicated by the highest VIF value of 4.68.

Regression Analysis and discussion

An occurrence of autocorrelation and heteroscedasticity restricts to use fixed effect or OLS model. Also, the empirical model is static or dynamic. If the model considered a dependent variable with lag as an explanatory variable, it indicates the model is dynamic. Table 5 presents the final results of estimations. Using two-step system generalized method of moment, the problem of correlation among lagged dependent variable and error term is resolved. The GMM technique also took into account the problem of the weak instrument by using the instrument at both level and difference. The validity of the Sargan test instrument is suggested by the GMM regression results, indicating the usage of a dynamic panel. Arellano and Bond's second-order test shows that the present dataset has no second-order correlation.

Table 4: Correlation Matrix

	DEP	CAP	LAS	PR	NIM	NPA	INT	CRR	SLR	GDP
DEP	1.000									
CAP	-0.019	1.000								
LAS	-0.151	-0.444	1.000							
PR	0.067	0.053	-0.102	1.000						
NIM	0.051	0.335	-0.266	0.442	1.000					
NPA	-0.008	0.165	0.196	-0.528	-0.110	1.000				
INT	-0.055	0.016	-0.060	0.134	0.110	-0.034	1.000			
CRR	0.033	-0.008	-0.238	0.242	0.166	-0.204	0.221	1.000		
SLR	0.047	0.024	-0.243	0.292	0.187	-0.218	0.488	0.792	1.000	
GDP	0.026	0.005	-0.087	0.008	0.017	0.039	0.458	0.202	0.478	1.000
VIF	1.06	1.54	1.57	1.89	1.47	1.69	1.55	3.26	4.68	1.58

Source: Author's calculation.

The study examined the influence of capital, deposits, profitability, bank size, non-performing assets, net interest margin, interest rate, statutory liquid ratio, cash reserve ratio, and GDP on liquidity. Numerous research has looked into the relationship between bank liquidity and specified variables. The development of the hypothesis has been based on these previous studies. The results for the empirical model show that DEP, ROA, and NPA have a substantial positive influence while CAP, LAS, NIM, INT, CRR, and GDP negatively influence liquidity. SLR has an insignificant influence on bank liquidity.

Deposits has a substantial positive influence on bank liquidity at the 5 percent. It signifies that banks must maintain adequate liquidity to deal with unexpected cash withdrawals. Arif and Anees (2012) state that the association between deposits and bank liquidity is positively significant. The coefficient of size showed an inverse link with liquidity at the 5 percent level. It signifies that smaller banks need greater liquidity due to a lack of access to external funding than larger banks. Loan *et al.* (2021), Bhati *et al.* (2019), Singh and Sharma (2018), and El-Chaarani (2018) show a substantial negative impact of bank size on liquidity. This investigation contradicts Aspachs, Nier, and Tieset (2005), who recommend that size has an insignificant impact on banks' liquidity. The coefficient of capital showed a negative significant influence with bank liquidity at the 5 percent. Diamond and Ranjan (2001) shows an inverse link between capital and liquidity of banks. The results is not similar to studies by Al-

Khouri (2012) and Ghosh (2016), who found that a higher capital increases a bank's capacity to produce liquidity.

Table 5: GMM Model estimates

Variables	Coefficient	Standard Error	Z	P-Value
Lag LIQ	.0001	.00002	5.19	0.000
DEP	.3137	.00004	6.93	0.000
CAP	-.0002	.00010	-2.58	0.010
LAS	-.1159	.01326	-8.74	0.000
PR	.0142	.00295	4.82	0.000
NIM	-.0103	.00277	-3.73	0.000
NPA	.0013	.00048	2.68	0.007
INT	-.0084	.00363	-2.32	0.020
CRR	-.0289	.00536	-5.39	0.000
SLR	-.0015	.00159	-0.98	0.327
GDP	-.0015	.00076	-1.97	0.049
_cons	.7925	.07359	10.77	0.000
Wald χ^2	2.39e+11			
Prob > χ^2	0.0000			
No. of groups	49			
No. of instruments	33			
Observation	588			
Sargan Test	22.95			
Sargan Test (p-value)	0.3466			
Arellano- Bond AR(2)	0.172			
AR (2) p-value	0.6802			

Note: This study has considered generalized method of moment (GMM) suggested by Arellano-Bond and Blundell-Bover method. The estimates are significant at 5 percent level.

Source: Reserve Bank of India (Author's calculation).

The results of the regression show a strong positive correlation between profitability and liquidity. A bank's profitability can be increased by investing in a riskier project. However, sufficient liquidity should be maintained if the bank invests in riskier assets. Aspachs *et al.* (2005) and Delechat *et al.* (2012) reported similar finding. The net interest margin coefficient demonstrated a statistically significant negative association with bank liquidity at the level of 5 percent. It provides some flexibility to banks to maintain low liquid reserves. Hesse (2007) demonstrates that net-interest margin significantly reduces banks' liquidity. NPA has a positive association on bank liquidity at 5 percent level. It suggests that banks are urged to keep sufficient liquidity to support cash flow management if the number of non-performing assets (NPAs) rises. Similar findings were concluded by Malik and Rafique (2013), who found a substantial positive link between bank liquidity and nonperforming assets.

An interest rate negatively impacts bank liquidity at the 5 per cent level. A rise in interest rates could cause the bank's liquidity to decline. The findings are consistent with the work of Valla *et al.* (2006) and Al-Homaidi *et al.* (2019), who conclude that interest rates significant negatively affect bank liquidity. Further, regression analysis reveals that SLR has an insignificant negative influence on liquidity. A study by Bhati *et al.* (2019) also exhibits a deleterious association between SLR and bank liquidity. Bank liquidity is significantly impacted negatively by GDP at a 5 percent level. The findings align with the findings of Aspachs *et al.* (2005) and Chen and Phuong (2014), who propose an inverse relationship between GDP and bank liquidity. However, some previous research also indicates a noteworthy positive influence on bank liquidity (Loan *et al.* 2019).

CONCLUSION, SUGGESTIONS, AND FUTURE SCOPE

The study investigated the influence of deposits, capital, bank size, net interest margin, profitability, non-performing assets, statutory liquid ratio, interest rate, cash reserve ratio, and GDP on bank liquidity. Liquidity is crucial for the smooth functioning of the banking industry. If a bank experience liquidity issues for a prolong period, it may affect other institutions and economy. Therefore, exploring

these factors' effect on banks' liquidity is significant. The analysis shows that DEP, ROA, and NPA positively impact while CAP, LA, NIM, INT, CRR, and GDP negatively influence bank liquidity. SLR has an insignificant influence on liquidity.

The study's findings have implications for policymakers, bankers, and researchers. The study's implications and significant findings are listed below.

The deposit positively correlates with bank liquidity at a 5 per cent level. Our finding parallels other studies (Arif & Anees, 2012; Bonner *et al.* 2013). Deposits are an essential source of funds that banks use to generate profit and income. In certain circumstances, customer withdraws their money unexpectedly, and banks borrow funds from other sources at a higher rate. To evade such circumstances, a bank must maintain an adequate level of liquidity. Profitability showed a positive association with the liquidity of banks. The profitability of banks could be enlarged by investing in riskier assets. However, such investments have a significant risk of loss which may affect bank operational activities, so the bank must maintain an adequate level of liquidity to tackle such situations. The results are consistent with Al-Homaidi *et al.* (2019), while some studies show contradictory results (Delechat *et al.*, 2012; Aspachs *et al.* 2005). Future studies may address this results disparity. The analysis showed a negative association between capital and bank liquidity. The result contradicts Ghosh's (2016) and Al-khoury's (2012) studies, which indicate that a high capital ratio increases the bank's capability to generate liquidity. Although, financial fragility hypothesis proposes that bank liquidity reduces by maintaining a higher capital ratio (Diamond & Ranjan, 2001). Future studies may address this results disparity.

The link between liquidity and bank size is negatively substantial, as shown in regression analysis. The finding parallels to previous studies Lee *et al.* (2013) and Moussa (2015). The finding reveals that small banks must keep a high liquidity level as they do not have access to an alternate source of funds compared to large banks. The link between NIM and bank liquidity is proven to be substantially negative. Some studies (Drakos, 2003; Hesse, 2007) also show NIM's negative and substantial influence on banks' liquidity. A high level of NIM shows better bank management and

indicates future profits. Therefore, it provides some flexibility to banks to maintain low liquid reserves. Non-performing assets positively influenced bank liquidity. Our study's finding parallels Malik and Rafique (2013), which also shows a substantial positive influence on bank liquidity. A bank must hold significant liquid assets if the amount of non-performing assets increases to maintain cash flow management. Future studies may address this results disparity.

The interest rate has a substantial deleterious influence on bank liquidity. Al-Homaidi *et al.* (2019), Vodová (2013), and Chen *et al.* (2014) also revealed a similar finding, indicating that interest rates had a considerable detrimental impact on the liquid ratio. Liquidity is impacted by an increase in interest rates as the bank's ability to borrow funds has reduced. Central bank use repo rate as a significant monetary policy instrument to manage bank liquidity efficiently. The cash reserve ratio showed a significant adverse impact on banks' liquidity. A rise in CRR decreases banks' liquidity as banks must maintain some percentage of NDTL with the reserve bank of India. Central bank use cash reserve ratio as an effective instrument of monetary transmission to control the money supply in the country. Further, the statutory liquidity ratio has insignificant adverse influence on bank liquidity. Bhati *et al.* (2019) also demonstrate an adverse impact on liquidity in the Indian context. The finding reveals that SLR does not impact banks' liquidity in India. Therefore, policymakers should reconsider the SLR as an effective tool to manage bank liquidity. Lastly, the link between liquidity and GDP is negative and substantial. The result is parallel with other studies (Chen & Phuong, 2014), which indicate a negative link between GDP and liquidity.

The study's findings are limited as bank ownership was not considered. Future studies may include bank ownership and check what impact of these factors on different kinds of banks, as liquidity may be impacted in diverse ways based on bank ownership.

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