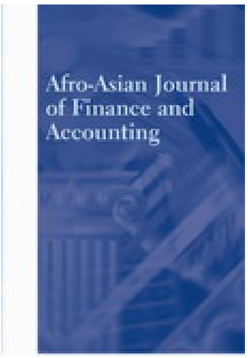


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# The effect of liquidity creation on bank profitability and credit risk: evidence from BRICS countries

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# The effect of liquidity creation on bank profitability and credit risk: evidence from BRICS countries

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**Abstract:** In this study, we empirically investigate whether liquidity creation after the implementation of liquidity regulations can help boost profitability and reduce credit risk for emerging economies. This study analyses a sample of 499 commercial banks from the BRICS countries between 2013 and 2021 and applies the two-step system generalised method of moments (GMM). Further, results are confirmed through robustness tests. The study's findings indicate a positive impact of liquidity creation on bank profitability, but this doesn't hold true for small banks. Also, findings indicate that more liquidity creation leads to an increase in credit risk. Thus, the results suggest that regulators should devise measures to restrict excessive liquidity creation and call for combined regulation of liquidity and credit risk.

**Keywords:** liquidity creation; profitability; credit risk; BRICS; Basel III.

**JEL codes:** G21, G28.

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## 1 Introduction

The global financial crisis (GFC) underlined the necessity for rigorous banking rules to mitigate the risks arising from bank balance sheet imbalances (Gupta and Kashiramka, 2020). Although the banks' fundamentals are strong, the GFC crisis shows how rapidly and severely illiquidity may cause a run on the banks and impact macroeconomic stability. This is partly because ignorant depositors are unable to discern the difference between solvency and liquidity shocks. Therefore, in order to lower the risk of liquidity and maturity transformation, the Basel Committee on Banking Supervision (BCBS) introduced two minimum liquidity norms: the liquidity coverage ratio (LCR), addressing short-term requirements, and the net stable funding ratio (NSFR), addressing long-term considerations. As per the LCR, banks must maintain a sufficient amount of high-quality liquid assets to cover their needs for liquidity during times of stress that last longer than a month. It is believed that the bank can take necessary corrective action during such times. The goal of the NSFR is to guarantee, over a one-year period, a minimum level of consistent funding for bank assets based on those assets' liquidity characteristics (BIS, 2013). However, once banks adhered to the liquidity requirements, their ability to generate liquidity was limited. This is because banks generate liquidity by converting liquid short-term liabilities into long-term non-liquid assets and extending off-balance-sheet loan obligations and guarantees (Bryant, 1980; Kashyap et al., 2002).

Liquidity creation (LC), coupled with risk transformation, constitutes the most significant factor of bank existence and also serves as a comprehensive indicator of bank productivity (Diamond and Dybvig, 1983; Berger and Bouwman, 2009). It serves the vital purpose of granting credit to borrowers who may not be able to acquire financing through the capital market and also provides access to payment services and liquid cash to depositors (Kashyap et al., 2002). However, because both borrowers and depositors seek liquidity at the same time, there is a need to maintain a balance between the costs and benefits of providing more liquidity (Berger et al., 2019). Diamond and Dybvig (1983) claim that while LC helps banks generate money, it may also lead to asset liquidation sales and bank failures because of increased liquidity risk brought on by more non-liquid assets. According to Chatterjee (2018), bank LC can also be used to anticipate recessions. Therefore, we can say banks not only play an important role as liquidity providers for the efficient operation of the banking sector and the macroeconomy but also exert conflicting effects on the stability of banks (Gupta and Kashiramka, 2020). However, studies on the effects of LC are limited due to the lack of tools for quantifying LC. The foundational work of Berger and Bouwman (2009) presented a mechanism for calculating bank LC based on the category (cat) and maturity (mat) of loans and advances. When loans and advances are categorised based on category, and both on and off-balance sheet items are included, then it is termed as CATNONFAT, but when only balance sheet items are included, it is termed as CATFAT, similarly, on the basis of maturity.

Although the generation of liquidity is necessary not only for the financial sector but also for the economy as a whole to operate effectively, uncontrolled LC can lead to bank vulnerabilities like credit risk (Berger and Bouwman, 2009; Fungáčová et al., 2017). Banks generate income by creating liquidity through issuing loans and providing services as a guarantor, such as standby letters of credit, letters of credit, etc. However, the LC renders banks susceptible to liquidity risk, not only impacting their loan screening processes, thereby elevating credit risk, but also leading to an increase in distressed asset sales (Diamond and Dybvig, 1983; Duan and Niu, 2020). Although LC raises the likelihood of a bank failure, banks create liquidity despite the risk involved (Fungáčová et al., 2017; Chatterjee, 2018). Therefore, it becomes imperative to know the impact of LC on a bank's profitability and credit risk. These conflicting results prompt the following questions: given the risk associated with creating liquidity, why do banks undertake it? Does generating greater liquidity help banks increase their revenue? To answer these questions, we investigate the effect of LC on bank profitability and credit risk.

In this study, we use the Brazil, Russia, India, China, and South Africa (BRICS) bloc of emerging countries for a number of reasons. First, the nominal GDP of these five nations represents 26.2% of the gross world product, and they make up 41.30% of the world's population (State et al., 2021). Second, these countries are still more dependent on the banking financial system because of the developing capital market in these countries (Fernandes et al., 2021; Fofack et al., 2020). Lastly, given that banks from these five nations are among the top 100 banks in the world, a thorough investigation into how LC affects the profitability and credit risk of commercial banks in emerging nations is lacking in the literature.

Our study contributes to the body of knowledge regarding the effects of LC on developing nations. Our findings of a positive association between LC and bank profitability propose that the liquidity risk outweighs the lower returns risk of liquid assets. Secondly, our study finds that credit risk is rising along with the increase in LC, supporting the hypothesis that having plenty of liquidity encourages people to take more risk, making them less liquid and raising credit risk. Conclusively, our study findings imply that banks have stronger incentives to generate liquidity despite the fact that doing so increases banks' credit risk.

The remainder of the paper is structured as follows. The relevant literature and hypotheses derived from it are covered in Section 2. Section 3 covers the study's data and methodology. The empirical results, analysis, and robustness tests are all covered in Section 4. Section 5 summarises the study's findings and policy implications.

## 2 Literature review and hypothesis development

Banks contribute significantly to the economy by generating liquidity. This notion emphasises the critical part that banks serve in facilitating the efficient circulation of cash among diverse economic agents. LC is a statistically and economically important indicator of bank output when compared to established metrics of bank output (Berger and Sedunov, 2017). In order to better understand how LC affects bank profitability and credit risk, we evaluate the pertinent literature in this section, on the basis of which we build a set of testable hypotheses.

### *2.1 The LC and profitability*

Creating liquidity is a significant source of earnings (Duan and Niu, 2020). Despite the fact that creating liquidity increases the likelihood of bank failure, banks have a tremendous incentive to do so. Similarly, Berger and Bouwman (2009) argue that bigger net surpluses are distributed among stakeholders as greater liquidity is created. Thus, the

LC has a positive effect on the value of banks. According to Bordeleau and Graham (2010), by retaining more liquid assets banks can lower their probability of default and illiquid risk. Consequently, banks with greater levels of liquid assets typically have reduced funding expenses and greater net profit. High liquidity is typically associated with higher profitability for banks (Kosmidou, 2008). Chen et al. (2018) examine the factors that contribute to liquidity risk and the relationship between bank liquidity risk and performance in 12 advanced economies from 1994 to 2006. The study's findings confirm that liquidity risk has an endogenous role in determining bank profitability. However, according to Islam and Nishiyama (2016), liquidity has a positive but insignificant impact on profitability. However, Adelopo et al. (2022), who study the largest banks in the European Union across 28 nations from the years 2010 to 2018, find a significantly positive association between the generation of liquidity and bank profitability. According to Bourke (1989) analysis of bank profitability and its factors. The findings indicate that banks generating higher levels of liquidity tend to be more profitable. Abbas et al. (2019) investigate how LC affects commercial banks' profitability. The results reveal that an increase in liquidity of 3.5% results in a rise in profit of 1%, while the intensity of profit generation is highest for large banks. According to Afzal et al. (2023), there is a positive association between liquidity generation and profitability and a negative association between LC and the cost of funds. Veeramoothoo and Hammoudeh (2022) observe a positive correlation between profitability and liquidity standards. However, the lower significance implies that Basel III was successful in establishing sufficient liquidity standards to lessen the effect on bank profitability. Additionally, Obadire et al. (2022) contend that Basel III liquidity regulations assist banks in maintaining liquidity levels, which in turn gives them more confidence to take on high-yielding projects that ultimately result in improved profitability. Therefore, we propose the following hypothesis considering the aforementioned observations:

H1a Higher LC leads to an increase in bank profitability.

Another body of research discovered a negative association between LC and banks' profitability ratios. According to Sahyouni and Wang (2018), LC has a sizable detrimental impact on bank profitability. This is consistent with the predicted bankruptcy cost hypothesis. Basel III liquidity regulations result in greater funding costs and, as a result, there is a reduction in profitability (Ötker-Robe and Pazarbaşıoğlu, 2010). Bonner and Eijffinger (2016) empirically identify the negative association between LC and profitability, confirming the notion that more LC is associated with higher expenses. Basel III capital standards, which are more stringent, will result in less LC, which would reduce profitability. Using US banks, data from 1984 to 2014, Berger and Bouwman (2015) investigated the relationship between LC and bank profitability. The investigation's findings reveal a negative association for medium and small banks, while proving to be beneficial for large banks. Banks which generate more liquidity are more likely to suffer greater losses if they are required to sell assets to satisfy their liquidity needs (Allen and Gale, 2004a). Sahyouni and Wang (2019) find that LC significantly and negatively affects profitability (return on average equity) of MENA banks. This finding lends support to the projected bankruptcy cost theory, which holds that LC may raise the risk of illiquidity, which lowers bank profitability and raises the likelihood of bankruptcies. However, the findings indicated that LC has no impact on return on average assets. Utilising quarterly data from US banks spanning from the period 1996 to 2013, Tran et al. (2016) demonstrate that when banks have high LC and liquidity risk, they typically have low profitability. Though these results are encouraging, it is still unclear conceptually how LC affects bank performance as a whole. Based on the above findings, our hypothesis is:

H1b Increased LC results in lower bank profitability.

## *2.2 Risk and LC*

Banks play two crucial roles, i.e., provide liquidity and reduce risk, according to Bhattacharya and Thakor (1993). These roles are performed by funding illiquid liabilities with liquid assets in an environment of random shocks. However, higher capital ratios are required to be maintained by high-risk institutions. The rationale for this stipulation is to prevent banks from being exposed to risk as financing an excessive number of economically distressed projects due to weak evaluation processes (Le and Pham, 2021). According to Ghosh (2015), credit risk in a banking industry is a significant challenge for both regulators and banks due to its correlation with bank failures and its role as a precursor to banking crises. Furthermore, the deterioration of bank asset quality has the potential to adversely affect overall economic activity. So, it is imperative to study the impact of LC on credit risk of BRICS nations. LC is intrinsically risky, as banks make themselves less liquid while delivering liquidity to the economy in an effort to boost their profits (Diamond and Rajan, 2001). A few research (Acharya and Viswanathan, 2011; Diamond and Rajan, 2005; Nguyen et al., 2022) find a substantial positive association between LC and credit risk. Le and Pham (2021) explore the interdependence of LC and credit risk in six Asia-Pacific rising nations from 2012 to 2016. The results indicate a negative effect of credit risk on LC while failing to find any evidence of an inverse relationship. Umar and Sun (2018) investigate 197 banks in China between 2005 and 2014 and find that LC by banks is independent of changes in NPLs across all bank sizes. Basel III NSFR, however, adversely affects not only LC but also credit risk, in addition to reducing the mismatch between assets and liabilities (Dang, 2021). If significant LC is produced by high business loans and obligations, this will increase credit risk (Berger et al., 2016). Casu et al. (2019) find that LC increases in tandem with credit risk, implying that banks with higher LC eventually lead to higher credit risk. According to Vazquez and Federico (2015), banks that are failing are more likely to have insufficient structural liquidity. Higher leverage combined with excessive LC may make banks more vulnerable and raise their risk of failure (Acharya and Thakor, 2016). As a result, it is worthwhile to investigate how LC, after meeting the Basel III liquidity criteria, affects credit risk. As a result, we suggest the following hypothesis:

H2a Higher LC leads to an increase in credit risk.

Alternatively, findings suggest that the availability of liquidity in the economy promotes and stimulates economic activity by providing a large source of investment. By fostering favourable economic conditions and raising asset quality, the ability of borrowers to pay off their obligations will improve (Espinoza and Prasad, 2010). Furthermore, according to Berger and Sedunov (2017), LC is positively associated with real economic activity in terms of GDP. Although LC by small banks results in higher GDP compared to that of large banks, the LC of large banks matters more due to differences in scale (Angelini et al., 2015). According to Gambacorta (2011), a percentage point increase in the NSFR results in a 0.1% reduction in GDP. For the Russian region, Fidrmuc et al. (2015) explore the relationship between LC and economic growth using fixed effects – GMM estimation. The study's conclusions imply that increasing bank liquidity supports economic growth. On the other hand, slow economic growth may negatively impact bank asset quality; therefore, there is a need to reduce non-performing loans (NPLs) for enhancing the economic health (Ghosh, 2015). This implies that banks' contributions to fostering and supporting economic activity increase in proportion to the amount of liquidity they provide to businesses and people. As a result, debtors will be better able to pay back their obligations, raising the quality of bank assets. Alaoui Mdaghri (2022) investigate the impact of LC on banks' NPLs, considering both on- and off-balance sheet activities for calculating LC. The results reveal that LC significantly diminishes NPLs, regardless of on and off-balance sheet activities. Additionally, this association remains consistent for both conventional and Islamic banks. Vuong et al. (2023) examine the impact of LC on credit risk in terms of NPLs. Their findings show that LC by Vietnamese commercial banks negatively impacts NPLs due to an enhancement in borrowers' repayment ability stemming from their superior payback capability. Additionally, larger banks benefit more from LC than smaller banks, resulting in a significant decrease in their NPLs. In light of this critical evaluation, we test the following hypothesis:

H2b Higher LC leads to a decrease in credit risk.

In addition to theoretical disagreements, limited research actually evaluating the consequences of LC on bank profitability and credit risk has yielded varied conclusions. The empirical research lacks a thorough examination of how LC affects profitability and credit risk in developing nations, how much of an impact it has, how small, medium, and large banks are affected differently, and what is the difference in relationships after employing different proxies of LC. By examining the effect of LC on bank profitability and credit risk in emerging economies, this study aims to fill the aforementioned gaps.

## 3 Data and methodology

### *3.1 Data*

To analyse the effect of LC on banks' profitability and credit risk, this study uses the annual data of banks operating in BRICS economies from 2013–2021. We examine Basel III's real transition phase commencing from 2013 and limiting it to 2021 because of data availability. Our final sample comprises 499 banks after excluding banks with less than three years of data. We also Winsorised the data at the 1st and 99th percentiles to mitigate the impact of outliers. We used Moody's Analytic BankFocus database for banks' financial data, the World Development Indicator (WDI) of the World Bank for country-specific regulatory environment, and the Heritage Foundation for financial freedom index.

## 3.2 Variables

### 3.2.1 Dependent variables

- *Profitability indicators:* The profitability of a bank has been evaluated using four different measures. First, the net income to total asset ratio is used to determine the return on assets (P_ROA). P_ROA is a metric used to assess a company's efficiency and productivity in managing total assets in order to create profit (Alaoui Mdaghri, 2022; Dietrich and Wanzenried, 2011; Duan and Niu, 2020; Ovi et al., 2020). Second, return on equity (P_ROE) is determined by dividing net income by shareholders' equity. According to Mazioud Chaabouni et al. (2018) and Saleh and Abu Afifa (2020), P_ROE measures how well a company's management generates revenue from its equity financing. Third, the net interest margin (P_NIM) is the difference between the amount of interest earned and the amount of interest paid by financial institutions in relation to the amount of their assets. P_NIM is a profitability metric that, according to Batten and Vo (2019) and Dietrich and Wanzenried (2011), roughly predicts the likelihood that a bank will prosper over a period of time. Fourth, in addition to profitability measures, the cost-to-income ratio (P_CTI[2]) serves as a measure of cost-effectiveness, utilised to access and capture the efficiency of a bank's operations. Therefore, since P_CTI provides a clear picture of the bank's operational efficiency, a lower ratio indicates a more profitable bank (Bitar et al., 2018; Saleh and Abu Afifa, 2020).
- *Risk indicators:* Similarly, four measures are used in the study to assess a bank's credit risk. Credit risk has been estimated by the NPLs to gross loans ratio (R_NPL). To decrease credit risk, loan quality must be monitored continuously because higher R_NPL has a negative impact on bank asset quality and profitability (Alaoui Mdaghri, 2022; Dimitrios et al., 2016). The variance of return on assets (R_VROA) and variance of return on equity (R_VROE) have been utilised, following Lee and Hsieh (2013) and Lepetit et al. (2008). Lastly, we utilised R_Zscore to gauge banks' risk-taking, as recommended by Berger and Bouwman (2009), Chen et al. (2017), Demirgüç-Kunt and Huizinga (2010) and Fu et al. (2016). Therefore, a lower R_Zscore indicates bank's vulnerability to risk.

### 3.2.2 Key explanatory variables

Bank LC[1] is our main explanatory variable. We used Berger and Bouwman's (2009) methodology because the information needed to assess the actual liquidity created by banks is not readily available. According to the methodology, all of the assets, liabilities, and equities are divided into three categories: liquid, semi-liquid, and illiquid. After that, weights are applied according to the degree of certainty or uncertainty associated with their liquidity. Finally, the liquidity generated is calculated by combining the determined activities and the weights assigned. However, we limit our LC to Catnonfat (CNFLC) in the study due to the lack of off-balance sheet data for the majority of the banks. To prevent providing large financial institutions an undue edge, we normalised LC by total assets (Berger and Bouwman, 2009; Fu et al., 2016).

**Table 1** Summary statistics of the variables utilised in the study

| *Variable* | *Obs.* | *Mean* | *Std. dev.* | *Min* | *Max* |
|---|---|---|---|---|---|
| *Profitability measures* | | | | | |
| P_ROA | 3,682 | 0.821 | 1.617 | –6.547 | 6.549 |
| P_ROE | 3,683 | 7.624 | 11.078 | –43.803 | 32.365 |
| P_NIM | 3,683 | 4.739 | 4.794 | –2.319 | 28.119 |
| P_CTI | 3,683 | 10.386 | 21.846 | 0.853 | 160.770 |
| *Credit risk measures* | | | | | |
| R_NPL | 3,683 | 6.889 | 14.331 | 0 | 93.712 |
| R_VROA | 3,683 | 2.130 | 9.601 | 0.001 | 82.439 |
| R_VROE | 3,683 | 72.228 | 245.6623 | 0.011 | 1,969.421 |
| R_Zscore | 3,672 | 6.120 | 10.233 | –2.116 | 59.849 |
| *Bank-specific control variables* | | | | | |
| CNFLC | 3,668 | 39.687 | 22.455 | –29.536 | 96.203 |
| BCAR | 3,683 | 21.177 | 18.835 | 10.11 | 137.20 |
| Logassets | 3,681 | 15.259 | 2.721 | 9.215 | 21.328 |
| NLR | 3,682 | 46.382 | 19.092 | 0.258 | 97.146 |
| DEPR | 3,655 | 117.51 | 43.080 | 1.102 | 178.033 |
| IDR | 3,667 | 0.047 | 0.190 | 0 | 1.577 |
| *Macroeconomic control variables* | | | | | |
| M_BUC | 3,683 | –0.160 | 2.366 | –10.166 | 5.932 |
| M_GQ | 3,683 | –0.3707 | 0.213 | –0.787 | 0.128 |
| M_FF | 3,683 | 34.054 | 13.628 | 20 | 60 |

Notes: This table provides the summary statistics of variables utilised in the study. The variables used in the study are uniform since all except Logassets (in logarithm), M_GQ (averaged index), and M_FF (scores out of 100) are expressed as percentages.

### *3.2.3 Bank-specific control variables*

The literature has revealed a number of bank-specific control variables that may have an impact on banks' profitability and credit risk. The ratio of total regulatory capital to risk-weighted assets (BCAR) has been used as a proxy for capital (Bitar et al., 2018). It demonstrates a bank's capacity to effectively absorb risks (Mutarindwa et al., 2020; Rizvi et al., 2018). Bank size (Logassets) is the natural logarithm of total bank assets following Rizvi et al. (2018) and Sarkar et al. (2019). According to Alaoui Mdaghri (2022) and Mergaerts and Vander Vennet (2016), business models are major determinants of profitability and risk. Therefore, determining a bank's specialisation in traditional bank lending activities is done by assessing its net loans to total assets (NLR), its reliance on retail funding is determined by evaluating its deposits to total assets (DEPR), and its capacity to generate non-interest income is determined by non-interest income to total operating income (IDR).

**Table 2** Pairwise correlation coefficient matrix of variables

| | *P_ROA* | *P_ROE* | *P_NIM* | *P_CTI* | *R_NPL* | *R_VROA* | *R_VROE* | *R_Zscore* | *CNFLC* | *BCAR* | *Logassets* | *NLR* | *DER* | *IDR* | *M_BUC* | *M_GQ* | *M_FF* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P_ROA | 1 | | | | | | | | | | | | | | | | |
| P_ROE | 0.791*** | 1 | | | | | | | | | | | | | | | |
| P_NIM | 0.219*** | 0.026 | 1 | | | | | | | | | | | | | | |
| P_CTI | –0.078*** | –0.172*** | 0.212*** | 1 | | | | | | | | | | | | | |
| R_NPL | –0.115*** | –0.249*** | 0.295*** | 0.222*** | 1 | | | | | | | | | | | | |
| R_VROA | –0.266*** | –0.318*** | 0.193*** | 0.174*** | 0.237*** | 1 | | | | | | | | | | | |
| R_VROE | –0.325*** | –0.389*** | 0.105*** | 0.114*** | 0.227*** | 0.627*** | 1 | | | | | | | | | | |
| R_Zscore | 0.160*** | 0.309*** | –0.144*** | –0.170*** | –0.180*** | –0.132*** | –0.165*** | 1 | | | | | | | | | |
| CNFLC | –0.023 | 0.031* | –0.025 | –0.298*** | –0.018 | –0.067*** | 0.020 | 0.066*** | 1 | | | | | | | | |
| BCAR | 0.046*** | –0.156*** | 0.263*** | 0.295*** | 0.158*** | 0.243*** | 0.042*** | –0.160*** | –0.348*** | 1 | | | | | | | |
| Logassets | 0.025 | 0.277*** | –0.483*** | –0.392*** | –0.365*** | –0.269*** | –0.177*** | 0.341*** | 0.121*** | –0.500*** | 1 | | | | | | |
| NLR | 0.141*** | 0.103*** | 0.162*** | –0.421*** | –0.112*** | –0.130*** | –0.042** | 0.031* | 0.478*** | –0.297*** | 0.102*** | 1 | | | | | |
| DER | –0.072*** | 0.051*** | –0.202*** | –0.240*** | –0.081*** | –0.172*** | –0.032** | 0.132*** | 0.619*** | –0.366*** | 0.246*** | 0.121*** | 1 | | | | |
| IDR | –0.005 | –0.021 | 0.022 | 0.175*** | 0.034** | 0.027* | –0.008 | –0.042** | –0.127*** | 0.086*** | –0.085*** | –0.153*** | –0.153*** | 1 | | | |
| M_BUC | 0.034** | 0.051*** | –0.038** | –0.029* | –0.056*** | –0.025 | –0.035** | 0.082*** | –0.019 | –0.018 | 0.085*** | 0.012 | 0.010 | 0.024 | 1 | | |
| M_GQ | –0.029* | 0.006 | –0.171*** | –0.012 | –0.183*** | –0.091*** | –0.093*** | 0.040** | –0.226*** | –0.140*** | 0.302*** | 0.084*** | –0.183*** | 0.082*** | 0.086*** | 1 | |
| M_FF | 0.062*** | –0.062*** | 0.293*** | 0.288*** | 0.158*** | 0.119*** | 0.115*** | –0.158*** | –0.357*** | 0.111*** | –0.289*** | 0.010 | –0.502*** | 0.190*** | –0.005 | 0.370*** | 1 |

Notes: This table presents the correlation matrix.

### 3.2.4 Country-specific control variables

The Hodrick-Prescott filter is used to examine the annual growth rates of the GDP in order to measure the business cycle (M_BUC) (Tran et al., 2016). The average of all six world governance indicators (M_GQ), as proposed by Shaddady and Moore (2019) and Awdeh and El-Moussawi (2022), has been utilised for controlling the influence of governance quality. The Financial Freedom Index (M_FF) shows the increased operational flexibility and efficiency of banking operations, which enables banks to take advantage of a variety of revenue-generating options (Ovi et al., 2020). To address the potential impact of COVID-19 pandemic on bank profitability and credit risk, we utilise a dummy variable denoted as Dm_CVD. In accordance with Tran et al. (2023), Dm_CVD is assigned a value of 1 for the years 2020 and 2021, and 0 otherwise.

## 3.3 Methodology

We utilised a dynamic panel data model with a lagged value of the dependent variable in both equations to cope with endogeneity and omitted explanatory concerns to empirically evaluate the effect of LC on bank profitability and credit risk. The following are the equations:

$$\pi_{i,c,t} = \alpha_0 + \alpha_1 \pi_{i,c,t-1} + \sum_{p=1}^{P} \gamma_p X_{pi,c,t} + \sum_{q=1}^{Q} \delta_q Z_{qc,t} + \eta_c + \varphi_t + \varepsilon_{i,c,t} \quad (1)$$

$$\upsilon_{i,c,t} = \alpha_0 + \alpha_1 \upsilon_{i,c,t-1} + \sum_{p=1}^{P} \gamma_p X_{pi,c,t} + \sum_{q=1}^{Q} \delta_q Z_{qc,t} + \eta_c + \varphi_t + \varepsilon_{i,c,t} \quad (2)$$

where subscript $i$ is the bank, $c$ is the country, and $t$ is the time. $\pi_{i,c,t}$ are the bank's four profitability indicators; $\upsilon_{i,c,t}$ are the bank's four credit risk indicators; $X_{pi,c,t}$ are bank-specific controls; $Z_{qc,t}$ are country-specific control variables; $\alpha$ are estimated parameters of interest, $\gamma$ vector of coefficient of bank-specific variables, $\delta$ vector of country-specific control variables; $\eta_c$ are country-fixed effects, and $\varphi_t$ are year-fixed effects; $\varepsilon_{i,c,t}$ is the error term. The year and country-fixed effects are used to control for unobservable time-variant and country-time-invariant variables, respectively.

The literature that is currently available reveals a two-way relationship between profitability and credit risk, suggesting potential endogeneity problems. As a result, the generalised method of moments (GMM) has been well-suited to address the challenges of auto-correlation, endogeneity, the dynamic character of the panel data, and heterogeneity, as well as to take simultaneity into account (Fu et al., 2016). Due to the robust instrumentation and efficiency of this investigation, we used a two-step dynamic panel system GMM estimation technique to estimate the coefficients of equations (1) and (2) (Arellano and Bover, 1995; Blundell and Bond, 1998).

# 4 Empirical results and discussion

## 4.1 Descriptive statistics and multi-collinearity test

Table 1 shows the descriptive statistics of each variable utilised in the study, along with the abbreviations used. The mean values of profitability measures P_ROA, P_ROE, P_NIM, and P_CTI are 0.82, 7.62, 4.73, and 10.38, respectively. However, the P_ROE and P_CTI have the highest standard deviation. Whereas the mean values of credit risk measure R_NPL, R_VROA, R_VROE, and R_Zscore mean values are 6.88, 2.13, 72.22, and 6.12, respectively. CNFLC has an average value of 39.68 and a standard deviation of 22.45. However, pairwise correlation coefficients shown in Table 2 of all the variables are less than 0.80, which suggests there is no significant multi-collinearity.

## *4.2 Regression analysis*

The results of Tables 3 and 4 demonstrate that all current measures of profitability and risk are substantially correlated with the prior year, demonstrating the persistence of profit and credit risk. The use of a two-step system GMM estimation for the current investigation is therefore justified because there is an accumulation from one year to the next. Additionally, we utilised the AR (2) test to look at the auto-correlations of the error components and Hansen test p-values to analyse the reliability of the selected.

Table 3 presents the results of equation (1), where P_ROA, P_ROE, P_NIM, and P_CTI are the dependent variables. The regression results in columns (1), (2) and (3) indicate that LC is positively and significantly associated with P_ROA, P_ROE, and P_NIM. At the same time, there is a negative and significant association between LC and P_CTI because lower P_CTI leads to higher profits. Accordingly, a 1% increase in CNFLC brings approximately 0.3% to 3.4% increase in bank profitability and approximately 0.5% decrease in P_CTI. However, BCAR shows a positive association with profitability measures, supporting the notion that capital improves the performance of the bank (Berger and Bouwman, 2013). Also, our results about the effect of LC on bank profitability are consistent with the results of Bourke (1989), Berger and Bouwman (2009) and Afzal et al. (2023). Banks manage LC by keeping more liquid assets to safeguard against liquidity risk. Therefore, holding liquid assets reduces revenue since they generate lower returns than illiquid assets for banks. In light of this, bank profitability ought to be inversely correlated with LC. In contrast, our findings show a positive association between LC and bank profitability. These findings come up with the notion that liquidity risk outweighs the lower returns risk of liquid assets and, therefore, support the Basel III liquidity regulations. The results for the remaining control variables are fairly consistent with our assumptions. R_NPL exhibits a negative association with bank profitability measured through P_ROA, and P_ROE. In contrast, there is a positive and significant association between R_NPL, and P_NIM, supporting the notion that banks adjust interest rate based on customers' credit scores. Additionally, there is a positive and significant association of Logassets, NLR, and DER with bank profitability. This supports the idea that larger banks enjoy economies of scale, potentially attributed to higher bank assets, net loans, and deposits (Abedifar et al., 2013). Additionally, this association suggests enhanced risk management, evident from negative association of R_NPL with profitability (Barth et al., 2013). The findings also suggest that profitability increases with a larger dependence on IDR, although the association is significant at 10% only. All other macroeconomic control variables, M_BUC, M_GQ, and M_FF were positively and significantly associated with bank profitability. However, the coefficient of Dm_CVD shows a negative and statistically insignificant association with bank profitability. These results imply that, there is no significant evidence to support the notion that the occurrence of COVID-19 has a notable impact on the profitability of banks in emerging countries.

**Table 3** Two-step system GMM estimation results, showing effects of LC on bank profitability

| | *P_ROA* | *P_ROE* | *P_NIM* | *P_CTI* |
|---|---|---|---|---|
| LagP_ROA | 0.318*** (0.075) | | | |
| LagP_ROE | | 0.360*** (0.069) | | |
| LagP_NIM | | | 0.477*** (0.079) | |
| LagP_CTI | | | | 0.621*** (0.170) |
| CNFLC | 0.004** (0.003) | 0.034** (0.018) | 0.003** (0.007) | –0.005** (0.032) |
| BCAR | 0.014*** (0.003) | 0.031** (0.015) | 0.026*** (0.008) | –0.018** (0.044) |
| R_NPL | –0.006 (0.004) | –0.053** (0.024) | 0.026*** (0.008) | 0.021 (0.033) |
| Logassets | 0.062*** (0.020) | 0.782*** (0.158) | –0.255*** (0.053) | –0.986** (0.406) |
| NLR | 0.012*** (0.003) | 0.058*** (0.018) | 0.034** (0.010) | –0.169*** (0.055) |
| DER | 0.004** (0.001) | 0.004** (0.008) | 0.001** (0.003) | 0.001* (0.011) |
| IDR | 0.170* (0.191) | 0.214* (0.886) | –0.025* (0.081) | 0.473* (3.837) |
| M_BUC | 0.016*** (0.005) | 0.101** (0.048) | 0.018** (0.014) | –0.077** (0.147) |
| M_GQ | 0.073*** (0.278) | 0.198** (0.241) | 0.573** (0.581) | –0.172* (3.090) |
| M_FF | 0.012*** (0.003) | 0.051** (0.026) | 0.028*** (0.010) | 0.098* (0.054) |
| Dm_COVID | –0.134 (0.087) | –0.807 (0.075) | –0.810 (0.237) | 0.123 (0.400) |
| Constant | 1.678*** (0.502) | 12.013*** (0.418) | 3.309*** (1.111) | 23.123** (1.604) |
| Observations | 3,138 | 3,140 | 3,145 | 3,140 |
| Wald $chi^2$ | 190.21*** | 285.10*** | 381.79*** | 291.82*** |
| AB test AR (1) (p-value) | 0.000 | 0.000 | 0.000 | 0.002 |
| Hansen test (p-value) | 0.335 | 0.354 | 0.434 | 0.210 |

Notes: The significant thresholds at 1%, 5%, and 10%, respectively, are the *** if $p < 0.01$, ** if $p < 0.05$, and *** if $p < 0.10$. In brackets, the standard error values are listed.

LC is both significantly and positively correlated with R_NPL, R_VROA, and R_VROE, as shown in Table 4's regression results for equation (2) in columns (1) to (3) and significantly negative with R_Zscore. In contrast, there is a negative and significant association between CNFLC and R_Zscore, which suggests that the increase in LC will increase the bank's exposure to credit risk. Accordingly, a 1% increase in CNFLC brings approximately a 0.7% to 1.7% increase in credit risk, with approximately 0.4% decrease in the stability of the bank. Our study's findings are, therefore, in line with the literature's argument that banks take more risk when they have more access to liquidity, which causes them to become less liquid (by creating more liquidity) and raise credit risk (Acharya and Naqvi, 2012; Berger et al., 2016). The moral hazard hypothesis, which posits that banks are inclined to increase their risk exposures as capital declines, is supported by the negative but insignificant coefficient of BCAR (Bitar et al., 2018; Guidara et al., 2013; Gupta and Kashiramka, 2020). This negative relationship could be attributed to the effectiveness of Basel III capital regulations. With regard to the control variables, P_ROA, Logassets, DER, and IDR exhibits a significantly negative association with credit risk, aligning with previous studies (Abdelaziz et al., 2022; Hakimi et al., 2022). However, NLR shows a positive association with credit risk, indicating that credit risk increases with higher loan volumes. Simultaneously, there is a negative association between IDR and credit risk, supporting the notion that a greater reliance on non-interest income adversely affects bank stability (Gupta and Kashiramka, 2020). Macroeconomic control variables, M_BUC, M_GQ and M_FF, exhibit a negative and significant association with credit risk, supporting the notion that favourable business cycle, good governance, and financial freedom helps in reducing the credit risk of banks (Jabbouri and Naili, 2019). However, the coefficient of Dm_CVD shows a positive and statistically insignificant association with credit risk. These results imply that there is no significant evidence to support the findings of Mehmood and De Luca (2023) that COVID-19 increased the credit risk of banks.

**Table 4** Two-step system GMM estimation results, showing effects of LC on credit risk

| | *R_NPL* | *R_VROA* | *R_VROE* | *R_Zscore* |
|---|---|---|---|---|
| LagR_NPL | 0.435*** (0.096) | | | |
| LagR_VROA | | –0.164*** (0.106) | | |
| LagR_VROE | | | 0.660*** (0.087) | |
| LagR_Zscore | | | | 0.513*** (0.047) |
| CNFLC | 0.012** (0.109) | 0.007** (0.012) | 0.017** (0.029) | –0.004** (0.010) |
| BCAR | –0.034 (0.027) | –0.010 (0.023) | –0.002 (0.043) | 0.013** (0.006) |
| P_ROA | –0.636** (0.033) | –0.562*** (0.021) | –0.552** (0.037) | 0.493*** (0.053) |
| Logassets | –0.157*** (0.166) | –0.036** (0.068) | –0.001 (0.016) | 0.453*** (0.081) |
| NLR | 0.083** (0.057) | 0.030** (0.011) | 0.021* (0.023) | –0.011* (0.007) |
| DER | –0.017 (0.028) | –0.007 (0.005) | 0.058 (0.099) | 0.003* (0.004) |
| IDR | 0.680 (2.222) | –0.726 (0.035) | –0.210 (0.021) | 0.176 (0.061) |
| M_BUC | –0.093** (0.089) | –0.010** (0.012) | –0.176* (0.017) | 0.291*** (0.052) |
| M_GQ | –0.249** (2.757) | –0.038* (1.983) | –0.276** (0.082) | 0.101*** (0.229) |
| M_FF | –0.125*** (0.035) | –0.019** (0.020) | –0.271** (0.059) | 0.120** (0.024) |
| Dm_COVID | 0.082 (0.904) | 0.014 (0.504) | 0.065 (0.803) | –0.409 (0.747) |
| Constant | 9.797** (3.856) | 5.739*** (2.240) | 24.530 (2.425) | 16.187*** (2.324) |
| Observations | 3,139 | 3,139 | 3,139 | 3,136 |
| Wald $chi^2$ | 521.98*** | 278.16*** | 462.83*** | 919.43*** |
| AB test AR (1) (p-value) | 0.000 | 0.011 | 0.001 | 0.000 |
| Hansen test (p-value) | 0.123 | 0.165 | 0.112 | 0.230 |

Notes: The significant thresholds at 1%, 5%, and 10%, respectively, are the *** if $p < 0.01$, ** if $p < 0.05$, and *** if $p < 0.10$. In brackets, the standard error values are listed.

## 4.3 Robustness analysis

This section includes two robustness tests that we run:

1 We divided our sample into three equal quantiles because size is expected to impact the profitability and credit risk profiles of banks through economies of scale (Bitar et al., 2018; Lang and Stulz, 1994).

2 Basel III introduced two liquidity restrictions, with the aim of lowering the risk of maturity transformation and liquidity risk.

However, the LC will be reduced when the LCR and NSFR increase (Vazquez and Federico, 2015). Therefore, in order to maintain the same interpretation of the coefficients, we use the inverse of LCR and NSFR to measure LC but use the proxies as LCR and NSFR only. To calculate the LCR and NSFR, we utilised the approximation method outlined by Chiaramonte and Casu (2017) and Gupta and Kashiramka (2020).

**Table 5** Two-step system GMM estimation results, showing effects of LC on bank profitability across small, medium, and large-sized banks

| | *P_ROA* | *P_ROE* | *P_NIM* | *P_CTI* |
|---|---|---|---|---|
| *Sample: small banks* | | | | |
| LagP_ROA | 0.370*** (0.010) | | | |
| LagP_ROE | | 0.386*** (0.012) | | |
| LagP_NIM | | | 0.335** (0.013) | |
| LagP_CTI | | | | 0.590*** (0.020) |
| CNFLC | –0.005*** (0.005) | –0.036*** (0.025) | –0.023*** (0.017) | 0.022*** (0.051) |
| BCAR | 0.009** (0.004) | 0.029** (0.019) | 0.009** (0.013) | –0.122** (0.055) |
| Observations | 1,412 | 1,412 | 1,412 | 1,414 |
| *Sample: medium banks* | | | | |
| LagP_ROA | 0.421*** (0.075) | | | |
| LagP_ROE | | 0.469*** (0.082) | | |
| LagP_NIM | | | 0.764*** (0.018) | |
| LagP_CTI | | | | 0.810*** (0.010) |
| CNFLC | 0.004** (0.001) | 0.043** (0.021) | 0.006** (0.005) | –0.019** (0.011) |
| BCAR | 0.024** (0.009) | 0.026** (0.086) | 0.023** (0.015) | –0.024** (0.015) |
| Observations | 968 | 970 | 973 | 970 |
| *Sample: large banks* | | | | |
| LagP_ROA | 0.612*** (0.094) | | | |
| LagP_ROE | | 0.608*** (0.084) | | |
| LagP_NIM | | | 0.652*** (0.010) | |
| LagP_CTI | | | | 0.213*** (0.032) |
| CNFLC | 0.002*** (0.001) | 0.053*** (0.025) | 0.003** (0.001) | –0.012*** (0.004) |
| BCAR | 0.056*** (0.011) | 0.439*** (0.015) | 0.022** (0.012) | –0.024*** (0.017) |
| Observations | 684 | 684 | 684 | 684 |

Notes: The significant thresholds at 1%, 5%, and 10%, respectively, are the *** if $p < 0.01$, ** if $p < 0.05$, and *** if $p < 0.10$. In brackets, the standard error values are listed.

Table 5 shows the findings of the relationship between LC and profitability for banks of various sizes, encompassing small, medium, and large banks. For medium-sized and large banks, the coefficient of CNFLC is still significantly positive, while it is negative for small banks. These results confirm that larger banks' production of liquidity has a beneficial impact on profitability (Abbas et al., 2019). It also emphasises the likelihood that liquidity rules may need to be adjusted depending on the size of the bank. The relationship between the generation of liquidity and credit risk, however, holds true regardless of the size of the bank (Table 6). The findings from our re-estimation of equations (1) and (2) using LCR and NSFR estimators for LC in Tables 7 and 8 support the findings of Tables 3 and 4.

**Table 6** Two-step system GMM estimation results, showing effects of LC on credit risk across small, medium, and large-sized banks

| | *R_NPL* | *R_VROA* | *R_VROE* | *R_Zscore* |
|---|---|---|---|---|
| *Sample: small banks* | | | | |
| LagR_NPA | 0.518*** (0.145) | | | |
| LagR_VROA | | 0.534** (0.022) | | |
| LagR_VROE | | | 0.486** (0.037) | |
| LagR_Zscore | | | | 0.504*** (0.014) |
| CNFLC | 0.034** (0.028) | 0.008** (0.018) | 0.103** (0.031) | –0.011** (0.009) |
| BCAR | –0.019 (0.025) | –0.005 (0.024) | –0.461 (0.032) | 0.013* (0.006) |
| Observations | 1,412 | 1,412 | 1,412 | 1,410 |
| *Sample: medium banks* | | | | |
| LagR_NPA | 0.636*** (0.024) | | | |
| LagR_VROA | | 0.185*** (0.058) | | |
| LagR_VROE | | | 0.691*** (0.036) | |
| LagR_Zscore | | | | 0.489*** (0.052) |
| CNFLC | 0.022** (0.012) | 0.001** (0.001) | 0.015** (0.084) | –0.020** (0.034) |
| BCAR | –0.032 (0.026) | –0.002 (0.007) | –0.033 (0.031) | 0.113** (0.013) |
| Observations | 969 | 969 | 969 | 968 |
| *Sample: large banks* | | | | |
| LagR_NPA | 0.104*** (0.075) | | | |
| LagR_VROA | | 0.148 (0.096) | | |
| LagR_VROE | | | 0.122 (0.014) | |
| LagR_Zscore | | | | 0.557*** (0.051) |
| CNFLC | 0.011** (0.007) | 0.005** (0.003) | 0.133** (0.069) | 0.004** (0.070) |
| BCAR | –0.074 (0.049) | –0.010 (0.013) | –0.318 (0.041) | 0.0240** (0.026) |
| Observations | 684 | 684 | 684 | 684 |

Notes: The significant thresholds at 1%, 5%, and 10%, respectively, are the *** if $p < 0.01$, ** if $p < 0.05$, and *** if $p < 0.10$. In brackets, the standard error values are listed.

**Table 7** Two-step system GMM estimation results showing the effects of LC on bank profitability with the use of LCR and NSFR liquidity proxies

| | *P_ROA* | *P_ROE* | *P_ROA* | *P_ROE* |
|---|---|---|---|---|
| LagP_ROA | 0.288*** (0.060) | | 0.281*** (0.060) | |
| LagP_ROE | | 0.429*** (0.068) | | 0.424*** (0.068) |
| B_LCR | –0.001*** (0.000) | –0.003*** (0.000) | | |
| B_NSFR | | | –0.004*** (0.000) | –0.001** (0.000) |
| BCAR | 0.014*** (0.003) | 0.030** (0.014) | 0.013*** (0.003) | 0.028** (0.014) |
| R_NPL | –0.007** (0.004) | –0.045* (0.023) | –0.007* (0.004) | –0.046** (0.023) |
| Logassets | 0.074*** (0.021) | 0.079*** (0.016) | 0.070*** (0.020) | 0.782*** (0.016) |
| NLR | 0.009*** (0.002) | 0.032** (0.014) | 0.011*** (0.002) | 0.039*** (0.013) |
| DER | 0.001** (0.001) | 0.004** (0.006) | 0.002** (0.001) | –0.008** (0.006) |
| IDR | 0.132* (0.019) | 0.131* (0.086) | 0.145* (0.018) | 0.134* (0.085) |
| M_BUC | 0.024*** (0.006) | 0.143*** (0.047) | 0.025*** (0.006) | 0.143*** (0.047) |
| M_GQ | 0.068*** (0.025) | 0.041** (0.018) | 0.065*** (0.024) | 0.398** (0.018) |
| M_FF | 0.011*** (0.003) | 0.066*** (0.024) | 0.014*** (0.003) | 0.078*** (0.025) |
| Constant | 1.791*** (0.502) | 13.273*** (0.344) | 1.600*** (0.487) | 12.755*** (3.441) |
| Observations | 3,141 | 3,143 | 3,141 | 3,143 |
| Wald chi$^2$ | 154.83*** | 277.77*** | 163.34*** | 277.01*** |
| AB test AR (1) (p-value) | 0.000 | 0.000 | 0.000 | 0.000 |
| Hansen test (p-value) | 0.184 | 0.574 | 0.206 | 0.489 |

Notes: The significant thresholds at 1%, 5%, and 10%, respectively, are the *** if $p < 0.01$, ** if $p < 0.05$, and *** if $p < 0.10$. In brackets, the standard error values are listed.

## 5 Conclusions and policy implications

This study empirically examines the impact of LC estimated using a three-step category technique advanced by Berger and Bouwman (2009) on the profitability and credit risk of 499 banks in the BRICS economies from 2013 to 2021. In particular, we assessed how the LC after the adoption of Basel III and following the liquidity constraint liquidity requirements LCR and NSFR will affect the profitability and credit risk of commercial banks in emerging economies.

Using the two-step dynamic panel system GMM estimator, we find a significantly positive association between LC and bank profitability. This finding supports Duan and Niu (2020), which suggests that banks have substantial incentives to provide liquidity, despite the fact that LC raises the likelihood of bank failure. However, this positive relationship doesn't hold true for small-size banks because of a significant negative association between LC and bank profitability. The possible reasons for this association may be twofold. Firstly, the Basel III liquidity standards may pose a burden on small banks due to their limited scale of business. Secondly, there is a need for liquidity requirements to limit excessive LC without adversely affecting their profitability.

Nevertheless, a significantly positive association between LC and bank profitability holds true for different proxies of LC. This positive association between LC and bank profitability somewhat supports the success of liquidity standards in managing liquidity risk. Furthermore, we find that the increase in LC leads to an increase in credit risk. This relationship holds true across various sizes of banks and alternative proxies of LC, aligning with the findings of Allen and Gale (2004a), Acharya and Naqvi (2012) and Fungáčová et al. (2017). As a result of the positive correlation between LC and bank profitability, our study's findings indicate that banks have substantial incentives for LC. However, because excessive LC raises the likelihood of a financial crisis due to increased credit risk (Fungáčová et al., 2017; Berger et al., 2016), regulators may enact measures that restrict banks' excessive LC. Moreover, this positive effect of LC on bank credit risk calls for combined regulation of liquidity and credit risk so that none of the risks is left uncontrolled, as well as their influence on one another.

**Table 8** Two-step system GMM estimation results, showing the effects of LC on credit risk with the use of LCR and NSFR liquidity proxies

| | *R_NPL* | *R_VROA* | *R_NPA* | *R_VROA* |
|---|---|---|---|---|
| LagR_NPL | 0.472*** (0.088) | | 0.471*** (0.087) | |
| LagR_VROA | | 0.631*** (0.010) | | 0.045*** (0.005) |
| B_LCR | 0.002** (0.000) | 0.001** (0.000) | | |
| B_NSFR | | | 0.005** (0.000) | 0.008** (0.000) |
| BCAR | –0.007 (0.022) | –0.008 (0.021) | –0.007 (0.022) | –0.041* (0.023) |
| P_ROA | –0.677** (0.031) | –0.572*** (0.020) | –0.694** (0.032) | –0.556*** (0.019) |
| Logassets | –0.631*** (0.016) | –0.073** (0.065) | –0.641*** (0.015) | –0.036*** (0.013) |
| NLR | 0.057*** (0.018) | 0.003** (0.007) | 0.053*** (0.017) | 0.013*** (0.016) |
| DER | –0.014** (0.006) | –0.003 (0.000) | –0.012** (0.007) | –0.020*** (0.006) |
| IDR | 0.245 (0.022) | 0.167 (0.013) | 0.245 (0.022) | 0.104* (0.059) |
| M_BUC | –0.082** (0.039) | –0.016** (0.03) | –0.081** (0.039) | –0.057* (0.034) |
| M_GQ | –0.317*** (0.012) | –0.488*** (0.074) | –0.311** (0.012) | –0.268*** (0.018) |
| M_FF | –0.092*** (0.024) | –0.010** (0.001) | –0.098*** (0.024) | –0.089*** (0.029) |
| Constant | 9.667*** (0.341) | 1.225** (1.815) | 9.882*** (3.173) | 5.111** (3.661) |
| Observations | 3,142 | 3,143 | 3,143 | 3,629 |
| Wald $chi^2$ | 571.04*** | 279.27*** | 564.05*** | 268.03*** |
| AB test AR (1) (p-value) | 0.000 | 0.012 | 0.000 | 0.012 |
| Hansen test (p-value) | 0.223 | 0.246 | 0.229 | 0.236 |

Notes: The significant thresholds at 1%, 5%, and 10%, respectively, are the *** if $p < 0.01$, ** if $p < 0.05$, and *** if $p < 0.10$. In brackets, the standard error values are listed.

These findings have a number of policy implications. First, despite strict liquidity requirements, the generated liquidity continues to exhibit a positive correlation with bank profitability. This underscores the importance for policymakers to endorse and support LC as a crucial element for maintaining a healthy banking system in emerging countries.

Second, compliance with liquidity laws should be regularly monitored because one size does not fit all, as stated by Gupta and Kashiramka (2020) and Tran et al. (2016). Third, considering the significant and positive association between LC and credit risk, policymakers are advised to introduce norms for regulating credit risk associated with LC. This recommendation aligns with the observation by Acharya and Naqvi (2012) that banks are incentivised for lax lending to generate more liquidity. Consequently, LC encourage banks to undertake unwarranted risks, thereby elevating credit risk.

Regarding the study's limitations, we acknowledge the need for additional research that concentrates on cross-country scenarios, simultaneously covers developing as well as developing countries, and compares the differences between them. Second, the literature contends that relationships are modified when off-balance sheet LC is taken into account. As a result, we suggest that more studies that take into account off-balance sheet activities will help us further deepen our understanding.

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## Notes

1 Refer to Berger and Bouwman (2009) for a detailed explanation and estimation of LC.

2 P_CTI is usually used as an efficiency ratio, but in our study, we have used it as a profitability ratio. Therefore, we explain its results inversely.