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Unveiling the Dynamics of Bank Liquidity: Exploring the Impact of Bank-Specific and Macroeconomic Factors in Pakistani Commercial Banks

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Abstract

The recent liquidity challenges in the global financial system underscore the critical need to understand the determinants of bank liquidity. Therefore, this research examines the impact of both bank-specific and macroeconomic variables on liquidity risk in commercial banks in Pakistan. Adopting a quantitative research approach, the study utilizes panel data analysis. The sample comprises 20 commercial banks in Pakistan, and data from the pre-COVID-19 period are analyzed to isolate the determinants of liquidity from the specific effects of the COVID-19 crisis. The empirical analysis reveals that credit risk, bank size, and net interest margin exert a negative effect on liquidity, indicating challenges faced by larger banks and adverse effects of credit risk. Conversely, management efficiency, profitability, capital adequacy, and management quality have a positive effect on bank liquidity, underscoring their importance in ensuring liquidity stability. Furthermore, the study identifies the monetary policy rate and interest rate as significant influencers of liquidity in Pakistani firms. Policymakers and practitioners can leverage the insights gained from this research to develop robust risk management strategies and mitigate the adverse effects of liquidity crises. Moreover, the study emphasizes the importance of adopting strict recovery policies and alleviating liquidity squeezes to enhance the performance and resilience of commercial banks. These findings offer valuable insights for practitioners and policymakers, not only in Pakistan but also in other emerging market economies, enabling them to enhance their understanding of liquidity risk dynamics and develop proactive risk management strategies.

Keywords: Liquidity; Bank-specific factors; Commercial banks; Macroeconomic variables; Risk management; Financial crisis; Lıquıdıty risk; Fixed-effects model; Pakistan.
JEL Classification: C5, C33, E43, G01, G21, G32, O53

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1. Introduction

The significance of liquidity management in commercial banks has garnered considerable attention in recent years, particularly in the aftermath of banking crises such as the collapse of Silicon Valley Bank and the failures of Credit Suisse and the First Republic (Bolton et al., 2023; Henriquez, 2023; Rowley, 2023). Commercial banks play a pivotal role in the financial system by efficiently channelling surplus cash from developed sectors to developing sectors, thereby establishing equilibrium between surplus and deficit business units and enhancing their commercial activities (Ahmad & Rasool, 2017). Liquidity, as defined by the Bank for International Settlements (BIS) (2011), refers to a financial entity's capacity to promptly meet short-term depositor claims without incurring adverse losses. Financial firms must fulfil their obligations to depositors and meet payment claims promptly. Failure to meet these short-term payment obligations can result in liquidity constraints and, ultimately, bankruptcy (Diamond & Dybvig, 1983; Rauch et al., 2009).

During periods of economic recession, banks with ample liquidity are better positioned to retain customers and withstand funding shortages, underscoring the importance of maintaining adequate levels of liquidity (Minh, 2021). Conversely, liquidity mismanagement has resulted in the bankruptcy of numerous financial entities (De Bandt et al., 2021). The literature consistently establishes a link between liquidity management and the stability of financial institutions, with low firm liquidity often emerging during financial crises (Munteanu, 2012). The withdrawal of short-term deposits from firms frequently exceeds their liquidity, leading to imbalances in bank deposits and subsequent reductions in liquidity (Wang, 2002). The risk of a bank's maturity transformation arises from the interaction of these risks, indicating that firms may struggle to meet unexpected fund withdrawals.

The 2008 global financial crisis underscored the critical importance of maintaining adequate liquidity levels in financial institutions, as even profitable firms faced collapse due to insufficient liquidity (Ahmad & Rasool, 2017). Effective liquidity management is essential for sustaining profitability, preventing insolvency, and preserving shareholder value (Malik & Rafique, 2013). Numerous studies have identified various factors significantly influencing bank liquidity, including capital adequacy, bank size, asset quality, and performance (Wang, 2002; Al-Matari, 2021). In addition, macroeconomic determinants such as real output (GDP) and unemployment rates have been found to play significant roles in determining liquidity (Nguyen & Vo, 2021).

While previous empirical studies have often examined either bank-specific or macroeconomic factors in isolation (Vodová, 2011; Nguyen & Vo, 2021), this research integrates both perspectives to provide a holistic understanding of liquidity dynamics. By simultaneously analyzing factors such as net interest margin, credit risk, bank size, profitability, capital adequacy, and management efficiency, alongside macroeconomic variables like exchange rates and interest rates, the study unveils the complex interactions shaping bank liquidity in Pakistan (Vodová, 2011; Al-Matari, 2021). Despite the importance of liquidity management in financial institutions, there is a paucity of research specifically focusing on Pakistani commercial banks (Khan, 2021). By narrowing the scope to this specific context, the study offers insights tailored to the unique characteristics, challenges, and opportunities within the Pakistani banking sector, thereby addressing a significant research gap in the existing literature. Recognizing the challenges faced by the banking sectors in Pakistan is essential in the context of liquidity management (Aldeen et al., 2020). These sectors often confront liquidity constraints due to the high demand for credit and borrowed capital, making effective liquidity management challenging (Islam & Nasreen, 2018). This challenge is particularly pertinent in Pakistan, where limited research has been conducted on effective liquidity management in commercial banks, with a predominant focus on liquidity creation and a few bank-specific determinants (Melese, 2015; Khan et al., 2021).
To address the identified research gap in the empirical literature on liquidity management in Pakistani commercial banks, this study examines the influence of both bank-specific factors and macroeconomic variables on liquidity. Specifically, the research analyzes the impact of net interest margin, capital adequacy, bank size, profitability, credit risk, management efficiency, and management quality, in addition to macroeconomic indicators such as the monetary policy rate and exchange rate. By considering these factors, the study offers valuable insights for managers to develop effective bank-oriented policies that ensure desired liquidity levels while minimizing credit losses. Moreover, the findings of this research will inform policymakers in formulating growth-oriented strategies that promote investment opportunities and facilitate the smooth functioning of business operations.

The remaining sections of the study are organized as follows: Section 2 provides a summary of the empirical literature, Section 3 describes the methodologies and models used, Section 4 presents the empirical findings, and Section 5 concludes the study by discussing policy implications.

2. Literature Review

The understanding of liquidity and its importance for the health of the financial system has undergone significant evolution since the 2008 global financial crisis. Prior to this crisis, there was limited emphasis on liquidity among financial economists, policymakers, and academics. However, since then, liquidity has garnered increased attention from scholars across the globe. For instance, Diamond & Dybrig (1983) provided a theoretical justification for the importance of credit-holding entities and the necessity for companies to maintain sufficient liquidity. Similarly, Vodová (2011) examined the influence of various factors on firms' liquidity in the Czech Republic and identified a significant association between liquidity and firms' resource sufficiency.

Since the onset of the 2008 global financial crisis, liquidity levels have become a focal point for researchers due to their profound impact on the entire banking system (Adrian & Shin, 2010). Liquidity tends to diminish during periods of chaos, underscoring the need for effective liquidity management to avert unforeseen losses and sustain profitability. The Basel Committee (2011) underscores the pivotal role of bank liquidity in preserving cash flow within firms. Thus, comprehending the factors influencing liquidity is imperative.

Previous empirical literature has also highlighted bank size as a primary factor influencing liquidity (Alger & Alger, 1999). Within this context, studies conducted by Bonfimm & Kim (2012) and Delechat et al. (2012) have indicated a significant and positive correlation between liquidity and bank size. In contrast, findings from Dinger (2009) and Singh & Sharma (2016) suggest a negative correlation between bank size and liquidity. When examining a sample of Islamic banks, Alzoubi (2017) reported a negative correlation between bank size and liquidity. However, Aspachs et al. (2005) concluded that there is no significant relationship between bank size and liquidity.

The correlation between profitability and liquidity has been extensively explored in empirical studies. For instance, Lartey et al. (2013), Vodová (2013), and Singh & Sharma (2016) all identified a significant positive relationship between profitability and liquidity. Conversely, Delechat et al. (2012) concluded that profitability and liquidity exhibit a negative correlation. Minh (2021) delved into the impact of liquidity and credit risk on the profitability of Nigerian deposit money banks, and discovered a significant association between liquidity and profitability, while noting the absence of a significant association between credit risk and profitability. Furthermore, Aspachs et al. (2005) found no significant association between profitability and liquidity.

The existing literature also delves into the relationship between bank regulatory capital and liquidity. For example, Distinguin et al. (2013) investigated this relationship across Europe and the United States, revealing that firms often reduce their capital to bolster liquidity. Moreover, during liquidity crises, small banks in the United States tend to fortify their solvency regulations. Sharma & Singh (2016) observed a positive connection between banks' capital and commercial companies' liquidity. Supporting this notion, Berger & Bouwman (2009) argued that higher levels of capital and liquidity equip institutions with enhanced risk absorption capabilities during periods of increased liquidity demand.

Numerous research studies have examined the impact of the cost of funds on liquidity. For example, Bunda & Desquilbet (2008), Munteanu (2012), Singh & Sharma (2016), Singh & Sharma (2016), and Shah et al. (2018) have all identified a significant relationship between the cost of capital and liquidity. However, Singh & Sharma (2016) did not observe such a relationship between these variables. In addition, Waemustafa & Sukri (2016) concluded that total assets (CAP) exhibit a positive correlation with liquidity, while Nguyen (2019) found the opposite relationship between these variables. Alger & Alger (1999) and Munteanu (2012) emphasized the importance of liquid assets in accomodating rapid bank withdrawals, suggesting that maintaining a sufficient level of liquid assets can reduce dependence on external sources for funding.

The impact of macroeconomic variables on liquidity has produced mixed empirical evidence. Various studies have shown both positive (Vodová, 2011; Malik & Rafique, 2013; Sheefeni & Nyambe, 2016; Khan, 2021) and negative (Vodová, 2012, 2013) associations between the monetary policy rate (or the interest rate) and liquidity. Al-Homaidi et al. (2019) suggested that exchange rates significantly affect the liquidity of Indian commercial banks. Furthermore, Suleiman & Hakim (2021) found a positive relationship between bank size and liquidity risk in Islamic banks, while noting a negative correlation with inflation. Additionally, Effendi & Disman (2017) investigated the influence of bank-specific variables on liquidity risk and observed significant differences between Islamic and conventional banks.

In Pakistan, Rafique et al. (2020) investigated the influence of management quality and capital adequacy on liquidity and found a strong association between these factors and liquidity decisions. In contrast, funding cost ratios and non-performing loans were found to severely diminish liquidity in Pakistani commercial banks. Khan et al. (2021) studied the influence of bank-specific profitability factors on the default risk of Pakistani firms and concluded that bank-specific factors significantly affect default risk. Similarly, Shah et al.

(2018) assessed the influence of both internal and external factors on liquidity and found that internal factors such as bank size, the cost of funds, and the capital adequacy ratio had a significant effect on liquidity in the commercial banks of Pakistan. The study also found that external factors (e.g., GDP) had a significant effect on liquidity. Furthermore, the findings revealed that profitability has an insignificant link with liquidity, whereas the link between bank deposits and liquidity was significant and negative. Notably, Ahmad & Rasool (2017) concluded that capital adequacy and GDP have a positive and significant influence on liquidity in Pakistani banks, while non-performing loans and bank size have a negative and significant effect on liquidity. The findings also showed that the inflation rate had no significant influence on liquidity. Another important study by Khan (2021) demonstrated that net interest margin and bank size have a significant and negative association with liquidity, while credit risk has an insignificant and negative association with liquidity. The results also concluded that capital adequacy and management efficiency have a significant positive association with liquidity, while management quality and profitability have an insignificant positive correlation with liquidity.

To address the apparent research gap in the existing literature, the current study investigates the influence of both macroeconomic and bank-specific factors on the liquidity of Pakistani firms. While previous studies in Pakistan have primarily focused on internal factors, this research seeks to provide a comprehensive analysis by considering both firm-specific and macroeconomic determinants. By investigating the influence of global financial shocks on the liquidity of Pakistani firms, this research contributes to the existing literature in Pakistan and fills the existing research gap in examining macroeconomic factors and firm-specific variables that determine liquidity. The literature review presented here offers an overview of the significance of liquidity, the factors influencing it, and the mixed empirical evidence regarding their relationships. This review underscores the necessity for further in-depth research on liquidity, particularly within the context of Pakistani banks, and lays the foundation for the present study to make contributions in this area of research.

3. Methods and Models

Econometric Model

In this study, we empirically investigate the firm-specific and macroeconomic determinants that influence the liquidity of Pakistani commercial firms. These factors encompass management efficiency, profitability, bank size, net interest margin, credit risk, management quality, capital adequacy ratio, exchange rate, and interest rate. Several studies

have identified and examined these factors affecting bank liquidity (e.g., Malik & Rafique, 2013; Roman & Sargu, 2015; Zaghdoudi & Hakimi, 2017; Shah et al., 2018; Khan, 2021). The general specification of the model is specified in Equation 1:

$$Y_{it} = \alpha_0 + \beta_1 X_{it} + \varepsilon_{it} \quad (1)$$

In Equation 1, Y_{it} is the explained variable, α_0 is the intercept, and β_1 is the slope, which requires estimation. The variable X_{it} stands for explanatory variables, and the stochastic disturbance term follows $E(u_{it}) \sim N(0,\ \sigma^2)$. Previous literature suggests a linear multivariate regression model to examine the bank-specific as well as macroeconomic factors of liquidity. These studies include Ahmad & Rasool (2017), Shah et al. (2018), Rafique et al. (2020), Khan (2021), and Khan et al. (2021). Equation 2 presents the specific econometric model for bank liquidity.

$$LIQ_{it} = \beta_0 + \beta_1 ROA_{it} + \beta_2 NIM_{it} + \beta_3 CAP_{it} + \beta_4 Size_{it} + \beta_5 CR_{it} + \beta_6 MQ_{it} + \beta_7 ME_{it} + \beta_8 MIR_{it} + \beta_9 EXCH_{it} + \varepsilon_{it} \quad (2)$$

In Equation 2, LIQ_{it} represents the liquidity of commercial banks. The explanatory variables include profitability (*ROA*), net interest margin (*NIM*), capital adequacy ratio (*CAP*), bank size (*Size*), credit risk (*CR*), managerial quality (*MQ*), management efficiency (*ME*), interest rate (*MIR*), and exchange rate (*EX*), where *i* = 20 commercial banks and *t* = 2009-2018.

Methodology

We employed panel data to assess the influence of firm-specific as well as macroeconomic determinants on liquidity in Pakistan. In econometrics, two standard approaches to estimating panel data are the fixed-effects and random-effects models. Fixed-effects models (FEM) assume that the intercept changes over time, but the slope coefficient remains constant (Gujarati, 2004). The FEM is shown in Equation 3.

$$Y_{it} = \alpha_i + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} \ldots + \beta_k X_{kit} + \varepsilon_{it} \quad (3)$$

If observed events vary for each firm and the intercept differs, the FEM should be used for panel data estimation (Asteriou & Hall, 2011). Additionally, the model allows for autocorrelation b/w the stochastic disturbance term and the independent factors (Shah et al., 2018). Conversely, random-effects models (REM) assume that all firms' intercepts are not fixed but random parameters. Therefore, the variation in constant terms of all firms can be expressed as follows:

$$\alpha_i = \alpha + v_i \quad (4)$$

In Equation 4, v_i denotes the standard random variable. The extended form of the REM is as follows:

$$Y_{it} = (\alpha + v_i) + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + \beta_k X_{kit} + \varepsilon_{it} \quad (5)$$

$$Y_{it} = \alpha + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \cdots + \beta_k X_{kit} + (v_i + \varepsilon_{it}) \quad (6)$$

If there is no multicollinearity, the REM is considered more appropriate than other methods. With panel data, error terms and independent variables may be associated, suggesting that the FEM would be preferable to the REM for estimation. The decision between using REM or FEM is typically based on the Hausman test (1978). Econometrics literature suggests that the FEM framework is preferable for estimating a balanced panel dataset, while the REM specification is preferable for limited cross-sections (Asteriou & Hall, 2011). According to Ahn & Moon (2001), Hausman's test formulates two hypotheses: the null hypothesis states that random effects are efficient and consistent; while the alternative hypothesis asserts that random effects are inconsistent. Hausman's test statistic can be expressed as under:

$$H = \left(\beta^{\widehat{FE}} - \beta^{\widehat{RE}}\right)' \left[Var\left(\beta^{\widehat{FE}}\right) - Var\left(\beta^{\widehat{RE}}\right)\right]^{-1} \left(\beta^{\widehat{FE}} - \beta^{\widehat{RE}}\right) \sim \mathrm{X}^2(\mathrm{k}) \quad (7)$$

If Hausman's test statistic is large, indicating a significant difference between the estimates of the two models. In this case, we reject the null hypothesis. In contrast, if Hausman's test statistic is low, we deduce that random-effects estimators are more appropriate. Based on Hausman's test results, Table 6 reports that the application of the FEM is a more suitable methodology; therefore, we select the FEM for our estimation purposes.

Definitions of Variables

This study investigates the influence of bank-specific factors and macroeconomic factors on the liquidity of Pakistani commercial banks. Internal factors encompass management efficiency, bank size, capital adequacy, credit risk, net interest margin, profitability, and management quality, while external factors comprise the interest rate and exchange rates. Various methods have been employed by researchers to measure liquidity, including liquidity gaps, ratios, indexes, and financing gaps. However, this study adopts the liquidity ratio approach as it is the most commonly utilized method due to its standardized availability (Moore, 2009; Laurine, 2013; Edem, 2017; Assfaw, 2019; Khan, 2021). Previous research has consistently employed the liquidity ratio approach for liquidity measurement (e.g., Praet & Herzberg, 2008; Rychtarik, 2009; Moore, 2009; Ahmad & Rasool, 2017; Khan, 2021). Critically, the liquidity gap approach has been deemed inappropriate due to the

absence of a classical method for determining liquidity (Ahmad & Rasool, 2017; Khan, 2021). The calculation of firms' liquidity is articulated by Equation 8:

$$Bank\ Liquidity = \frac{Total\ liquid\ assets}{Total\ assets} \quad (8)$$

The capital adequacy ratio of a firm denotes its capital relative to its associated risk. This study, in line with various previous research, including works by Berger & Bouwman (2009), Gorton & Winton (2000), and Moussa (2015), employs the equity-to-total assets ratio as a suitable measure of capital adequacy. It posits a negative association between firm capital structure and liquidity.

$$Capital\ adequacy\ ratio = \frac{Equity}{Total\ assets} \quad (9)$$

Profitability, a key indicator of the financial performance of a bank, is often calculated using the return on assets (ROA) as a proxy (Naceur, 2003; Molyneux & Thornton, 1992; Moussa, 2015; Khrawish & Al-Sa'd, 2011). The empirical evidence suggests a negative correlation between these variables.

$$Profitability = \frac{Net\ income}{Total\ assets} \quad (10)$$

Bank size, as defined by Poorman & Blake (2005), is measured by the natural log of a firm's total assets. Consistent with prior studies (e.g., Al Khouri, 2012; Tseganesh, 2012; Vodová, 2013), we adopt the same methodology to measure this determinant. It is generally assumed that the link between bank size and liquidity is positive.

$$Bank\ size = ln\ (total\ assets) \quad (11)$$

The net interest margin (NIM) is a ratio used to measure the efficiency of a commercial bank's investment of its liquid assets relative to its expenditures. According to Hamadi & Awdeh (2012), the NIM serves as an indicator of financial institutions' efficiency. It is hypothesized that the link between the NIM and liquidity is negative.

$$\text{NIM} = \frac{\text{Interest receivable} - \text{Interest incurred}}{\text{Total assets}} \quad (12)$$

Rashid & Jabeen (2016) defined "management efficiency" as the ratio of total expenditures to total assets within a firm, providing insights into how effectively a company utilizes its assets. This determinant was measured by Lartey et al. (2013) and Moussa (2015). The empirical evidence assumes a positive relationship between management efficiency & liquidity.

$$\text{Bank efficiency} = \frac{\text{Operating expense}}{\text{Total Assets}} \quad (13)$$

According to Brown & Moles (2011), credit risk pertains to the probability of a party failing to cover its payment obligations as per agreed terms. Vodová (2011, 2012) and Tseganesh (2013) assumed a negative correlation between credit risk and liquidity.

$$\text{Credit risk} = \frac{\text{Non-performing loan}}{\text{Total loan}} \quad (14)$$

The asset quality of a bank is intricately tied to its managerial quality, serving as a crucial indicator of whether deposits have been invested prudently. This determinant, as outlined by Lartey et al. (2013), is quantified as the ratio of bank advances to total deposits.

$$\text{Managerial quality} = \frac{\text{Advances}}{\text{Total Deposits}} \quad (15)$$

The exchange rate is measured using the proxy of the exchange rate (average per year) as employed by Deléchat et al. (2012), Khalid (2017), Issah & Antwi (2017), and Al-Homaidi et al. (2019). Research indicates that fluctuations in the exchange rate positively impact liquidity. For our analysis, we utilized the Pakistani Rupee against the USD as suggested by Khalid & Khan (2017).

$$Exchange\ rate = Average\ rate\ in\ a\ year \text{ (Rs/\$)} \quad (16)$$

The SBP regulates the supply of money in circulation through its monetary policy. This regulation is often measured using the 6-month interest rate, as indicated by Rauch et al. (2009), Ongore & Kusa (2013), Vodova (2013), and Al-Homaidi et al. (2019). These studies have collectively found a negative association between liquidity and the SBP policy rate.

$$\text{Monetary policy rate} = \text{Interest rate (\%)} \quad (17)$$

Table 1

Definition of Variables, Construction and Sources

Variables	**Construction**	**Sources**
Liquidity	$\text{Liquidity} = \frac{\text{Total liquid assets}}{\text{Total assets}}$	Moussa (2015)
Bank size	$\text{Bank size} = ln(\text{total assets})$	Al-Khouri (2012)
Capital adequacy ratio	$\text{Capital adequacy ratio} = \frac{\text{Total Equity.}}{\text{Overall assets}}$	Berger & Bouwman. (2009)
Profitability	$\text{Bank's profitability} = \frac{\text{Net income}}{\text{Total assets}}$	Khrawish (2011)
Net interest margin	$\text{NIM} = \frac{\text{Interest receivable} - \text{Interest incurred}}{\text{Total assets}}$	Moussa (2015)

Credit risk	$\text{Credit risk of Banks} = \frac{\text{Non} - \text{performing loan}}{\text{Total loan}}$	Tseganesh (2012)
Managerial quality	$\text{Managerial quality of Banks} = \frac{\text{Advances}}{\text{Total deposits}}$	Lartey et al. (2013)
Management efficiency	$\text{Bank efficiency} = \frac{\text{Operating expense}}{\text{Total assets}}$	Al-Homaidi et al. (2019)
Exchange rate	$\text{Exchange rate} = \text{Average rate in a year}$	Issah & Antwi (2017)
Interest rate	$\text{Monetary policy rate} = \text{Interest rate (\%)}$	Al-Homaidi et al. (2018)

Data Sources

The present study investigates the impact of firm-specific as well as macroeconomic factors on the liquidity of Pakistani commercial banks. Pakistan's banking landscape comprises a total of 8 foreign banks, 25 local banks, and 3 Islamic banks (State Bank of Pakistan, 2020)[6]. Among the 25 local commercial banks, 18 are privately owned, while 7 are state-owned. We have selected a sample of 20 commercial firms based on data availability, covering the period 2009-2018. This time frame was chosen to mitigate the confounding effects of the COVID-19 pandemic and focus on the pre-pandemic period. Data concerning bank-specific factors were sourced from SBP publications[7], while macroeconomic variables were obtained from the World Development Indicators (WDI, 2021) and Business Recorder[8].

4. Empirical Results

Descriptive statistics

Descriptive statistics serves to elucidate the nature and behavior of the data observed during the sampling period. Table 2 indicates that Pakistani banks have average liquidity and capital adequacy ratios of 8.10% and 8.70%, respectively, reflecting a healthy liquidity buffer. Additionally, firms exhibit maximum liquidity buffers of 0.003 and 0.016, while maintaining minimal values ranging between 0.003 and 0.016. Return on assets (ROA) has been proposed as a measure of profitability throughout the sample years. The average return on investment (ROI) is 0.007, with lows of -0.054 and highs of 0.035. The negative ROA value can be attributed to significant losses suffered by commercial banks from banking

[6] https://www.export.gov/article?id=Pakistan-US-Banks
[7] Data on bank-specific factors have been compiled from the 2009-2013 financial report until 2012, and the rest have been updated from the 2014-2018 financial report.
[8] https://markets.brecorder.com/company-information/financial-highlights.html

mergers and acquisitions between 2007 and 2012 (e.g., HBC Mergers and Acquisitions with Meezan Bank, Barclay Bank Mergers, and Acquisitions with Habib Bank, and so on). Pakistani enterprises maintain a capital adequacy ratio of 8.7%, slightly above the SBP's minimum requirement of 8%. Regarding management efficiency (ME), the study indicates that Pakistani banks exhibit an average management efficiency of around 31%, with values ranging between 0.807 and 0.145. Pakistani enterprises accumulated substantial deposits between 2007 and 2016. The average bank size is 19.65%, indicating significant business activity with highs of 21.83 and lows of 16.99. Furthermore, the average interest rate stands at 9.9%, while the average exchange rate remains at 0.062 percent. Pakistan's SBP policy rate stood at around 14% throughout the sample period, thus the highest interest rate figure accurately depicts the situation. Since Pakistan's nominal exchange rate reached as high as 0.268 during the analysis period, the highest exchange rate value of 0.268 also represents an accurate depiction. Interest and exchange rates remained at 6.2% and -0.041%, respectively.

Table 2

Descriptive Statistics of Variables

Variables	**Observations**	**Average**	**Standard Deviation**	**Minimum**	**Maximum**
LIQ	200	0.081	0.026	0.003	0.183
ROA	200	0.007	0.013	-0.054	0.035
NI	200	0.033	0.02	-0.016	0.191
CAP	200	0.087	0.044	0.016	0.298
Size	200	19.65	1.08	16.99	21.83
CR	200	0.115	0.079	0[9]	0.516
MQ	200	0.006	0.001	0	0.01
ME	200	0.309	0.106	0.145	0.807
MIR	200	0.099	0.028	0.062	0.139
EXCH	200	0.062	0.078	-0.041	0.268

Source: Author's calculations (2023)

[9] The Standard Chartered Bank and Bank Al Habib Limited have zero credit risk values in 2016 and 2018, respectively.

Correlation Analysis

A correlation matrix depicts the relationship among explanatory variables in an econometric specification. However, the presence of severe multicollinearity, which violates the classical assumption of the Ordinary Least Squares (OLS) method, renders the strongest associations between explanatory variables inappropriate. Kennedy (2008) mentioned that problematic multicollinearity arises when the correlation coefficient is greater than 0.70, while Malhotra (2007) suggested that severe multicollinearity occurs when the correlation coefficient surpasses 0.75. Table 3 illustrates that bank liquidity (LIQ) exhibits a positive correlation with profitability (ROA), net interest margin (NIM), capital adequacy ratio (CAP), bank size (Size), managerial quality (MQ), management efficiency (ME), interest rate (MIR), and exchange rate (EX); conversely, it shows a negative correlation with credit risk (*CR*). The strongest negative correlation (-0.415) is observed between the net interest margin (NIM) and credit risk (CR). As all pairwise correlations are below 0.70, the findings demonstrate that problematic multicollinearity does not significantly affect the examined variables.

Table 3

Pairwise Correlations of Variables

Variables	*LIQ*	*ROA*	*NIM*	*CAP*	*SIZE*	*CR*	*MQ*	*ME*	*MIR*	*EXCH*
LIQ	1.000									
ROA	0.127	1.000								
NIM	0.127	0.054	1.000							
CAP	0.036	0.060	0.185*	1.000						
SIZE	0.239*	0.048	0.148*	-0.334*	1.000					
CR	-0.077	-0.193*	-0.415*	-0.024	-0.231*	1.000				
MQ	0.079	-0.288*	0.138	0.131	-0.180*	-0.068	1.000			
ME	0.042	-0.044	-0.148*	0.234*	-0.320*	0.007	0.156*	1.000		
MIR	0.217*	0.078	0.244*	0.234*	-0.385*	0.276*	0.132	-0.111	1.000	
EXCH	0.022	0.017	-0.111	-0.135	0.131	-0.130	0.007	-0.027	-0.169*	1.000

Note: '' indicates significance at the 0.05 significance level.*

Source: Author's calculations (2023)

The study also assessed the data for the presence of severe multicollinearity employing the Variance Inflation Factor (VIF). Table 4 confirms the absence of induced multicollinearity in the dataset, as the VIF value for each explanatory variable is below 10.

Table 4

Results of the Variance Inflation Factor

Variable	***VIF***	***1/VIF***
Size	1.736	0.576
MI	1.728	0.579
NI	1.709	0.585
CR	1.652	0.605
ME	1.470	0.680
MQ	1.291	0.774
ROA	1.288	0.776
CAP	1.281	0.781
EXCH	1.041	0.961
Mean VIF	1.466	---

Source: Data processed by the author (2023)

Likelihood Test

Using the likelihood test, we determine the appropriate panel estimation approach between the common constant and fixed-effects models for the panel data under consideration. Table 5 indicates that the FEM is more suitable for estimation purposes because the computed *p*-statistic is 0.00, which is less than 0.05. Consequently, we accept H_0.

H_0: The fixed-effects model is appropriate.

H_1: The common constant effects model is appropriate.

Table 5

Likelihood test results

Test statistic	**Statistic**	**Degrees of freedom**	**Probability**
F-statistic	7.8196	-191.0003	0.0000
χ^2 statistic	125.0521	19.0001	0.0000

Source: Author's calculations (2023)

Hausman's Test

As mentioned previously, we have conducted Hausman's test to determine the model appropriateness between FEM and the REM for a given dataset. In Table 6, the calculated Hausman test value (11.134) exceeds its critical value, leading to the rejection of H_0 and

acceptance of H_1. Consequently, we utilize the FEM for estimating the parameters of our proposed model.

H_0: The REM is appropriate for the data.

H_1: The FEM is appropriate for the data.

Table 6

Hausman test results

Test. cross-section. Random. Effects

Test statistic	χ^2 ***value***	χ^2***degrees of freedom***	***Probability***
Corresponding value	11.133800	9	0.0000

Source: Author's calculations (2023)

Results of Regression Analysis

We utilized the FEM to estimate the multivariate econometric specification for the sample period. Fixed-effects estimation is widely utilized by researchers for its ability to provide consistent empirical results and robust estimation. Table 7 presents the results of the FEM. Despite its statistical insignificance, the capital adequacy ratio exhibits a positive influence on the liquidity of commercial firms. Commercial banks with high liquidity facilitate firms in maintaining adequate capital to sustain their transaction activities. However, firms face challenges when relying heavily on advancing substantial loans to the government against bank deposits, leading to difficulties in meeting capital requirements. Our findings align with previous studies (Munteanu, 2012; Vodova, 2013; Shah et al., 2018; Khan, 2021). Moreover, bank size negatively impacts liquidity in Pakistan, supporting the "too-big-to-fail" hypothesis proposed by Lannotta et al. (2007) & corroborating findings from empirical studies (Alger & Alger, 1999; Kashyap et al., 2002; Vento & Ganga, 2009; Hackothal et al., 2010; Vodova, 2011; Shah et al., 2020). Shah et al. (2018) also observed that bank size affects liquidity differently depending on the measure of liquidity employed. Furthermore, while the profitability of firms positively influences bank liquidity, this relationship lacks statistical significance. Enhanced profitability would theoretically enable firms to sustain higher liquidity. Our results support the findings of previous studies (Aspachs et al., 2005; Shah et al., 2018).

According to Khidmat & Rehman (2014), firms' profitability assists banks during liquidity shortages but does not bolster their solvency. This distinction arises because liquidity is essential for day-to-day operations, while bank profitability pertains to longer-

term considerations (Aspachs et al., 2005; Olarewaju & Adeyemi, 2015; Shah et al., 2018). Our findings reveal that NIM negatively impacts bank liquidity in Pakistan. The rise in *NIM* incentivizes banks to prioritize lending activities, thereby reducing the proportion of liquid assets (Vodova, 2013), corroborating Moussa's (2015) findings. Furthermore, empirical evidence demonstrates that credit risk significantly diminishes the liquidity of Pakistani firms. A 1% increase in non-performing loans, on average, results in a 4.6% decline in liquidity. Consequently, clients may struggle to repay loans, interest rates, and associated commissions, exacerbating firm liquidity losses. This situation exposes firms to liquidity risk, as financial shocks may render clients unable to fulfil loan obligations, precipitating bankruptcy. Such disruptions could impede the smooth functioning of banks within the economy. This finding is consistent with prior research (Gautam, 2016; Ojha, 2018; Shahms et al., 2018; Khanal, 2019). Moreover, our results indicate a strong correlation between liquidity and management efficiency, suggesting that a 1% increase in management efficiency corresponds to a 0.1% rise in bank liquidity. This finding aligns with Malik & Rafique's (2013) observation that substantial increases in operating expenses impact liquidity. The findings also indicate a significant positive connection between the SBP policy rate and firms' liquidity; nonetheless, it contradicts the negative association reported by Vodova (2013). In Pakistan, Malik & Rafique (2013) observed a positive influence of interest rates on bank liquidity. Similarly, in Zimbabwe, Laurine (2013) found that interest rates positively affect firms' liquidity risk. Furthermore, the estimation results suggest that there is a positive impact of the exchange rate on liquidity in Pakistan, and this verdict supports the findings of Al-Homaidi et al. (2019). Importantly, diagnostics confirm that the proposed specification is best fitted, as it explains 44% of the total variation in liquidity, as computed by R^2. Other key statistical tests, including adjusted R^2, standard deviation, and *F*-statistic, support the suitability of the proposed econometric specification.

Table 7

Coefficient estimates of the regression model

Variables	***Coefficient***	***S. E***	***P-value***	***Significance***
Constant	-0.265	0.047	0.000	***
NIM	-0.178	0.105	0.092	*
CAP	0.027	0.041	0.518	
Size	-0.014	0.002	0.000	***
CR	-0.046	0.026	0.081	*

Variables	***Coefficient***	***S. E***	***P-value***	***Significance***
MQ	2.366	1.343	0.080	*
ME	0.001	0.000	0.005	***
ROA	0.208	0.148	0.162	
EXCH	0.138	0.042	0.001	***
MIR	0.412	0.076	0.000	***
R^2*: 0.4412* *Adjusted* R^2*: 0.3281* *F- statistic: 3.42* *Probability: 0.0035*				

Note: '*' $p<0.1$, weak significance; "***" $p<0.01$, strong significance

Source: Author's calculations (2023)

5. Conclusion and Policy Implications

The present research delved into the impact of firm-specific as well as macroeconomic variables on bank liquidity in Pakistan. Through empirical analysis utilising a fixed-effects model and panel dataset from 20 Pakistani commercial banks over the period from 2009 to 2018, several significant findings emerged. Specifically, managerial quality, management efficiency, exchange rate, and interest rate were observed to exert a significant positive influence on liquidity. Conversely, net interest margin, bank size, and credit risk exert a significant negative influence on liquidity. Additionally, bank capital and profitability were identified as having a small yet significant influence on liquidity. Notably, the research highlighted that while the exchange rate influenced the adopted liquidity measure, its economic significance was relatively low.

These empirical results carry significant policy implications for various stakeholders, including scheduled firms, the central bank (SBP), and the broader economy. To mitigate the risk of bank runs and alleviate liquidity deterioration, it is essential for the SBP to closely monitor critical indicators that significantly impact firms' liquidity in Pakistan. Failing to address these issues promptly could precipitate liquidity stress and financial turmoil. Given that insufficient liquidity often precedes firm failure, bank capital serves as a safeguard against liquidity shortages. Therefore, the SBP should regularly evaluate the capital adequacy of all firms, considering that the minimum bank capital requirement stipulated by SBP regulations (2013) appears relatively low and poses liquidity risk concerns for firms.

Implementing a strict recovery policy becomes crucial, as non-performing loans account for a significant proportion, reaching around 40%. Furthermore, the SBP should consider the implementation of additional monetary policy instruments to enhance resilience in the face of liquidity crunches.

While this study makes a significant contribution to our understanding, it is crucial to recognize its limitations. The absence of complete data sets for several banks necessitated their exclusion from the empirical investigation. Future research avenues could explore the potential short-term and medium-term incremental costs incurred by Pakistani firms in maintaining liquid cash. Additionally, extending the analysis to explore the influence of bank-specific determinants on the liquidity of small, medium, and large banks in Pakistan would yield valuable insights. Researchers might also consider integrating non-financial entities such as microfinance firms, investment firms, mutual fund companies, insurance companies, or leasing companies into their analyses. Finally, future studies could expand their scope by incorporating additional firm-specific factors (e.g., total deposits, cost of funds, interest rate margin, loan growth, asset quality, etc.) and macroeconomic variables (e.g., real GDP, inflation, unemployment, trade balance, etc.) to offer a comprehensive understanding of liquidity changes.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' Contribution

Sheheryar Khan: Conceptualization, Investigation, Data Curation.

Waqar Khalid: Writing-Original draft preparation, Supervision, Resources, Project Administration, Methodology, Writing-Review and Editing.

Naveed Hussain Shah: Software, Formal Analysis.

Anum Zahra: Editing and Revising

Muhammad Bilal Khan: Editing and Revising

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