The Impact of Capital Structure on Liquidity Risk in Commercial Banks- A Case Study of Listed Banks in China

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Abstract. In China's bank-dominated financial system, liquidity risk has become a key threat to financial stability. In the wake of the 2008 global financial crisis, Basel III elevated liquidity regulation to the core agenda of the international banking regulatory system. Based on the risk absorption theory and the financial vulnerability theory, and adding the dimensions of equity and debt structure analysis, this paper takes 42 Chinese listed banks from 2020 to 2024 as samples to study the correlation between capital structure and liquidity risk by constructing a multiple regression model. The study shows that in China, an increase in capital adequacy ratio can significantly reduce liquidity risk for listed banks; an increase in the proportion of active debt will exacerbate liquidity risk, but the correlation between equity structure and liquidity risk is not large.; a decline in loan quality is an important inducement of liquidity risk. The research conclusions provide micro-evidence for achieving a balance between risk and return through capital structure adjustments, suggesting that regulatory authorities should strengthen capital constraint mechanisms, and commercial banks should optimize their debt structure and establish a comprehensive credit management system.

1 Introduction

As important financial institutions in the financial system, banks play an indispensable role in fundraising, optimizing financial market resource allocation, and regulating the national economy, especially in a country like China with a bank-dominated financial structure. However, as the risk awareness in the Chinese banking industry continues to strengthen, effective management of capital remains a significant issue. The Chinese banking sector still faces numerous risks, with liquidity risk being one of the main risks. The 2008 global financial crisis exposed the liquidity crisis of most banks, which prompted Basel III to incorporate liquidity supervision into the core framework and reconstruct the global banking supervision paradigm through dual liquidity indicators. For China, the current domestic and international economic situation is unstable, with domestic economic growth falling short of expectations, demand contraction, supply shocks, and market turbulence

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exacerbating the liquidity risks faced by commercial banks. As a symbol of a bank's risk absorption capacity, capital structure not only affects capital costs and operational efficiency but is also a core variable determining the ability to withstand liquidity risk. Today, how to achieve a dynamic balance between risk and return through capital structure adjustments has become an important proposition for maintaining financial stability. Based on this, this paper takes 42 listed commercial banks in China as an example and conducts research using data from the past five years. Existing studies mainly explore the impact of capital structure on liquidity risk based on risk absorption theory and financial fragility theory, while this paper further incorporates the analysis dimensions of equity structure and debt structure, and draws conclusions through empirical models, so as to provide suggestions for optimising the capital structure of the banking industry to cope with the lack of liquidity.

2 Literature review

2.1 Capital structure of commercial banks

Kareken applied MM theory to the study of commercial banks for the first time, highlighted that banks need to bear liquidity risk when generating profits from deposit business, and examined the equilibrium point between the advantages of bank scale expansion and the costs associated with bankruptcy, thereby providing a theoretical basis for the rationality of the optimal capital structure [1]. Lee empirically analysed the relevant data of 26 Korean banks from 1985 to 1994 and demonstrated that Equity concentration exhibits a positive correlation with banks' operational performance [2]. Barrios and Blanco argued that the Capital allocation of commercial banks is influenced by regulatory and market environments: under regulatory constraints, banks optimize their capital structure to meet capital adequacy requirements; in the financial market, capital outcomes are influenced by factors such as financing costs, asset size, and profitability [3]. Yao Yanyan conducted a study on Chinese commercial banks, and his analysis showed that the degree of equity concentration will weaken their profitability, while the proportion of debt financing will increase their profitability [4]. Niluthpaul proposed in his research on the banking industry in developing countries that although banks in developing countries are relatively small, value creation and profitability can still be achieved through optimizing financing structure, debt maturity structure, and equity allocation in capital structure combinations [5]. In summary, most scholars mainly represent capital structure in terms of capital adequacy ratio and debt-to-asset ratio, while some scholars study capital structure from the perspectives of equity and debt. Therefore, this paper combines the viewpoints of scholars to study the capital structure of commercial banks from the angles of financing structure, debt structure, equity structure, and capital adequacy ratio.

2.2 Liquidity risk

Diamond and Dybvig pointed out that "commercial banks, as intermediary institutions, provide liquidity transformation for both depositors and borrowers; if there is an imbalance in liquidity supply and demand, it will lead to a liquidity shortfall for the bank [6]." Kashaya, Raj and Stein consider the two functions of banks' deposit absorption and loan issuance, and argue that banks' loans are actualised through commitments, and the provision of liquidity according to loan demand may optimise the loan and deposit absorption businesses in relation to one another, as the synergy of deposit and loan activities results in a substantial liquid deposit balance [7]. Imbierowicz and Rauch point

out that the term structure mismatch between bank assets and liabilities is the core cause of liquidity risk, and when short-term liabilities support long-term assets, the risk of tight capital chain increases significantly.[8]. In terms of measurement methods, Bangia et al. incorporated liquidity risk into the VaR framework based on spread volatility, constructing the La-VaR model [9]; Li Qicheng advocated empirical measurement through indicators such as loan-to-deposit ratio, loan volatility, and debt-to-asset ratio [10]. In summary, liquidity risk mainly manifests as the risk of mismatch in the use of funds by commercial banks, which is influenced by both macro and micro factors. The methods for measuring liquidity risk in commercial banks include dynamic measurement methods and static measurement methods. Given the availability of data, this paper measures liquidity risk in commercial banks mainly by referencing the loan-to-deposit ratio indicator proposed by Li Qicheng , which is significant for monitoring liquidity risk in Chinese commercial banks [10].

2.3 Capital structure effects on banking liquidity risk

Concerning the influence of bank capital structure on liquidity risk", the financial fragility theory and the risk absorption hypothesis are the most representative. Minsky proposed the "financial instability hypothesis" based on the theory of financial vulnerability, indicating that financial vulnerability is endogenous. When the situation in the market economy improves, banks are prone to relax their risk vigilance and expand their business scale through excessive debt, leading to the continuous accumulation of liquidity risk and ultimately triggering a financial crisis [11]. Allen and Gale argue that the liquidity risk caused by excessive debt can be partially offset by capital expansion, and the capital adequacy ratio has a certain positive effect on liquidity reserves [12]. Berger and Bouwman empirical analysis based on U.S. banking data shows that the improvement of capital adequacy ratio can significantly alleviate the liquidity risk of large banks, but the effect is weaker in smaller banks, which may be due to limited capital replenishment channels [13]. On the other hand, Sun Liu pointed out that major shareholders, based on their own interests, intervene in management to lower the restrictions on exceeding risk audits, lending more to their affiliated enterprises, which often leads to non-performing loans, and the concentration of loans infringes on the legitimate rights and interests of minority shareholders and even depositors, ultimately resulting in insufficient liquidity and increased liquidity risk for banks [14]. Yu Ying focused on the segmented debt structure of capital structure and explored the impact of commercial banks' debt structure on liquidity risk [15]. Using panel data from 16 listed banks as a sample, an empirical model was constructed, concluding that a higher proportion of interbank liabilities and scale expansion significantly weaken liquidity conditions, while an increase in the proportion of deposit liabilities helps alleviate liquidity pressure and reduce risk levels. Combining domestic and foreign research, this paper will explore the impact of capital structure on liquidity risk from several levels, including financing structure, capital adequacy ratio, equity structure, and debt structure, and propose hypotheses:

Hypothesis 1: As the debt-to-asset ratio increases, liquidity risk increases.
Hypothesis 2: Higher capital adequacy ratios correlate with reduced liquidity risk.
Hypothesis 3: An increase in proactive liabilities of commercial banks increases liquidity risk.
Hypothesis 4: Equity concentration has a promoting effect on liquidity risk.

3 Variable selection and empirical model construction

3.1 Variable selection

This research focuses on analyzing the impact of capital structure on liquidity risk in commercial banks, with liquidity risk designated as the core dependent variable. Due to data constraints, the study employs a static measurement approach for liquidity risk assessment and incorporates the loan-to-deposit ratio metric proposed by Li Qicheng.[10].

In selecting core explanatory variables, the overall capital structure of commercial banks is represented by the debt-to-asset ratio and capital adequacy ratio, i.e., the financing structure. Based on the debt structure of commercial banks, the interbank lending ratio is used to represent their proactive liability situation, and the shareholding ratio of the top five shareholders is introduced as a measure of equity concentration..

In terms of control variables, this paper primarily differentiates between macro-level and micro-level control variables. At the macro level, based on the mechanism through which economic growth influences commercial banks' credit distribution and liquidity, GDP growth rate is adopted as the proxy for economic expansion. At the micro level, two indicators are selected: the logarithm of total assets (reflecting banks' capital capacity) and non-performing loan ratio (relating to asset security). The former mirrors institutional financial strength, while the latter has implications for asset quality, with both demonstrating correlations to liquidity risk.All variables are detailed in Table 1.

Table 1. The variables in the model are defined as

Variable	Specific Indicator	Symbol	Definition
Dependent Variable	Loan-to-Deposit Ratio	LS	Loan Amount/Deposit Amount
Independent Variable	Debt-to-Asset Ratio	DAR	Total liabilities/Total Assets
	Capital Adequacy Ratio	CAR	Total Capital/Risk-Weighted Assets
	Interbank Borrowing Ratio	ID	Total Interbank Borrowing/Total Deposits
	Proportion of Shares Held by the Top Five Shareholders	CR5	Total number of the top five shareholders / Total number of shares
Control Variables	GDP Growth Rate	RGDP	GDP Difference/Last Year GDP
	Log of Total Asset Size	LnTA	Ln(Total Asset Size)
	Non-Performing Loan Rate	CR	Non-Performing Loan Balance/Loan Balance

3.2 Model construction

Based on previous scholars' research and the actual situation of this paper, a multiple linear regression equation model will be established for the study, specifically represented by equation (1). The equation examines the impact of capital adequacy ratio (CAR), debt-to-asset ratio (DAR), interbank lending ratio (ID), and top-five shareholders'

ownership concentration (CR5) on the loan-to-deposit ratio (LS).

$$LS_{i,t} = \alpha_0 + \alpha_1 DAR_{i,t} + \alpha_2 CAR_{i,t} + \alpha_3 ID_{i,t} + \alpha_4 CR5_{i,t} + \alpha_5 RGDP_{i,t} + \alpha_6 LnTA_{i,t} + \alpha_7 CR_{i,t} + \varepsilon_{i,t} \quad (1)$$

3.3 Sample selection

Drawing on the annual panel data from 42 Chinese listed commercial banks spanning 2020-2024, this study constructs a dynamic analysis sample, and uses the data substitution or historical growth rate method to fill in the small number of missing data, and implements econometric tests through Eviews software. The data sources include macro data from the China Bureau of Statistics and annual reports of commercial banks.

4 Empirical results and analysis

4.1 Descriptive statistical analysis

Table 2. Descriptive statistics of variables

Classification	Variable name	Observation	Mean	StandardDeviation	Minimum	Maximum	Skewness	Kurtosis
All Samples	Loan-to-Deposit Ratio	210	84.636	11.864	55.190	116.230	0.260	2.700
	Debt-to-Asset Ratio	210	92.069	0.866	89.67	94.130	0.129	2.986
	Capital Adequacy Ratio	210	14.328	1.7335	11.120	19.690	1.069	3.812
	Interbank browing and leading ratio	210	3.805	2.985	0.020	12.730	1.014	3.328
	Proportion of Shares Held by the Top Five Shareholders	210	47.970	21.778	17.680	96.220	0.601	2.487

	GDP Growth Rate	210	4.880	3.747	2.880	13.430	1.325	3.044
	Natural logarithm of total asset size	210	9.770	1.640	7.170	13.100	0.285	1.967
	Non-Performing Loan Ratio	210	1.226	0.312	0.660	2.190	0.312	2.561

According to the descriptive statistical results presented in Table 2, the average loan-to-deposit ratio of the sample banks is approximately 84.636%, the maximum is 116.23%, and the minimum is only 55.190%., indicating that there is a large difference in liquidity risk among listed banks in China. The average debt-to-asset ratio is 92.069%, with most commercial banks above 90%. In terms of capital adequacy ratio, the average is 14.328%, which is relatively robust, indicating strong risk tolerance. However, the peak value reaches 19.690% while the lowest recorded value stands at 11.120%,, showing considerable variation. The interbank browing and leading ratio and the shareholding ratio of the top five shareholders also exhibit significant differences among banks, reflecting the diversity in the capital structure of China's listed banks.

4.2 Regression result analysis

Table 3. Empirical Results of Regression Analysis

VARIABLES	**All Samples**
DAR	-5.006*** （-5.759）
CAR	-2.867*** （4.886）
ID	1.063*** （4.886）
CR5	-0.005 （-0.112）
RGDP	0.226 （1.317）
LASSET	3.221*** （5.727）

CR	5.255*** （6.495)
Constant	543.486*** (6.495)

t-statistics in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1
Data source: Eviews model regression results

The regression is shown according to the data in Table 3. results,the debt-to-asset ratio of banks has a restraining effect on liquidity risk., rejecting hypothesis 1. This may be because commercial banks become more cautious in lending as their liabilities increase, keeping funds on hand to reduce liquidity risk. As the capital adequacy ratio increases, the liquidity risk of commercial banks decreases, confirming the views of Allen and Gale and hypothesis 2[11]. Furthermore, commercial banks increase liquidity risk through proactive liabilities, confirming hypothesis 3. This is mainly because commercial banks increase loan disbursement through proactive liabilities. However, in China, the concentration of equity does not significantly affect the liquidity risk of commercial banks, possibly because decision-making efficiency is not as critical in the banks' lending activities. Additionally, both asset size and non-performing loan ratio have a significant positive effect on liquidity risk.

4.3 Robustness test

In verifying the robustness of the regression results, the variable substitution method is employed to test: the capital adequacy ratio (CAR) of the original variable is substituted with the core Tier 1 capital adequacy ratio (CET1) and then regressed. The results of the regression are presented in Table 4 and are generally consistent with the results of the original model, indicating that the model is robust.

Table 4. Robustness Test

VARIABLES	**All Samples**
DAR	-6.665*** （-7.546）
CET1	-3.495*** （-8.311）
ID	1.100*** （5.381）
CR5	-0.050 （-1.273）
RGDP	0.100 （0.616）

LASSET	2.355*** （4.588）
CR	3.842** （1.847）
Constant	704.868*** (8.269)

t-statistics in parentheses
*** p < 0.01, ** p < 0.05, * p < 0.1
Data source: Eviews model regression results

5 Conclusions

Using panel data from 42 listed Chinese banks spanning 2020-2024, this study empirically investigates the nexus between capital structure and liquidity risk.

The capital structure of Chinese commercial banks aligns more closely with the risk absorption theory regarding its impact on liquidity risk. This may stem from the scale characteristics of Chinese listed banks—large institutions tend to enhance their risk absorption capacity through sufficient capital reserves, thereby reducing liquidity risk. In terms of financing structure, an increase in the debt-to-asset ratio helps to lower liquidity risk, primarily because the increase in liabilities leads banks to be more cautious in credit issuance. On the debt structure level, higher active debt ratios exacerbate liquidity risk by creating liquidity mismatches with asset-side long-term loans. No significant link exists between equity structure and liquidity risk, possibly because concentrated ownership in Chinese listed banks subjects controlling shareholders to stronger regulation than market discipline.

Based on this, it is recommended that the financial regulatory authorities in China continue to strengthen capital constraints to enhance banks' risk absorption capacity by absorbing substantial capital. At the micro level, commercial banks should focus on optimizing their debt structure, increasing the proportion of long-term stable liabilities to enhance funding stability; simultaneously, they should establish a comprehensive credit management system, implementing a three-dimensional mechanism of pre-loan due diligence, precise approval during the loan process, and dynamic monitoring post-loan to effectively improve loan quality and prevent liquidity risk.

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