Research on the Impact of ESG Factors on Bank Liquidity Risk

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Abstract: In recent years, with the increasing prominence of environmental and social issues, investors have been paying more attention to the ESG performance of enterprises, highlighting the importance of ESG factors in the financial field. This study is based on the theories of banking business models, stakeholder theory, risk management theory, and ESG investment theory. It uses the financial data and ESG scores of Chinese listed banks to deeply analyse the ESG factors and explore their impact on the liquidity risk of commercial banks. The research found that (1) good ESG performance can reduce commercial banks' liquidity risk by improving bank value and financial performance. (2) ESG factors can also enhance the liquidity management level of commercial banks through standardization and sustainable business principles, thereby reducing the occurrence and impact of liquidity risk.

1. Introduction

ESG factors have emerged as critical in financial decisions since their formal introduction in 2004[1]. They guide companies towards sustainability, focusing on environmental protection, social responsibility, and governance. The China Securities Regulatory Commission's 2022 mandate for ESG disclosure highlights its investment significance[2]. ESG also impacts banking, particularly in managing liquidity risks, which include capital and market liquidity challenges. Good ESG performance can mitigate these risks by enhancing bank value and promoting sustainable operations. This relevance is supported by research indicating that strong ESG practices can reduce liquidity risks. This study examines ESG's effect on liquidity risk among China's listed banks, underscoring the importance of ESG-centered supervision for sustainable and stable development of the banking sector.

2. Research Design and Research Data

2.1 Sample selection and data sources

As of 2023, China has a total of 54 listed banks. After excluding banks that do not have ESG-related data, this article focuses on 41 listed banks, including Ping An Bank and Bank of China. The liquidity indicators and financial indicators of commercial banks are measured using data from the Wind database. Considering the influence of data outliers, this paper utilizes Huazheng's ESG score.

2.2 Variable Selection

1) Explained variable: loan-to-deposit ratio (LTD)

With reference to previous studies, the deposit-loan ratio is a key indicator for measuring bank liquidity risk[3]. Therefore, the bank's deposit-to-loan ratio (LTD) is selected as the explanatory variable in this article. A high deposit-to-loan ratio means that the loan balance significantly exceeds the deposit balance, which may imply that the bank is too biased towards lending in its capital operations. This may bring certain risks in the short term: if there is a large-scale withdrawal of customers or a large number of loans that have not been recovered when they expire, the bank may not be able to meet this cash demand, which may lead to an increase in the bank's liquidity risk.

2) Core Explanatory Variable: HZESG

The core explanatory variable used in this article is the ESG score. To remove the unit influence

of the score and maintain the multiple relationships of the data, a logarithmic transformation was performed on the converted score. This treatment does not change the relative size of the ESG score, but it can make the data conform to the assumptions of some statistical models.

3) Intermediary variables: bank value (TobinQ), profitability (ROE)

This article selects bank value (TobinQ) and profitability (ROE) as intermediary variables. It utilizes TobinQ to assess bank value. As a real-time reflection of bank value, TobinQ aids in exploring and comprehending the relationship between the influence of ESG ratings on bank value and bank liquidity risk[4].

Profitability is often measured by the company's ROE (return on equity), which reflects the ability to produce profit per unit of capital. The higher the ROE, the stronger the company's profitability. This is an important indicator that can directly reflect the company's economic benefits in its business activities[5]. Therefore, ROE helps to explore the relationship between the impact of ESG rating on the profitability and operational efficiency of enterprises and the liquidity risk of banks.

4) Control variables

In addition to the above factors, according to previous studies, many factors affect bank liquidity risk. In this paper, considering the relevance and availability of the selected data, the final selected control variables include "non-interest income ratio (NIR), independent shareholder ratio (INDEP), top ten shareholder ratio (TOP10), non-performing loan provision coverage ratio (PLLCR), year-on-year growth of GDP in the provinces where banks are registered (PGDPG), and consumer price index (CPI)"[6]. Among them, "the proportion of non-interest income (NIR), the proportion of independent shareholders (INDEP), and the proportion of the top ten shareholders (TOP10)" are characteristic variables at the bank level; "Non-performing loan provision coverage ratio (PLLCR)" as a regulatory factor; "The year-on-year growth of GDP in the provinces where banks are registered (PGDPG) and the consumer price index (CPI) is macro-influencing factors[7]. Table 1 shows all the relevant variables.

Table 1 Variable Explanation

Variable Type	Indicator	Variable Symbol	Measurement Method
Dependent Variable	Loan-to-Deposit Ratio	LTD	Bank Loans / Bank Deposits
Independent Variable	Hua Zheng ESG Score	HZESG	Natural Logarithm After Conversion
Mediating Variable	Bank Value	TobinQ	(Market Value + Bank Liabilities) / Book Value
	Profitability	ROE	End-of-Period Net Profit / End-of-Period Total Assets
Moderating Variable	Peking University Bank Digital Transformation Index	PKUDBI	Natural Logarithm of Peking University's Digital Inclusive Finance Index
Control Variable	Non-interest Income Ratio	NIR	Non-interest Income / Total Income
	Proportion of Independent Shareholders	INDEP	Number of Independent Shareholders / Total Number of Company Shareholders
	Proportion of Top 10 Shareholders	TOP10	Number of Shares Held by the Top 10 Shareholders / Total Company Share Capital
	Non-performing Loan Provision Coverage Ratio	PLLCR	Bank Provisions for Non-performing Loans / Total Non-performing Loans
	Year-on-Year Growth of Bank's Registered Province GDP	PGDPG	China National Bureau of Statistics
	Consumer Price Index	CPI	China National Bureau of Statistics

2.3 Model building

This article first analyzes the impact of ESG scores on bank liquidity risk. Select the ESG rating published by the China Affairs Index as the explanatory variable, and set the model (1) as follows:

$$LTD_{it} = \alpha_0 + \alpha_1 lnhzesg_{it} + CV + \sum year + \varepsilon_{it} \tag{1}$$

Among them, the subscript i represents the i-th bank (i=1,2,...,41), t represents the tth year (t=2009, 2010,...,2022).In order to eliminate the dimensional difference between different data, the relatively large data (absolute value) is taken as the natural logarithm, and the relative value (that is, proportional or percentage data) is not processed. In formula (1), the explained variable LTD is the bank's deposit and loan ratio; The explanatory variable lnhzesg is the ESG data after logarithmic processing; CONTROL represents the control variables included in the model. $\sum$ year represents the fixed effect of the year, which aims to control the systematic change or trend change between different years and avoid errors in the model due to unconsidered factors such as inflation rate, risk-free interest rate, and financial regulatory environment.

This paper predicts that the $\alpha 1$ coefficient in the model (1) is significantly negative, indicating that banks with high ESG scores have lower deposit-to-loan ratios, which indicates that banks with high ESG scores usually have better risk management and are more concerned about long-term sustainability, so they will be more cautious and tend to maintain lower deposit-to-loan ratios to prevent credit risk and liquidity risk. At the same time, banks with high ESG scores will attach importance to social responsibility abide by the principle of fair lending, and will not over-issue loans, resulting in relatively low deposits and loans.

In order to further explore the intermediary mechanism of ESG factor on bank liquidity risk and test whether a high ESG score can reduce bank liquidity risk, this paper takes TobinQ and ROE as proxy variables of ESG score and draws on the intermediary effect model proposed in (4) to establish the following three regression models step by step:

$$TobinQ_{it} = \beta_0 + \beta_1 hzesg_{it} + CV + \sum year + \varepsilon_{it} \tag{2}$$

$$ROE_{it} = \gamma_0 + \gamma_1 hzesg_{it} + CV + \sum year + \varepsilon_{it} \tag{3}$$

$$LTD_{it} = \zeta_0 + \zeta_1 In + \zeta_2 TobinQ_{it} + \delta_3 ROA_{it} + CV + \sum year + \varepsilon_{it} \tag{4}$$

Among them, TobinQ and ROE are intermediate variables, and the definitions and measurement methods of other variables are consistent with the above[8]. The coefficient $\alpha 1$ of the prediction model (2) is significantly negative, indicating that from the perspective of the overall effect, good ESG performance can significantly reduce the bank's liquidity risk. The coefficient $\beta 1$ of the prediction model (3) is significantly positive, and the coefficient $\gamma 1$ of the prediction model (4) is significantly positive, indicating that a high ESG score can increase the value of the bank and the return on equity of the bank. At the same time, the coefficients $\delta 1$, $\delta 2$, and $\delta 3$ in the prediction model (5) are significantly negative, which means that banks' investment in strengthening ESG performance can not only directly reduce liquidity risk, but also indirectly reduce liquidity risk by improving bank value and bank operating efficiency (reflected in equity return rate).

$$LTD_{it} = \delta_0 + \delta_1 hzesg_{it} + \delta_2 pkudbi_{it} + CV + \sum year + \varepsilon_{it} \tag{5}$$

3. Empirical Results and Analysis

3.1 Descriptive Statistics and Correlation Analysis

Table 2 Descriptive statistical characteristics are reported, and the number of valid samples in this experiment is 284. In order to make the data more intuitive and easy to understand, the original data is used in descriptive statistics. The results show that for the explained variable ltd, the average value is 77.032, the standard deviation is 12.956, the maximum value is 116.23, and the minimum value is 38.97, which indicates that there is a big difference in the loan-to-deposit ratio of the sample banks. At the same time, the distribution map of ltd is found that the skewness of LTD data is 0. 470, which means that the data has a certain right deviation relative to the normal distribution. That is, more values are located on the right side of the average, which means that more than half of the bank loan-to-deposit ratio is in a higher range, and less than half of the bank loan-to-deposit ratio is in a lower range.

Explanatory variable hzesg, the average value is 5.435, the standard deviation is 0.774, the maximum value is 7, and the minimum value is 3, which indicates that the ESG score of the sample bank is generally biased towards a higher level. At the same time, the ESG normal distribution chart was made, and found that the skewness is -0.653, which means that the data has a certain left deviation relative to the normal distribution. That is, more values are located on the right side of the average, which shows that most banks have higher ESG scores.

Table 2 Descriptive Statistics of Variables

Variable	Obs	Mean	Std. Dev.	Min	Max
hzesg	285	5.435	.774	3	7
ltd	285	77.032	12.956	38.97	116.23
tobinq	285	.995	.02	.93	1.06
roe	285	.144	.043	.06	.25
nir	285	23.419	8.696	5.82	51.09
coir	285	30.035	4.985	18.93	59.01
indep	285	.369	.048	.1	.56
top10	285	.662	.208	.25	.99
pllcr	285	261.578	97.179	132.44	567.71
pggdpg	285	7.086	2.144	1.2	13.9
cpi	285	2.27	1.007	.9	5.4

3.2 Benchmark regression results

This article initially applies the Hashman test to assess the impact of ESG on the liquidity of commercial banks. Subsequently, the year fixed effect model is selected for regression analysis. Panel fixed effect regression is conducted on model (2), while controlling for the influence of the year. The relationship between the explanatory variable and the explained variable is then determined. The regression results without adding control variables are presented in Table 3, column (1), while the results with control variables and year control are shown in column (2).

Table 3 Baseline Regression Results

VARIABLES	(1) ltd	(2) ltd
hzesg	-0.363***	-0.174***
	(0.0504)	(0.0350)
nir		0.151***
		(0.0345)
pllcr		-0.0154***
		(0.00317)
pggdpg		-1.066***
		(0.114)
cpi		0.0103***
		(0.000736)
indep		0.0950**
		(0.0468)
top10		0.115**
		(0.0480)
Constant	2.146***	1.965***
	(0.0370)	(0.0469)
Observations	284	284
Number of id	41	41
R-squared	0.176	0.680

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results of the multiple regression analysis of model (2) indicate that, when controlling for the year effect, the model's adjusted R2 is 0.68, indicating goodness of fit of 68%. The F test value

is 70.98, with a p-value of <0.01. This means that the fixed effect model passes the 99% confidence interval test and can proceed to test the coefficient of a single variable. The impact coefficient of the core explanatory variable ESGhzesg is -0.174, which is statistically significant at the 1% level. This significant negative impact suggests that ESG scores have a detrimental effect on the realization of commercial bank liquidity. This may be due to the fact that high ESG scores enhance the ability of commercial banks to obtain deposits, thereby reducing the index of bank loan-to-deposit ratio. The control variables nir,pllcr,pggdpg,cpi,indep,top10 all have a significant impact, and pllcr,pggdpg have a significant negative impact, indicating that the non-performing loan provision rate increases the non-interest cost of commercial banks, which is not conducive to the realization of liquidity, while the increase in macro GDP weakens the main characteristics of commercial banks as important external financing institutions, and also hinders the realization of liquidity in disguise.Nir,cpi,indep,top10 have significant positive effects, which shows that the proportion of non-interest income and independent directors and the top ten shareholders can improve the ability of commercial banks to issue loans at the micro level and enhance market financing confidence, while the consumer price index can enhance the macro environment and the consumption willingness and scale of the real market, and stimulate the continuous realization of commercial banks' consumer loans.

3.3 Mediating effect analysis

According to the previous analysis, ESG score will have an impact on the liquidity of commercial banks by enhancing bank value and financial performance. This paper uses the intermediary effect model to test the intermediary mechanism of these two types of elements. Model (3), model (4), and model (5) will be regressed separately, and the regression results are shown in Table 4.

Table 4 Mediation Effect Analysis

VARIABLES	(3) tobinq	(4) roe	(5) ltd
hzesg	0.0401***	0.142***	-0.0885**
	(0.0132)	(0.0230)	(0.0352)
tobinq			-0.493***
			(0.163)
roe			-0.469***
			(0.0937)
nir	-0.0188	-0.118***	0.0835**
	(0.0131)	(0.0227)	(0.0338)
indep	-0.0319*	-0.00470	0.0830*
	(0.0178)	(0.0309)	(0.0439)
top10	-0.0303*	-0.0236	0.0852*
	(0.0182)	(0.0316)	(0.0448)
pllcr	0.00484***	0.0130***	-0.00706**
	(0.00120)	(0.00208)	(0.00321)
pggdpg	0.336***	0.831***	-0.514***
	(0.0433)	(0.0751)	(0.136)
cpi	-0.00336***	-0.00613***	0.00582***
	(0.000278)	(0.000483)	(0.000987)
Constant	0.970***	-0.000458	2.446***
	(0.0177)	(0.0308)	(0.164)
Observations	283	283	283
Number of id	41	41	41
R-squared	0.542	0.694	0.727

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As can be seen in Table 4, the regression coefficients of the direct and indirect effects of tobinq are 0.0401 and -0.493, respectively, and both pass the significance test at the 1% level. This shows that there is a complete intermediary effect in bank value, indicating that banks with high ESG scores have higher bank value and have a positive impact on bank liquidity. The direct and indirect effects of ROE are 0.142 and -0.469, respectively, and both pass the significance test at the 1% level, which also shows that there is a complete mediating effect in financial performance, indicating that banks with high ESG scores have higher financial efficiency. This suggests that the market recognizes and has greater confidence in high-value banks, attracting more deposits and investments to banks thereby reducing liquidity risk. Banks with high financial efficiency have stronger capital allocation capabilities and effective risk management and control methods and play a more obvious role in optimizing asset-liability structure, business process risk management, and special line process management, thereby reducing liquidity risk.

4. Conclusion

In conclusion, the study unequivocally demonstrates that robust ESG performance is instrumental in mitigating liquidity risk for commercial banks, indicating that banks with superior ESG practices experience increased stability and an improved capacity to navigate liquidity challenges. This positive correlation between ESG performance and liquidity risk management suggests that enhanced ESG practices contribute to higher bank value and better financial performance, thus bolstering banks' ability to manage risks effectively. In light of these findings, it is imperative to expedite the development of ESG disclosures among Chinese commercial banks, as this will not only elevate their ESG performance but also diminish liquidity risks. Regulatory bodies should encourage the adoption of comprehensive ESG policies and regular reporting, while also establishing clear ESG indicators and standards to serve as benchmarks for liquidity risk assessments. Furthermore, there is a critical need for concerted efforts in ESG and liquidity risk education and training, facilitated by government and regulatory agencies, to deepen the understanding and application of ESG principles within banking institutions and across society. Finally, it is essential to bolster international cooperation in the banking sector to foster the global harmonization of ESG standards and practices, thereby reinforcing the liquidity risk management framework worldwide. This collective approach will undoubtedly lead to a more resilient and sustainable global banking industry.

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