5. Analysis on Liquidity Risk Management of Monetary and Financial Services based on the Goal of Financial Stability

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Abstract

Liquidity risk is one of the most destructive risks in monetary and financial services. If exposed, such a risk would impose serious losses to financial institutions, depositors, and the whole economy. Thus, this study aims to explore the liquidity risk management of monetary and financial services from the perspective of financial stability and asset-liability management theory. The information disclosure data of 181 monetary and financial service enterprises in China during 2015–2022 were used to study empirically whether liquidity risk management was implemented in monetary and financial services according to the target values of liquidity risk indicators. Then, the study examined how enterprise characteristics, macroeconomy, enterprise liquidity level and duration, and enterprise size affected the liquidity risk management of monetary and financial service enterprises. The results showed that monetary and financial service enterprises would adjust their liquidity structure based on the target values of liquidity risk indicators. The structural adjustment speed of monetary and financial service enterprises for liquidity risks was influenced by enterprise characteristics and macroeconomy. Moreover, the enterprises would adjust their liquidity structure according to their liquidity level and the duration. The target value and adjustment speed of the liquidity risk indicators of differently sized monetary and financial service enterprise varied, and the difference was even more evident in the liquidity risk management model. The conclusion revealed the regularity and diversity of liquidity risk management in monetary and financial services to some extent, which provided a new perspective for investigating the liquidity risk management at the micro-enterprise level and a decision-making reference for the liquidity supervision at the macro-regulatory level.

Keyword: liquidity risk management, monetary and financial services, financial stability

JEL Classification: D53, E44, G21, G23, G32.

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1. Introduction

The Liquidity risk is one of the basic risks faced by monetary and financial service enterprises, which include banks, credit cooperatives, loan companies, pawnshops, financial asset management companies, finance companies, financial leasing companies, auto finance companies (Kamarudin et al., 2021). The liquidity risk management of monetary and financial services mainly includes management indicators and management model, among which management indicators are the main basis of liquidity supervision. The tightening of liquidity supervision regulations leads monetary and financial service enterprises to carry out liquidity risk management actively. Then, these enterprises set their own optimal liquidity risk indicator value as the target value, which was generally more strict than that specified in the existing regulatory provision (Dietrich et al., 2014; Van den End, 2016; Edoardo and Lucio, 2021; D'Avino et al., 2022). The outbreak of liquidity risks often leads to payment difficulties in monetary and financial services, which may give rise to bankruptcy and even shake market confidence (Tang et al., 2023). Historically, Continental Illinois Bank in the United States experienced a liquidity crisis in 1984. In addition, Northern Rock Bank in the United Kingdom experienced a bank run in 2007. Recently, Silicon Valley Bank in the United States unexpectedly suffered a bank run of $42 billion on March 9, 2023. Subsequently, the bank was closed by the California Department of Financial Protection and Innovation the next day. During the global financial crisis in 2008, some banks faced trouble due to the lack of liquidity (Sakoda et al., 2022). Furthermore, the financial market experienced a rapid reversal from excess liquidity to shortage, which lasted for a long time. Stimulated by this situation, the Basel Committee issued the 'Principles for Sound Liquidity Risk Management and Supervision' in 2008 and 'Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring' in 2010. These standards revised and added the relevant content of liquidity risk management, especially newly established indicators, such as the Net Stable Funding Ratio (NSFR). As such, the loan-to-deposit ratio (LDR) was no longer the sole focus. Accordingly, the financial supervision authorities of various countries issued a number of regulatory provisions on liquidity. They also strengthened the prevention of liquidity risks to improve the liquidity risk management level of monetary and financial service enterprises. The effectiveness of liquidity supervision depends on whether it is consistent with the management objectives of monetary and financial service enterprises regarding liquidity risks. Seeking methods to guide the liquidity risk management of monetary and financial services better has become an important issue among financial supervision authorities in various countries.

From the perspective of macro-prudential supervision, the influence of liquidity supervision on the coping behavior of monetary and financial services has been investigated using the models of liquidity risk return, Granger causality test, ordinary least squares, and liquidity cascade. The majority or fast-growing enterprises hadn't met the requirements of financial stability indicators, such as the liquidity coverage ratio and the NSFR, before the global financial crisis in 2008. Although strong liquidity supervision after the crisis could reduce the overall liquidity risk of the industry by improving risk transparency, it failed to reduce the risk of individual enterprises (Allen et al., 2014; Horváth, 2014; Elbadry, 2018; Edoardo and Lucio, 2021). Research from these macro-regulatory dimensions generally aimed at financial stability (Allen et al., 2014; Bengtsson, 2014; Van den End, 2016; Edoardo and Lucio, 2021) and the corresponding minimum regulatory requirements (Dietrich et al., 2014; Horváth, 2014; Doumpos, 2016; Igan and Mirzaei, 2020). Financial stability is one of the important goals of the financial supervision policy, which is to make the financial system run smoothly and bear risks (de Haan et al., 2022). Moreover, it helps avoid abnormal social and economic fluctuations caused by the accumulation of systematic financial risks, especially the financial crisis. To prevent a financial crisis from causing great damage, the liquidity risk management of monetary and financial services aims for financial stability. However, the mainstream research on macro-regulation has not probed into the enterprise dimension from

the micro-level. As such, investigations on how monetary and financial service enterprises carry out liquidity risk management based on the goal of financial stability are lacking.

Some recent studies have applied various models, such as phase change, unit asset liquidity, simultaneous structural equation, dynamic panel data, panel smooth threshold regression, and moment dynamics, to reduce the liquidity risk of monetary and financial service enterprises from the dimension of micro-enterprises. Research has found that the liquidity risk could be reduced by traditional credits, investments, and inter-bank businesses. However, this risk could be aggravated by emerging businesses. In addition, the liquidity risk of monetary and financial service enterprises was significantly correlated with the economic environment, financial network, market power, and risk management (Acemoglu et al., 2015; Berger et al., 2019; Hassan et al., 2019; Taruna et al., 2020; Djebali and Zaghdoudi, 2020; Galletta et al., 2021; Saif-Alyousfi, 2021). Through such studies from the dimension of micro-enterprises, various measures that could reduce the liquidity risk of monetary and financial service enterprises have been established. Some of these approaches included wholesale financing (De Haas and Van Lelyveld, 2014; Bologna, 2015), sale at reduced prices (Chan and Milne, 2014; Ijtsma and Spierdijk, 2017), decentralized credit (Djebali and Zaghdoudi, 2020), and the establishment of a risk committee (Galletta et al., 2021). However, existing studies aimed only at reducing risks (Berger et al., 2019; Djebali and Zaghdoudi, 2020; Galletta et al., 2021) and did not comprehensively examined the overall risk of monetary and financial service enterprises. Despite greatly reducing the liquidity risk, the above measures have increased the risks that might cause greater harm to enterprises, such as rollover risk and credit risk. Therefore, a reasonable perspective should emerge from the liquidity risk. Researchers must look the liquidity risk at a higher target level, especially positioning it as the goal of financial stability adopted by the research from the macro-regulatory dimension.

The global financial crisis in 2008 prompted the Basel Committee to set up a new long-term indicator for liquidity risk management, the NSFR, which was used in some studies (Dietrich et al., 2014; Doumpos et al., 2016; Taruna et al., 2020; Edoardo and Lucio, 2021). Meanwhile, in other studies, the traditional indicator, the LDR (Ahrende and Goujard, 2015; Van den End, 2016; Elbadry, 2018), was still used. The LDR measures the overall liquidity risk and the matching of deposits and loans, which can reflect the liquidity risk by measuring the degree of credit expansion. However, it does not distinguish the liquidity risks of different items in deposits and loans. The NSFR characterizes the long-term liquidity risk and measures the ability of stable funding sources available to an enterprise for a long time to support the development of its on- and off-balance sheet assets business. The two indicators have their own advantages and disadvantages, and neither of them is negligible. However, only traditional indicators or newly established indicators were used in the existing studies without a comprehensive evaluation of the liquidity risk, which should be considered in future research.

In this study, monetary and financial services in China were taken as samples to probe into the following two questions: (1) Do monetary and financial services carry out liquidity risk management according to the target values of liquidity risk management indicators? (2) How do factors such as enterprise characteristics, macroeconomy, enterprise liquidity level and duration, and enterprise size affect the liquidity risk management model of monetary and financial services? The contributions of this study are presented as follows. First, the liquidity risk management model of monetary and financial services is investigated based on various influencing factors, which enriches the relevant research in the field of liquidity risk management. This study not only goes beyond the limitations of the past macro-research, which only analyzed the liquidity risk response behavior of enterprises. The current work also transcends the limitation of micro-research, which only explored how to reduce liquidity risks. Second, based on the goal of financial stability rather than risk reduction, the micro-behavior of liquidity risk management in monetary and financial services is investigated. This exploration deepens the understanding of how regulatory objectives affect enterprises' liquidity risk management and provides targeted reference for regulators to implement liquidity supervision better. Third, the LDR and the NSFR used in this study combine

the traditional indicators and new indicators of liquidity risk management, which can better reflect the level of the liquidity risk management of monetary and financial service enterprises. This undertaking is different from the previous literature, which solely used either traditional indicators or new indicators.

The remainder of this study is as follows. In Section 2, the theoretical hypothesis regarding the liquidity risk management of monetary and financial service enterprises is proposed by sorting out the existing literature. In Section 3, the relevant data involved in the research are acquired. The variables with regard to the research questions are selected, and relevant models are established. In Section 4, the empirical results of relevant models are analyzed. Then, the research hypotheses are tested. In Section 5, the dynamic management of indicators is further explored from the perspective of liquidity risk management based on test results. In Section 6, the conclusions, managerial implications, and future expectations are presented.

2. Literature Review and Hypotheses Development

2.1 Asset-liability Management Theory

Asset-liability management theory was developed by absorbing asset management theories (such as commercial loan theory, asset realization theory, and expected income theory) and liability management theory in the middle of the 20th century. Financial institutions would have difficulty forming a balance of safety, liquidity, and profitability, as if they rely solely on asset management or liability management. Only by adjusting the structure of assets and liabilities together according to the changes of economic and financial forms could the requirements of business objectives be realized (Kane and Malkiel, 1965; Baker, 1978). Asset-liability management theory adopted the technical methods of asset management theories and liability management theories, including the method for gap management (such as duration gap model and funding gap model) and the method for interest margin management (Nortman and Macaulay, 1938; Redington, 1952). Thus, it put forward asset-liability management indicators, especially liquidity risk management indicators, which realized the dynamic, coordinated, and comprehensive balance of assets and liabilities under the guidance of the principle of quantitative symmetry (Shen *et al.*, 2021). Liquidity risk management indicators mainly included the asset liquidity ratio, reserve ratio, and the proportion of medium- and long-term loans. The management goal was to maintain current assets above the normal minimum limit to improve asset liquidity; another aim was to avoid excessive short-term deposits and long-term loans to meet the demand for debt payment (Sinkey, 1979; Buser *et al.*, 1981).

2.2 Liquidity Risk Management Indicators

Liquidity risk management indicators refer to the use of various liquidity risk indicators to measure liquidity adequacy and risk status, formulate liquidity risk management plans, and put them into practice. The liquidity risk indicators in monetary and financial service enterprises had target values for the following reasons. First, financial regulatory authorities would prevent liquidity risk events from leading to bank runs and even bankruptcy of monetary and financial service enterprises (Bologna, 2015). Second, the authorities would alleviate the information asymmetry among the main bodies of the deposit market and enhance the activity of this market (Allen *et al.*, 2014). Third, they would ease the financing constraints in the interbank market and reduce the increase in financing costs caused by market uncertainties (Dietrich *et al.*, 2014). Fourth, the monetary and financial service enterprises would realize the optimal allocation of their asset portfolio, which would be convenient for managers to weigh the benefits and risks flexibly (Allen *et al.*, 2014). The financial crisis and financial supervision had significantly affected the target

values of the liquidity risk indicators of monetary and financial service enterprises (Bengtsson, 2014). In addition, liquidity supervision had significantly guided monetary and financial service enterprises to adjust the scale and structure of assets and liabilities with different liquidity levels (Galletta *et al.*, 2021). Thus, this effect proved that monetary and financial service enterprises set the target values of liquidity risk indicators. Accordingly, Hypothesis 1 is put forward.

Hypothesis 1: Monetary and financial service enterprises set the target values of liquidity risk indicators and adjust the liquidity structure accordingly.

2.3 Liquidity Risk Management Model

The research on the liquidity risk management model of monetary and financial service enterprises mainly focused on the speed and model of liquidity adjustment. Meanwhile, the research on adjustment speed showed that the adjustment speed was time varying and influenced by enterprise characteristics, macroeconomy, systemic risks, and monetary policy transmission. Consequently, the procyclicality of liquidity risk indicators was strengthened by the liquidity risk management model of momentary and financial service enterprises (Van den End, 2016; Taruna *et al.*, 2020). The research on adjustment methods revealed that monetary and financial service enterprises gave priority to adjusting assets and liabilities with high liquidity according to the liquidity of assets and liabilities (Kim, 2018; Berger *et al.*, 2019), which would be adjusted between the short and long liquidity term structures. This scenario resulted in a more significant liquidity adjustment effect of liquidity risk indicators on small monetary and financial service enterprises than large and medium-sized enterprises (Ahrende and Goujard, 2015; Moreno and Takalo, 2016). Therefore, Hypothesis 2 is put forward.

Hypothesis 2a: The structural adjustment speed of monetary and financial service enterprises for liquidity risks is influenced by enterprise characteristics and macroeconomy.

Hypothesis 2b: Monetary and financial service enterprises adjust their liquidity structure according to their liquidity level and duration.

2.4 Influence of Enterprise Size on Liquidity Risk Management

The research on the liquidity risk management model of different types of monetary and financial service enterprises mainly focused on the heterogeneity of enterprise size. Large monetary and financial service enterprises had more flexibility in adjusting their liquidity due to the following reasons. First, compared with small-scale monetary and financial service enterprises, large and medium-sized monetary and financial service enterprises had greater advantages in the deposit and loan market. Moreover, their enthusiasm for participating in interbank business was lower, and they were less restricted (Elbadry, 2018). Second, the liquidity adequacies of monetary and financial service enterprises of different scales were not the same. Large and medium-sized monetary and financial service enterprises had wide financing channels, low financing costs, and more adequate liquidity (Souza, 2016). Third, differences existed in the liquidity risk management models of monetary and financial service enterprises of different scales. Compared with large and medium-sized enterprises, small enterprises were more sensitive to the adjustment of the liquidity level (Tian *et al.*, 2021). Fourth, different liquidity adequacies reflected by the enterprise size resulted in different roles in the peer market, thus alienating the transmission effect of monetary policies (Djebali and Zaghdoudi, 2020). Therefore, Hypothesis 3 is put forward.

Hypothesis 3a: The target value and adjustment speed of the liquidity risk indicators of monetary and financial service enterprises of different scales are different.

Hypothesis 3b: The liquidity risk management models of monetary and financial service enterprises of different scales vary.

3. Methodology

3.1 Model Setting

3.1.1 Liquidity Gap

The liquidity gap of monetary and financial service enterprises was measured using the difference between the target value and the actual value of liquidity risk indicators (Saif-Alyousfi and Saha, 2021; De Haas and Van Lelyveld, 2014).

First, each monetary and financial service enterprise was assumed to have target values for liquidity risk indicators. The target values were expressed by a function about the characteristics and business cycle of monetary and financial service enterprises:

$$\text{LIQ}_{i,t}^{*} = \alpha_0 C_{i,t-1} + \alpha_1 M_{t-1}, \tag{1}$$

where $LIQ_{i,t}^{*}$ is the target value set by monetary and financial service enterprises for a liquidity risk indicator. $C_{i,t-1}$ denotes the characteristic variable of monetary and financial service enterprises. M_{t-1} is a macroeconomic variable. α_0 and α_1 stand for coefficient variables. If the estimated values of α_0 and α_1 are not equal to 0, then the liquidity risk indicators for monetary and financial service enterprises had target values.

Second, when the monetary and financial service enterprises temporarily deviated from the target values of liquidity risk indicators due to market fluctuations, they could not adjust their liquidity quickly, as the adjustment needed time and money. It was assumed that monetary and financial service enterprises dynamically adjusted toward the target liquidity ratio at an annual rate of μ:

$$LIQ_{i,t} - LIQ_{i,t-1} = \mu\left(LIQ_{i,t}^{*} - LIQ_{i,t-1}\right) + \varepsilon_{i,t}. \tag{2}$$

Among them, $LIQ_{i,t}$ and $LIQ_{i,t-1}$ represent the actual value of the liquidity risk indicator of monetary and financial service enterprises in periods t and t-1, respectively. μ is the dynamic adjustment speed of monetary and financial service enterprises for the target values of liquidity risk indicators. $\varepsilon_{i,t}$ represents the random error term. $0 < \mu < 1$ indicates that monetary and financial service enterprises partially adjust the target values of liquidity risk indicators between periods t-1 and t. A greater value of μ indicates a faster adjustment speed of monetary and financial service enterprises or a smaller adjustment in cost.

According to the estimation of the actual values of liquidity risk indicators, the estimated value $\hat{\mu}$ of the adjustment speed and the estimated values $\hat{\alpha}_0$ and $\hat{\alpha}_1$ of α_0 and α_1, respectively, could be solved. The estimated target value $LIQ_{i,t}^{*}$ of the liquidity risk indicator could be solved by substituting $\hat{\alpha}_0$ and $\hat{\alpha}_1$ into Equation (1).

Third, according to the target value of the liquidity risk indicator, the liquidity gap of each monetary and financial service enterprise in period t-1 was obtained:

$$LG_{i,t-1} = LIQ_{i,t-1} - LIQ_{i,t}^* . \tag{3}$$

When the liquidity gap value of the LDR is negative, a smaller value indicates that the liquidity of monetary and financial service enterprises is more adequate. When the gap value is positive, a larger gap value indicates that the liquidity of monetary and financial service enterprises is more deficient. When the liquidity gap of NSFR is negative, a smaller value indicates that the liquidity of monetary and financial service enterprises is more deficient. When the gap value is positive, a larger gap value indicates that the liquidity of monetary and financial service enterprises is more adequate.

3.1.2 Dynamic Liquidity Management

First, the adjustment speed of monetary and financial service enterprises for the target values of liquidity risk indicators was investigated. In the previous section, each monetary and financial service enterprise was assumed to have the same adjustment speed in each period. However, in reality, the adjustment speed of different monetary and financial service enterprises varied, and they would adjust the speed of approaching the target values of liquidity risk indicators according to individual characteristics and abilities. In addition, the macroeconomic cycle would affect the adjustment speed of monetary and financial service enterprises. Therefore, the adjustment speed of monetary and financial service enterprises is defined as follows:

$$\mu_{i,t} = \varphi S_{i,t-1}, \tag{4}$$

where $\mu_{i,t}$ represents the unique adjustment speed of each monetary and financial service enterprise in each period, $S_{i,t-1}$ is a variable that affects the adjustment speed of monetary and financial service enterprises, and φ represents a variable to be estimated.

The following can be acquired by substituting Equation (4) into Equation (2):

$$LIQ_{i,t} - LIQ_{i,t-1} = \varphi S_{i,t-1}\left(LIQ_{i,t}^* - LIQ_{i,t-1}\right) + \varepsilon_{i,t} . \tag{5}$$

Second, the gap was re-estimated. The estimated target value $LIQ_{i,t}^*$ of the liquidity risk indicator was substituted into Equation (5) to solve:

$$\Delta LIQ_{i,t} = \varphi S_{i,t-1}GAP_{i,t} + \varepsilon_{i,t}, \tag{6}$$

where $LIQ_{i,t} - LIQ_{i,t-1}$ is denoted as $\Delta LIQ_{i,t}$, which could be directly observed from the sample data. $LIQ_{i,t}^* - LIQ_{i,t-1}$ is denoted as $GAP_{i,t}$, which represents the difference between the target value and the actual value of the liquidity risk indicator estimated by monetary and financial service enterprises. According to the gap estimation, the estimated value $\hat{\varphi}$ of φ and the estimated specific adjustment speed $\hat{\mu}_{i,t}$ of monetary and financial service enterprises could be solved.

Third, the adjustment structure of monetary and financial service enterprises toward the target values of liquidity risk indicators was investigated. Thus, the following indicators were established:

$$GAP_{LDR} = \begin{cases} LGS_{i,t-1}^{LDR} = \left| LG_{i,t-1}^{LDR} \right|, LG_{i,t-1}^{LDR} < 0 \\ LGD_{i,t-1}^{LDR} = LG_{i,t-1}^{LDR}, LG_{i,t-1}^{LDR} \geq 0 \end{cases}, \tag{7}$$

$$GAP_{NSFR} = \begin{cases} LGS_{i,t-1}^{NSFR} = \left| LG_{i,t-1}^{NSFR} \right|, LG_{i,t-1}^{NSFR} < 0 \\ LGD_{i,t-1}^{NSFR} = LG_{i,t-1}^{NSFR}, LG_{i,t-1}^{NSFR} \geq 0 \end{cases}, \tag{8}$$

where $LGS_{i,t-1}^{LDR}$ indicates that the LDR of monetary and financial service enterprises is of adequate liquidity, and $LGD_{i,t-1}^{LDR}$ reflects the deficient liquidity of the LDR. $LGS_{i,t-1}^{NSFR}$ means that the liquidity of the NSFR is adequate, and $LGD_{i,t-1}^{NSFR}$ entails that the liquidity of the NSFR is deficient.

According to the calculation formula for the liquidity risk indicators of monetary and financial service enterprises, the following equations could be obtained:

$$LDR_{i,t} = \frac{Loan_{i,t}}{Deposit_{i,t}}, \tag{9}$$

$$NSFR_{i,t} = \frac{ASF_{i,t}}{RSF_{i,t}}. \tag{10}$$

Equations (9) and (10) show that monetary and financial service enterprises would adjust their LDR by adjusting loan and deposit to approach the target value of their LDR. Moreover, they would adjust the NSFR by changing the available stable funds (ASF) and the required stable funds (RSF) to approach the target value of their NSFR.

Therefore, the liquidity structure of monetary and financial service enterprises was dynamically adjusted using the following model:

$$\Delta R_{i,t} = \beta_i + \gamma \Delta R_{i,t-1} + \delta \, LGS_{i,t-1} \big/ LGD_{i,t-1} + \theta C_{i,t-1} + \vartheta M_{t-1} + \varepsilon_{i,t}, \tag{11}$$

where $\Delta R_{i,t}$ indicates the change rate of the structural variables of the liquidity of monetary and financial service enterprises, including the loan change rate ($\Delta Loan_{i,t}$), deposit change rate ($\Delta Deposit_{i,t}$), change rate of ASF ($\Delta ASF_{i,t}$), and change rate of RSF ($\Delta RSF_{i,t}$). Adding the first-order lag term $\Delta R_{i,t-1}$ of the explained variable $\Delta R_{i,t}$ is helpful to describe the persistent

characteristics of liquidity structure adjustment. β_i represents the individual effect. $LGS_{i,t-1} / LGD_{i,t-1}$ is the liquidity gap, $C_{i,t-1}$ denotes the characteristic variable of enterprises, M_{t-1} is the macroeconomic variable, and $\varepsilon_{i,t}$ indicates the random disturbance term.

3.2 Variable Setting

3.2.1 Liquidity Risk Indicator Variables

In this study, the liquidity risk of monetary and financial service enterprises was measured by selecting the LDR and NSFR. The LDR was obtained by dividing loans with deposits. A greater LDR value indicated more deficiency in the liquidity level. Meanwhile, the NSFR was equal to the ratio of ASF to RSF. A greater NSFR value entailed more adequacy in the liquidity level.

3.2.2 Characteristic Variables of Enterprises and Macroeconomic Variables

Among the characteristic variables of enterprises, enterprise size (SIZE), asset growth rate (AGR), shareholder's equity ratio (ER), Z value ($\ln Z$), loan-commitment ratio (LC), long-term debt portfolio mix level (LDM), and off-balance-sheet business development level (OBD) were introduced into the liquidity gap model of monetary and financial service enterprises (Lee *et al.*, 2022; Chatterjee, 2018; Summer, 2013). The enterprise size and AGR were introduced into the speed adjustment model. For the model for the liquidity structure adjustment, the enterprise size and Z value were introduced. In this study, the dummy variable, namely, the scale of monetary and financial service enterprises, was qualitatively divided into three size types: large, medium, and small. This classification was in accordance with the Classification Standard of Financial Enterprises jointly formulated by the People's Bank of China, China Banking and Insurance Regulatory Commission, China Securities Regulatory Commission, and National Bureau of Statistics of China. The macroeconomic variables were captured by the social financing scale growth rate (SFG).

4. Results Analysis

4.1 Estimation of Target Values for Liquidity Risk Indicators

In this study, 181 monetary and financial service enterprises in China during 2015–2022 were taken as the research object. To reduce the disturbance of extreme values to the empirical results, all continuous variables were winsorized by 1%. Table 1 lists the estimated target values for the liquidity risk indicators of monetary and financial service enterprises. In Columns (2) and (5) show the regression results with macroeconomic results. Columns (3) and (6) present the regression results with the dummy variable, that is, the enterprise size. The coefficients of $LDR_{i,t-1}$ and $NSFR_{i,t-1}$ were significantly positive at the level of 5%, and both of them passed the AR1, AR2, and Hansen J tests. Therefore, the target values for the LDR and NSFR of monetary and financial service enterprises were estimated using the models in Columns (3) and (6).

Table 1. Estimated Results of Target Values for Liquidity Risk Indicators

Variables	(1) $LDR_{i,t}$	(2) $LDR_{i,t}$	(3) $LDR_{i,t}$	(4) $NSFR_{i,t}$	(5) $NSFR_{i,t}$	(6) $NSFR_{i,t}$
$LDR_{i,t-1}$	0.929*** (0.054)	0.856*** (0.053)	0.833*** (0.051)			
$NSFR_{i,t-1}$				0.717*** (0.059)	0.706*** (0.074)	0.698*** (0.067)
Target Indicator Average			0.641			1.013
Actual Indicator Average			0.638			1.125
Adjusting Speed			0.169*** (0.059)			0.305*** (0.066)
Observation	347	347	347	347	347	347
Control Variable	Yes	Yes	Yes	Yes	Yes	Yes
AR1	0.001	0.002	0.001	0.001	0.002	0.002
AR2	0.142	0.203	0.189	0.462	0.428	0.448
Hansen J	0.978	0.966	0.981	0.907	0.946	0.966

*Notes: The P values are in brackets. *** represents significance at the 1% level. AR1 and AR2 represent the correlation test values of the first and second order sequence of the disturbance term, respectively. Hansen J represents the P value of the Hansen J test of the Gaussian Mixture Model. Source: Own calculations.*

4.2 Estimation of Adjustment Speed of Liquidity Risk Indicators

Table 2 shows the estimated adjustment speed for liquidity risk indicators under the assumption that monetary and financial service enterprises no longer have the same adjustment speed.

Table 2. Estimated Adjustment Speed for the Target Values of Liquidity Risk Indicators

Variables	(1) μ_{LDR}	(2) μ_{NSFR}
$\Delta GAP_{i,t} \times SIZE_{i,t-1}$	0.032** (0.018)	0.036 (0.027)
$\Delta GAP_{i,t} \times AGR_{i,t-1}$	−0.307*** (0.097)	−0.224 (0.211)
$\Delta GAP_{i,t} \times SFG_{t-1}$	−0.014** (0.007)	−0.024* (0.011)
Estimated adjustment speed mean	0.383	0.374

Variables	(1) μ_{LDR}	(2) μ_{NSFR}
Estimate adjustment speed median	0.382	0.381
Observations	717	717
Control Variable	Yes	Yes
R^2	0.341	0.352

*Notes: The P values are in brackets. *, **, and *** represent significance at the levels of 10%, 5%, and 1%, respectively.*
Source: Own calculations.

4.3 Dynamic Structural Adjustment Estimation of LDR

Table 3 lists the results of liquidity adjustment through deposits (LAD) and liquidity adjustment through loans (LAL) for monetary and financial service enterprises with adequate and deficient liquidity levels. Columns (1) and (2) present the regression results of monetary and financial service enterprises with deficient liquidity. Columns (3) and (4) show the regression results of monetary and financial service enterprises with adequate liquidity.

Table 3. Estimated Dynamic Structural Adjustment of the LDR

Variables	(1) LAL	(2) LAD	(3) LAL	(4) LAD
$LGD_{i,t-1}^{LDR}$	−0.053*** (−0.019)	−0.028 (−0.022)		
$LGS_{i,t-1}^{LDR}$			0.091*** (−0.016)	0.024 (−0.021)
Observations	370	370	346	346
Control Variable	Yes	Yes	Yes	Yes
AR2	0.926	0.104	0.484	0.943
Hansen J	0.302	0.155	0.266	0.776

*Notes: The P values are in brackets. *** represents significance at the 1% level. AR2 represents the correlation test values of the second-order sequence of the disturbance term. Hansen J represents the P value of the Hansen J test of the Gaussian Mixture Model.*
Source: Own calculations.

4.4 Dynamic Structural Adjustment Estimation of NSFR

Table 4 lists the results of liquidity adjustment through ASF (LAASF) and liquidity adjustment through RSF (LARSF) for monetary and financial service enterprises with adequate and deficient liquidity levels. Columns (1) and (2) present the regression results of monetary and financial service enterprises with deficient liquidity. Columns (3) and (4) show the regression results of monetary and financial service enterprises with adequate liquidity.

Table 4. Estimated Dynamic Structural Adjustments of the NSFR

Variables	(1) LAASF	(2) LARSF	(3) LAASF	(4) LARSF
$LGD_{i,t-1}^{NSFR}$	0.281*** (−0.056)	0.003 (−0.031)		
$LGS_{i,t-1}^{NSFR}$			−0.061*** (−0.017)	0.043*** (−0.014)
Observations	188	188	528	528
Control Variable	Yes	Yes	Yes	Yes
AR1	0.076	0.961	0.001	0.002
AR2	0.207	0.926	0.359	0.434
Hansen J	0.024	0.219	0.012	0.296

Notes: The P values are in brackets. *** represents significance at the 1% level. AR1 and AR2 represent the correlation test values of the first- and second-order sequences of the disturbance term, respectively. Hansen J represents the P value of the Hansen J test of the Gaussian Mixture Model.
Source: Own calculations.

5. Discussions

The test and analysis in this study confirmed that all the hypotheses were supported by the results of the empirical analysis. Monetary and financial services carry out liquidity risk management according to the target values of the indicators of liquidity risk management. Various factors, such as enterprise characteristics, macroeconomics, enterprise liquidity level and duration, and enterprise size, influence the liquidity risk management model of monetary and financial services. The conclusion that monetary and financial services perform liquidity risk management according to the target values of liquidity risk indicators was close to the conclusion proposed by Mdaghri and Oubdi (2022) and Langfield *et al.* (2014). These researchers found that the indicators of liquidity risk management significantly guided the liquidity adjustment of monetary and financial service enterprises. Enterprise characteristics, macroeconomy, enterprise liquidity level and duration, and enterprise size influence the liquidity risk management model of monetary and financial services, which also verified the research conclusions of Ariefianto *et al.* (2022), Bussiere *et al.* (2015), and Summer (2013).

(1) According to the estimated results of the target values of liquidity risk indicators (Table 1), the regression results in Column (3) showed that the target LDR value of monetary and financial service enterprises was 0.641. This outcome was very close to the average value (0.638) of the LDR, thus indicating that the actual LDR value of monetary and financial service enterprises was close to its target value. Therefore, Hypothesis 1 was supported. From the perspective of enterprise size, the target LDR value of medium-sized monetary and financial service enterprises was the highest, thus verifying Hypothesis 3a. Limited by the business area, small-scale monetary and financial service enterprises were characterized by their small scale, scattered outlets, weak storage capacity, and limited financing capacity. Moreover, as they were more likely to face a liquidity crisis, they had higher demand for LDR management (Toh *et al.*, 2019). According to the regression result in Column (6), the target NSFR value of monetary and financial service enterprises was 1.013, which was lower than the average value (1.125) of the NSFR. From the perspective of enterprise size, the NSFR target value of large-scale monetary and financial

service enterprises was the highest, thus further supporting Hypothesis 3a. This finding was consistent with the existing research conclusions on liquidity supervision (Yeddou and Pourhoy, 2020). Large-scale monetary and financial service enterprises are responsible for financial stability, and their NSFR management is not entirely based on their own profit demand. Comparing with Chatterjee (2018), Kim (2018) and Saif-Alyousfi (2021), this paper indicates that the target value and adjustment speed of the liquidity risk indicators of monetary and financial service enterprises of different scales are different, rather than the past findings that large-scale monetary and financial service enterprises usually remain while small and medium-scale ones are different, which enriches the understandngs of liquidity risk management.

(2) According to the estimated adjustment speed of liquidity risk indicators (Table 2), the adjustment speeds of the LDR and the NSFR were close at 0.383 and 0.374, respectively. This outcome showed that after considering the characteristics, capabilities, and macroeconomic cycle of enterprises, the adjustment speed of monetary and financial services toward the target value of liquidity risk indicators as a whole was accelerated. In addition, the adjustment speed of the LDR and the NSFR tended to be the similar. Therefore, Hypothesis 2a was supported. From the perspective of enterprise size, the liquidity adjustment speed of large and medium-sized monetary and financial service enterprises was slower than that of small monetary and financial service enterprises, thus proving Hypothesis 3a. First, large-scale monetary and financial service enterprises tended to set a higher target value of liquidity risk indicators. Hence, their adjustment motivation was weak, and the adjustment cost was high (DeYoung *et al.*, 2018). Second, medium-sized monetary and financial service enterprises had a wide range of financing channels, abundant profit models, sufficient motivation for asset expansion, and slow liquidity adjustment (Zhang *et al.*, 2020). Finally, the liquidity of small-scale monetary and financial service enterprises could only be improved in a few ways. The liquidity supervision requirements became tighter in recent years, and regulatory requirements needed to be met. Amid this scenario, the liquidity adjustment speed of small-scale monetary and financial service enterprises was the fastest (de Bandt *et al.*, 2021; Berrospide, 2021). Comparing with Taruna *et al.* (2020) and D'Avino *et al.* (2022), the analysis of this paper shows that the structural adjustment speed of monetary and financial service enterprises for liquidity risks is influenced by enterprise characteristics and macroeconomy, rather than the past findings that the structural adjustment speed depends more on the heterogeneities and specificities of monetary and financial service, which deppens the profiling of liquidity risk management.

(3) According to the estimated results of dynamic structural adjustment in the LDR (Table 3), the monetary and financial service enterprises with adequate and deficient liquidity levels tended to adjust their liquidity risk level through loans. The deposit coefficient of all enterprises was not significant, and the deposit coefficient of monetary and financial service enterprises with liquidity deficiency was negative. On the one hand, this outcome showed that with the rise of financial technology and third-party payment, the competition in the deposit market was becoming increasingly fierce. Moreover, the difficulty in the adjustment of the deposit structure of monetary and financial service enterprises was also greatly aggravated. On the other hand, monetary and financial service enterprises with liquidity deficiency had a low share in the deposit market, and they were more affected by the loss of deposits. Moreover, their correlation coefficient was negative. Therefore, Hypothesis 2b was verified. From the perspective of enterprise size, the ability of large-scale monetary and financial service enterprises with liquidity deficiency to replenish deposits was significantly higher than that of small-scale monetary and financial service enterprises. Therefore, Hypothesis 3b was supported. Large-scale monetary and financial service enterprises had a large number of business outlets, a wide range of business areas, and a complete range of deposit products. Compared with small and medium-scale monetary and financial service enterprises, they could interact with a wider range of deposit markets and had a stronger ability to replenish deposits. The motivation of large-scale monetary and financial service enterprises with adequate liquidity to expand loans was significantly lower than that of small-scale

monetary and financial service enterprises. This difference showed that the channels for asset allocation of large-scale monetary and financial service enterprises were more diversified than small and medium scale ones (Jiang *et al.*, 2019).

Deposits are generally divided into demand deposits, time deposits, and other deposits. The analysis demonstrated that the adjustment of monetary and financial service enterprises with deficient and adequate liquidity levels mainly aimed at time deposits. Thus, Hypothesis 2b was further supported. Adoptions of financial technology and third-party payment had risen. Furthermore, various wealth management products, such as money market funds, had been fast-growing. Thus, monetary and financial service enterprises with deficient and adequate liquidity levels faced shrinking in demand deposits. To compensate for the loss of demand deposits, enterprises with adequate liquidity also tended to increase time deposits, which led to the change in the deposit structure of monetary and financial services from short-term low costs to long-term high costs. From the perspective of enterprise size, large-scale monetary and financial service enterprises with liquidity deficiency were more inclined to adjust time deposits. Thus, Hypothesis 3b was further verified. Moreover, the outcome showed that large-scale monetary and financial service enterprises were still more competitive in the time deposits market.

Loans are generally divided into mortgage loans, consumer loans, commercial loans, and other loans. In the calculation, the loan risk control of monetary and financial service enterprises was more advantageous than the deposit risk control. In addition, enterprises with liquidity deficiency tended to reduce the scale of loan issuance overall, thus mainly reducing high-risk mortgages and consumer loans. Meanwhile, enterprises with adequate liquidity tended to expand the scale of commercial loans and reduce the scale of mortgage and consumer loans. From the perspective of enterprise size, compared with small monetary and financial service enterprises, large and medium-sized enterprises with liquidity deficiency made fewer adjustments to mortgage loans and consumer loans. Therefore, Hypothesis 3b was supported. This finding was consistent with the research findings of Legroux *et al.* (2022) on liquidity risk management at the micro-enterprise level. In particular, enterprises with liquidity deficiency were more inclined to adjust assets with poor liquidity.

Comparing with Ahrend and Goujard (2015), Van den End (2016), Elbadry (2018), and Djebali and Zaghdoudi (2020), this paper depicts how monetary and financial service enterprises adjust their liquidity structure according to their liquidity level and duration via LDR, which offers the empirical basis for the optimisation of liquidity regulation.

(4) According to the NSFR estimation results of the dynamic structural adjustment (Table 4), monetary and financial service enterprises with liquidity deficiency tended to adjust the liquidity risk level by increasing ASF. Thus, Hypothesis 2b was supported. Moreover, it was consistent with the research results of Davydov *et al.* (2021). Monetary and financial service enterprises with adequate liquidity tended to reduce ASF and increase RSF to adjust the liquidity risk level. As a result, enterprises would appropriately increase the proportion of medium and high-risk assets to maintain a sustainable profitability and meet the macro and governmental requirements. From the perspective of enterprise size, the incentive for large-scale monetary and financial service enterprises with liquidity deficiency to increase the NSFR was low. Meanwhile, the incentive for medium-sized monetary and financial service enterprises was high. Therefore, Hypothesis 3b was supported. This outcome also showed that the supervision of the NSFR had a good incentive and restrictive effect on small and medium-sized monetary and financial service enterprises, which coincided with the results of the macro-liquidity supervision research by Chodorow-Reich *et al.* (2022) and Chen *et al.* (2018).

ASFs are generally divided into five categories: portfolio of short-term mix assets such as deposits, other liabilities, provision for loan impairment, other impairment reserves, and owner's equity. The results showed that monetary and financial service enterprises with liquidity deficiency tended to increase relatively more stable and cheap sources of funds to meet the regulatory

requirements. This increase would not only reduce operating costs but also improve the stableness of daily operations. To reduce the impact of deposit business on the stable operation of the financial system, monetary and financial service enterprises with adequate liquidity adjusted the liquidity risk level by reducing the portfolio weights of short-term mix debts such as deposits. From the perspective of enterprise size, large and medium-sized monetary and financial service enterprises with deficient liquidity had insufficient motivation to replenish ASF. Meanwhile, large and medium-sized monetary and financial service enterprises with adequate liquidity balanced the structure of available assets by increasing other liabilities. This scenario also showed that the short-term financing and long-term capital replenishment channels of large and medium-sized monetary and financial service enterprises were more widely available than those of small enterprises.

RSFs are generally divided into four categories: loans and advances, investment assets, reserve assets, and off-balance-sheet items (Höhnke and Homölle, 2021). The analysis results showed that monetary and financial service enterprises with liquidity deficiency tended to increase loans and advances to adjust the liquidity risk level. Thus, Hypothesis 2b was supported. To demonstrate their good liquidity to outside investors and reduce the possibility of deposit run, monetary and financial service enterprises with deficient liquidity usually attempted to expand their loan business. Meanwhile, they tended to reduce investment assets to adjust the liquidity risk level, thus indicating the difficulty of attracting stable deposits in the short term. To compensate for the liquidity gap promptly, these enterprises had to sell short-term tradable investment assets in exchange of liquidity (Patel *et al.*, 2022). Meanwhile, to reduce the liquidity risk and improve the liquidity structure, monetary and financial service enterprises with adequate liquidity usually tended to reduce loans and advance assets with lower level of liquidity to meet the regulatory requirement for NSFR. From the perspective of enterprise size, large and medium-sized monetary and financial service enterprises with liquidity deficiency were more inclined to increase loans and reduce investment assets. Therefore, Hypothesis 3b was further supported.

Comparing with Dietrich *et al*. (2014), Doumpos (2016), and Edoardo and Lucio (2021), this paper delineates the varied liquidity risk management models of monetary and financial service enterprises of different scales with the use of NSFR, which provides the practical experience for improving liquidity regulation.

Conclusions, Research Limitations and Future Directions

6.1 Conclusions

Based on the information disclosure data of 181 monetary and financial service enterprises in China from 2015 to 2022, the liquidity risk management of monetary and financial services based on the goal of financial stability was analyzed. Hence, the following conclusions were drawn:

(1) Monetary and financial service enterprises adjust their liquidity structure around the target values of liquidity risk indicators to carry out liquidity risk management.

(2) The structural adjustment speed of monetary and financial service enterprises for liquidity risks is influenced by enterprise characteristics, such as enterprise size and asset growth rate, and macroeconomic factors, such as social financing scale. Monetary and financial service enterprises adjust their liquidity structure according to their liquidity level and duration.

(3) The target value and adjustment speed of liquidity risk indicators of differently sized monetary and financial service enterprises are varied. In addition, the liquidity risk management models are mainly attributed to their differences in competitiveness, financing methods and costs, and investment level.

6.2 Managerial Implications

Based on the above conclusions, the managerial implications are proposed:

(1) Regulators should adopt different regulatory policies for differently sized monetary and financial service enterprises. These enterprises vary in liquidity risk management models, and the target value and adjustment speed of liquidity risk indicators. Considering the significant differences of various enterprises in the risk characteristics of their asset-liability structure and profit models, efforts should be made to design more scientific and reasonable policies for liquidity risk supervision. These policies should consider the characteristics of enterprises with different sizes to improve the level of liquidity risk management effectively. Regulators should adhere to a robust and prudent strategy for liquidity risk supervision which is in accordance with the regulatory objectives of establishing a scientific and perfect system for liquidity risk management and maintaining a stable and adequate liquidity level. Furthermore, they should formulate regulatory policies such as liquidity risk measurement and monitoring, quota management, daytime liquidity management, financing management, stress testing, and emergency planning according to the external macroenvironment and industrial business development.

(2) Monetary and financial service enterprises should reduce short-term and vulnerable liabilities and increase long-term stable liabilities and assets. Given that the liquidity risk adjustment of monetary and financial service enterprises is influenced by factors such as enterprise characteristics, macroeconomy, and enterprise liquidity level and duration, enterprises should identify the changes of liquidity risks in time according to the indicators of liquidity risk management, such as the LDR and the NSFR. Furthermore, they should actively adjust their asset-liability structure. Monetary and financial service enterprises should also strengthen their market analysis and scenario analysis and optimize preference setting for liquidity risk, quota management, monitoring, and analysis. In addition, these enterprises can benefit from expanding active debts and emergency financing channels and ensuring the stability of the liquidity risk level. In particular, they should comprehensively consider the long-term arrangement of various liquidity risk indicators, effectively use management tools such as quotas and assessments, and strengthen the arrangement of key time points. These suggested approaches can ensure that liquidity risk indicators meet regulatory requirements and effectively reach a optimal balance of safety, liquidity, and profitability.

(3) The financial industry should actively explore the innovation of liquidity risk management models. At present, the liquidity risk management of monetary and financial service enterprises mainly focuses on the target values of liquidity risk indicators. However, this model is insufficient to identify and manage liquidity risks in the current environment of rapid financial innovation. On the one hand, regulators should consider the scale factor of enterprises in liquidity risk management and explore more effective and flexible supervision for monetary and financial service enterprises of different scales. On the other hand, monetary and financial service enterprises should probe into the ways to improve the efficiency and ability of liquidity risk management based on their own reality, such as strengthening the digital construction of the system for fund position management, realizing online fund forecasting, and more accurately and effectively grasping the changes of daytime positions. As another example, the enterprises should fully consider liquidity risk factors and costs in internal pricing and assessment incentives. Doing so can prevent loosened liquidity risk management instead of the excessive pursuit of business expansion and short-term profits.

6.3 Research Limitations and Future Directions

This study expands the research on the liquidity risk management of monetary and financial services. The research conclusions are of great theoretical significance and provide practical suggestions to the liquidity risk management of both regulatory agencies and monetary and financial service enterprises. However, this study has some limitations. For example, the data

came from monetary and financial service enterprises who volunteered to disclose information. Therefore, the sample size was not large. In addition, the values of quantitative indicators were mainly adopted to identify the characteristics of liquidity risk management. Moreover, the variables measured were not comprehensive. Hence, the following research directions are expected. (1) The main factors influencing liquidity risks will be empirically studied with regard to the liquidity risk management of monetary and financial service enterprises. In this study, the overall liquidity risk management model of monetary and financial service enterprises was investigated. Meanwhile, the main factors influencing liquidity risks are being analyzed by some scholars, which will be one of the future directions of empirical research. (2) Nowadays, qualitative factors, such as corporate governance, have not been incorporated into the liquidity risk management model of monetary and financial service enterprises. Therefore, they will also become one of the future research directions.

References

Acemoglu, D., Ozdaglar, A., and Tahbaz-Salehi, A., 2015. Systemic Risk and Stability in Financial Networks. *The American Economic Review*, 105(2), pp.564-608. https://doi.org/10.1257/aer.20130456.

Ahrend, R. and Goujard, A., 2015. Global banking, global crises? The role of the bank balance-sheet channel for the transmission of financial crises. *European Economic Review*, 80, pp.253-279. https://doi.org/10.1016/j.euroecorev.2015.10.003.

Allen, F., Carletti, E., and Gale, D., 2014. Money, financial stability and efficiency. *Journal of Economic Theory*, 149, pp.100-127. https://doi.org/10.1016/j.jet.2013.02.002.

Ariefianto, M.D., Trinugroho, I., Lau, E., and Sergi, B.S., 2022. Banks' liquidity management dynamics: evidence from Indonesia. *International Journal of Emerging Markets*, 17(9), pp.2321-2349. https://doi.org/10.1108/IJOEM-06-2020-0715.

Baker, J.V., 1978. A model policy for asset/liability management. *Banking (New York)*, 70(10), pp.82.

Bengtsson, E., 2014. Fund Management and Systemic Risk - Lessons from the Global Financial Crisis. *Financial Markets, Institutions & Instruments*, 23(2), pp.101-124. https://doi.org/10.1111/fmii.12016.

Berger, A.N., Boubakri, N., Guedhami, O., and Li, X., 2019. Liquidity creation performance and financial stability consequences of Islamic banking: Evidence from a multinational study. *Journal of Financial Stability*, 44, 100692. https://doi.org/10.1016/j.jfs.2019.10069.

Berrospide, J.M., 2021. Bank Liquidity Hoarding and the Financial Crisis: An Empirical Evaluation. *The Quarterly Journal of Finance*, . https://doi.org/10.1142/S2010139221500208.

Bologna, P., 2015. Structural Funding and Bank Failures: Does Basel 3 Net Stable Funding Ratio Target the Right Problem?. *Journal of Financial Services Research*, 47(1), pp.81-113. https://doi.org/10.1007/s10693-013-0180-4.

Buser, S.A., Chen, A.H., and Kane, E.J., 1981. Federal Deposit Insurance, Regulatory Policy, and Optimal Bank Capital. *The Journal of Finance (New York)*, 36(1), pp.51-60. https://doi.org/10.1111/j.1540-6261.1981.tb03534.x.

Bussiere, M., Camara, B., Castellani, F.D., Potier, V., and Schmidt, J., 2015. International Banking and Liquidity Risk Transmission: Evidence from France. *IMF Economic Review*, 63(3), pp.479-495. https://doi.org/10.1057/imfer.2015.24.

Chan, K.K. and Milne, A., 2014. Bank competition, fire-sales and financial stability. *The European Journal of Finance*, 20(10), pp.874-891. https://doi.org/10.1080/1351847X.2013.836552.

Chatterjee, U.K., 2018. Bank liquidity creation and recessions. *Journal of Banking & Finance*, 90, pp.64-75. https://doi.org/10.1016/j.jbankfin.2018.03.002.

Chen, Y.K., Shen, C.H., Kao, L., and Yeh, C.Y., 2018. Bank Liquidity Risk and Performance. *Review of Pacific Basin Financial Markets and Policies*, 21(1), 1850007. https://doi.org/10.1142/S0219091518500078.

Chodorow-Reich, G., Darmouni, O., Luck, S., and Plosser, M., 2022. Bank liquidity provision across the firm size distribution. *Journal of Financial Economics*, 144(3), pp.908-932. https://doi.org/10.1016/j.jfineco.2021.06.035.

D'Avino, C., Girardin, E., and Shabani, M., 2022. Bank liquidity creation: A new global dataset for developing and emerging countries. *Review of World Economics*, 158(2), pp.529-570. https://doi.org/10.1007/s10290-021-00434-1.

Davydov, D., Vähämaa, S., and Yasar, S., 2021. Bank liquidity creation and systemic risk. *Journal of Banking & Finance*, 123, 106031. https://doi.org/10.1016/j.jbankfin.2020.106031.

De Bandt, O., Lecarpentier, S., and Pouvelle, C., 2021. Determinants of banks' liquidity: A French perspective on interactions between market and regulatory requirements. *Journal of Banking & Finance*, 124, 106032. https://doi.org/10.1016/j.jbankfin.2020.106032.

De Haan, J., Pleninger, R., and Sturm, J.E., 2022. Does Financial Development Reduce the Poverty Gap?. *Social Indicators Research*, 161(1), pp.1-27.
. https://doi.org/10.1007/s11205-021-02705-8.

De Haas, R. and Van Lelyveld, I., 2014. Multinational Banks and the Global Financial Crisis: Weathering the Perfect Storm?. *Journal of Money, Credit and Banking*, 46(s1), pp.333-364. https://doi.org/10.1111/jmcb.12094.

DeYoung, R., Distinguin, I., and Tarazi, A., 2018. The joint regulation of bank liquidity and bank capital. *Journal of Financial Intermediation*, 34, pp.32-46. https://doi.org/10.1016/j.jfi.2018.01.006.

Dietrich, A., Hess, K., and Wanzenried, G., 2014. The good and bad news about the new liquidity rules of Basel III in Western European countries. *Journal of Banking & Finance*, 44, pp.13-25. https://doi.org/10.1016/j.jbankfin.2014.03.041.

Djebali, N. and Zaghdoudi, K., 2020. Threshold effects of liquidity risk and credit risk on bank stability in the MENA region. *Journal of Policy Modeling*, 42(5), pp.1049-1063. https://doi.org/10.1016/j.jpolmod.2020.01.013.

Doumpos, M., Zopounidis, C., and Fragiadakis, P., 2016. Assessing the financial performance of European banks under stress testing scenarios: a multicriteria approach. Operational Research, 16(2), pp.197-209. https://doi.org/10.1007/s12351-015-0192-y.

Edoardo, G. and Lucio, G., 2021. Achieving financial stability during a liquidity crisis: a multiobjective approach. Risk Management (Leicestershire, England), 23(1-2), pp.48-74. https://doi.org/10.1057/s41283-021-00067-6.

Elbadry, A., 2018. Bank's financial stability and risk management. Journal of Islamic Accounting and Business Research, 9(2), pp.119-137. https://doi.org/10.1108/JIABR-03-2016-0038.

Galletta, S., Mazzù, S., and Scannella, E., 2021. Risk committee complexity and liquidity risk in the European banking industry. Journal of Economic Behavior & Organization, 192, pp.691-703. https://doi.org/10.1016/j.jebo.2021.10.033.

Hassan, M.K., Khan, A., and Paltrinieri, A., 2019. Liquidity risk, credit risk and stability in Islamic and conventional banks. *Research in International Business and Finance*, 48, pp.17-31. https://doi.org/10.1016/j.ribaf.2018.10.006.

Höhnke, N. and Homölle, S., 2021. Impact investments, evil investments, and something in between: Comparing social banks' investment criteria and strategies with depositors'

investment preferences. Business Ethics, the Environment & Responsibility, 30(3), pp.287-310. https://doi.org/10.1111/beer.12342.

Horváth, R., Seidler, J., and Weill, L., 2014. Bank Capital and Liquidity Creation: GrangerCausality Evidence. Journal of Financial Services Research, 45(3), pp.341-361. https://doi.org/10.1007/s10693-013-0164-4.

Igan, D. and Mirzaei, A., 2020. Does going tough on banks make the going get tough? Bank liquidity regulations, capital requirements, and sectoral activity. Journal of Economic Behavior & Organization, 177, pp.688-726. https://doi.org/10.1016/j.jebo.2020.04.025.

IJtsma, P. and Spierdijk, L., 2017. Systemic risk with endogenous loss given default. Journal of Empirical Finance, 44, pp.145-157. https://doi.org/10.1016/j.jempfin.2017.09.012.

Jiang, L., Levine, R., and Lin, C., 2019. Competition and Bank Liquidity Creation. *Journal of Financial and Quantitative Analysis*, 54(2), pp.513-538. https://doi.org/10.1017/S0022109018000820.

Kamarudin, F., Anwar, N.A.M., Chien, F., Hussain, H.I., and Sadiq, M., 2021. Efficiency of Microfinance Institutions and Economic Freedom Nexus: Empirical Evidence from Four Selected Asian Countries. *Transformations in Business & Economics*, 20(2B), pp.845868.

Kane, E.J. and Malkiel, B.G., 1965. Bank Portfolio Allocation, Deposit Variability, and the Availability Doctrine. *The Quarterly Journal of Economics*, 79(1), pp.113-134. https://doi.org/10.2307/1880516.

Kim, J., 2018. Bank Competition and Financial Stability: Liquidity Risk Perspective. *Contemporary Economic Policy*, 36(2), pp.337-362. https://doi.org/10.1111/coep.12243.

Langfield, S., Liu, Z., and Ota, T., 2014. Mapping the UK interbank system. *Journal of Banking & Finance*, 45, pp.288-303. https://doi.org/10.1016/j.jbankfin.2014.03.031.

Lee, C.C., Wang, C.W., and Hong, P.C., 2022. The Dimension of Bank Liquidity Creation: Culture Viewpoint. *Emerging Markets Finance & Trade*, 58(12), pp.3567-3588. https://doi.org/10.1080/1540496X.2022.2060075.

Legroux, V., Rahmouni-Rousseau, I., Szczerbowicz, U., and Valla, N., 2022. Stabilising virtues of central banks: (Re)matching bank liquidity. *Journal of Banking & Finance*, 134, 106323. https://doi.org/10.1016/j.jbankfin.2021.106323.

Mdaghri, A.A. and Oubdi, L., 2022. Bank-Specific and Macroeconomic Determinants of Bank Liquidity Creation: Evidence from MENA Countries. Journal of Central Banking Theory and Practice, 11(2), pp.55-76. https://doi.org/10.2478/jcbtp-2022-0013.

Moreno, D. and Takalo, T., 2016. Optimal Bank Transparency. Journal of Money, Credit and Banking, 48(1), pp.203-231. https://doi.org/10.1111/jmcb.12295.

Nortman, P.B. and Macaulay, F.R., 1938. Some Theoretical Problems Suggested by the Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856. Political Science Quarterly, 53(4), pp.603-606. https://doi.org/10.1111/j.2397-2335.1938.tb01182.x.

Patel, A., Sorokina, N., and Thornton, J.H., 2022. Liquidity and bank capital structure. Journal of Financial Stability, 62, 101038. https://doi.org/10.1016/j.jfs.2022.101038.

Redington, F.M., 1952. Review of the Principles of Life-office Valuations. Journal of the Institute of Actuaries, 78(3), pp.286-340. https://doi.org/10.1017/S0020268100052811.

Saif-Alyousfi, A.Y.H. and Saha, A., 2021. Determinants of banks' risk-taking behavior, stability and profitability: evidence from GCC countries. International Journal of Islamic and Middle Eastern Finance and Management, 14(5), pp.874-907. https://doi.org/10.1108/IMEFM-03-2019-0129.

Sakoda, S., Tamura, M., and Wakutsu, N., 2022. The Global Financial Crisis and Healthcare Inequality in Japan. Social indicators research, 161(1), pp.273-286. https://doi.org/10.1007/s11205-021-02823-3.

Shen, Q., Chang, B., Ma, R., and Tao, X., 2021. How does Interest Rate Liberalisation Influence the Profits of Commercial Banks? Evidence from China. *Transformations in Business & Economics*, 20(3), pp.278-299.

Sinkey, J.F., 1979. *Problem and Failed Institutions in the Commercial Banking Industry*. JAI Press.

Souza, S.R.S., 2016. Capital requirements, liquidity and financial stability: The case of Brazil. *Journal of Financial Stability*, 25, pp.179-192. https://doi.org/10.1016/j.jfs.2015.10.001.

Summer, M., 2013. Financial Contagion and Network Analysis. *Annual Review of Financial Economics*, 5(1), pp.277-297. https://doi.org/10.1146/annurev-financial-110112-120948.

Tang, T.L.P., Li, Z., Özbek, M.F., Lim, V.K.G., Teo, T.S.H., Ansari, M.A., Sutarso, T., Garber, I., Chiu, R.K.K., Charles-Pauvers, B., Urbain, C., Luna-Arocas, R., Chen, J., Tang, N., Tang, T.L.N., Arias-Galicia, F., Torre, C.G.D.L., Vlerick, P., Akande, A., Al-Zubaidi, A.S., Kazem, A.M., Borg, M.G., Cheng, B.S., Du, L., Ibrahim, A.H.S., Kim, K., Malovics, E., Mpoyi, R.T., Nnedum, O.A.U., Sardžoska, E.G., Allen, M.W., Correia, R., Jen, C.K., Moreira, A.S., Osagie, J.E., Osman-Gani, A.M., Pholsward, R., Polic, M., Skobic, P., Stembridge, A.F., Canova, L., Manganelli, A.M., Pitariu, A.H., Pereira, F.J.C., 2023. Behavioral economics and monetary wisdom: A cross-level analysis of monetary aspiration, pay (dis)satisfaction, risk perception, and corruption in 32 nations. *Business Ethics, the Environment & Responsibility,* pp.925-945. https://doi.org/10.1111/beer.12505.

Taruna, A.A., Harun, C.A., and Nattan, R.R., 2020. Macroprudential Liquidity Stress Test: An Application to Indonesian Banks. *Journal of Central Banking Theory and Practice (Podgorica)*, 9(1), pp.165-187. https://doi.org/10.2478/jcbtp-2020-0027.

Tian, S., Park, D., and Cagas, M.A., 2021. Bond market development and bank stability: Evidence from emerging markets. *Research in International Business and Finance*, . https://doi.org/10.1016/j.ribaf.2021.101498.

Toh, M.Y., Gan, C., and Li, Z., 2019. Revisiting the Impact of Stock Market Liquidity on Bank Liquidity Creation: Evidence from Malaysia. *Emerging Markets Finance & Trade*, 55(8), pp.1776-1802. https://doi.org/10.1080/1540496X.2018.1496420.

Van den End, J.W., 2016. A macroprudential approach to address liquidity risk with the loan-to-deposit ratio. *The European Journal of Finance*, 22(3), pp.237-253. https://doi.org/10.1080/1351847X.2014.983137.

Yeddou, N. and Pourroy, M., 2020. Bank liquidity creation: Does ownership structure matter?. *The Quarterly Review of Economics and Finance*, 78, pp.116-131. https://doi.org/10.1016/j.qref.2020.01.003.

Zhang, J., He, L., and An, Y., 2020. Measuring banks' liquidity risk: An option-pricing approach. *Journal of Banking & Finance*, 111, 105703. https://doi.org/10.1016/j.jbankfin.2019.105703.