Pacific-Basin Finance Journal 95 (2026) 102998

Contents lists available at ScienceDirect

Pacific-Basin Finance Journal

journal homepage: www.elsevier.com/locate/pacfin

Liquidity and default risk in China: The double-edged role of state ownership[☆]

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ARTICLE INFO

JEL code:
G12
G32
G33
P34

Keywords:
Stock liquidity
Default risk
China
SOEs

ABSTRACT

This study explores the impact of stock liquidity on firm default risk in China, focusing on the moderating role of state ownership. The empirical results confirm that enhanced liquidity decreases default risk; however, the interaction of state ownership weakens this relationship. Notably, state ownership strengthens the informational efficiency channel (the learning channel) but weakens the corporate governance channel, with the latter effect outweighing the former. The findings highlight the dual role of liquidity in reducing default risk and emphasize the implications of state ownership in shaping this relationship. These findings contribute to the literature on financial risk management and provide policy implications for improving corporate governance in state-controlled economies.

1. Introduction

Stock liquidity plays a crucial role in the efficiency and stability of financial markets, influencing corporate financial policies, governance, and risk exposure. While the relationship between liquidity and default risk has been extensively studied in developed markets, its implications for emerging economies remain underexplored. Brogaard et al. (2017) provide evidence from the U.S. that increased liquidity reduces default risk through two key mechanisms: informational efficiency (the learning channel) and corporate governance improvements (the governance channel). Extending this research, Nadarajah et al. (2021) document a negative relationship between stock liquidity and default risk across 46 countries, including China. However, their broad international approach does not allow for an in-depth examination of the specific mechanisms at play in China's unique financial environment, nor does it explore channel effects.

China provides an ideal setting to investigate this relationship due to its distinctive institutional features, particularly the prevalence of state-owned enterprises (SOEs). As firms with majority government ownership and strategic policy commitments, SOEs have played an increasingly significant role in the global economy (Shleifer and Vishny, 1994; Boisot and Child, 1996; Lin et al., 2020). In 2022, 99 Chinese SOEs were listed in the Fortune Global 500, underscoring their economic significance. However, SOEs differ from privately owned firms in their objectives, incentives, and financial constraints, which may alter the effectiveness of liquidity in reducing default risk.

[☆] This article is part of a Special issue entitled: 'Digital Finance in Emerging Markets' published in Pacific-Basin Finance Journal.

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https://doi.org/10.1016/j.pacfin.2025.102998
Received 27 July 2025; Received in revised form 6 November 2025; Accepted 9 November 2025
Available online 10 November 2025
0927-538X/

Theoretical and empirical research suggests that stock liquidity can reduce default risk via two channels: (1) the learning channel, where enhanced liquidity improves informational efficiency and enables managers to make more informed decisions, and (2) the governance channel, where liquidity strengthens shareholder oversight and managerial discipline (Brogaard et al., 2017). The learning channel is based on the premise that stock prices incorporate private information, allowing managers to extract meaningful signals for decision-making (Chen et al., 2007). Default risk reduction from improved informational efficiency is referred to as the learning channel (Chen et al., 2007). While this mechanism has been validated in developed markets, institutional frictions in China – such as short-sale constraints, margin trading restrictions, and state control – may limit its effectiveness (Miller, 1977; Kim and Rhee, 1997; Chang et al., 2014; Xiong et al., 2017).

Additionally, the governance channel posits that liquidity reduces default risk by facilitating shareholder intervention through large shareholders' exit (or threat of exit) (Admati and Pfleiderer, 2009; Edmans and Manso, 2011; Chen et al., 2024). However, China's corporate governance environment differs from that of developed markets. Chinese firms' highly concentrated ownership structure exacerbates conflicts between controlling and minority shareholders (La Porta et al., 1999). While the 2005 split-share structure reform led to some dilution of state ownership, SOEs remain insulated from external governance pressures due to their strategic national importance (Chen et al., 2011; Apriyantopo et al., 2023). Moreover, governance mechanisms in SOEs may be less sensitive to liquidity changes because political and social objectives often take precedence over shareholder value maximization (Carpenter et al., 2021; De Pilla et al., 2024).

Given these institutional distinctions, this study aims to identify the dominant channel through which stock liquidity affects default risk in China. If the learning channel dominates, improving market transparency and relaxing trading restrictions could enhance risk pricing and managerial decision-making. Conversely, if the governance channel is more significant, corporate governance reforms – such as increased shareholder rights and improved board structures – may be more effective in reducing default risk. Thus, this study seeks to determine whether market-based informational efficiency improvements or governance enhancements play a greater role in mitigating default risk in China.

More importantly, this paper investigates the moderating role of state ownership in this relationship. Using Expected Default Frequency (EDF) and Distance to Default (DD) as default risk proxies, we employ fixed-effect regression models with clustered standard errors to examine how liquidity affects default risk across SOEs and non-SOEs. Our results confirm that while increased liquidity reduces default risk, state ownership significantly weakens this relationship. Specifically, state ownership strengthens the learning channel by enhancing informational efficiency but weakens the governance channel by reducing external monitoring. Since the governance effect dominates, the overall impact of liquidity on default risk is weaker in SOEs compared to non-SOEs.

Our contributions to the literature are threefold. First, we provide novel empirical evidence on how state ownership influences the liquidity-default risk nexus, extending corporate finance theories to emerging markets. Second, we distinguish between the learning and governance channels, highlighting their relative importance in China's institutional setting. Specifically, while increased stock liquidity enhances informational efficiency (learning channel), its ability to improve corporate governance and mitigate agency conflicts (governance channel) is significantly weaker in SOEs due to soft budget constraints and government-imposed strategic objectives. Third, our findings have important policy implications for market efficiency, corporate governance, and financial stability in state-controlled economies. Strengthening stock liquidity remains a crucial mechanism for reducing default risk, but its effectiveness in SOEs is constrained by weaker governance mechanisms. Policymakers should prioritize market-deepening initiatives, corporate governance reforms, and enhanced transparency measures to ensure that firms (particularly SOEs) can fully leverage the risk-reducing benefits of stock liquidity.

The remainder of this paper is structured as follows. Section 2 reviews the related literature and develops the hypotheses. Section 3 describes the data sources, variables, and empirical methods. Section 4 presents the results, while Section 5 concludes with implications for policy and future research.

2. Literature review and hypotheses development

2.1. Liquidity and informational efficiency

Stock liquidity plays a crucial role in enhancing informational efficiency by facilitating arbitrage activities and price discovery. Chordia et al. (2008) demonstrate that increased liquidity enhances price informativeness in the U.S. market by allowing informed traders to acquire private information and trade against less-informed investors. Similar findings have been confirmed in subsequent studies (Chung and Hrazdil, 2010a, 2010b; Lin et al., 2025). In China, Ma et al. (2020) find that liquidity improves intraday price efficiency, particularly through institutional trading.

However, the impact of liquidity on informational efficiency is not always positive. Increased trading volume can also introduce noise trading, as retail investors' speculative behavior reduces price informativeness (De Long et al., 1990; Xiong et al., 2020; Cao et al., 2023). In China, retail investors dominated trading activity before 2018, and studies have shown that their trading patterns – heavily influenced by market sentiment – undermined price efficiency (Tan and Wang, 2006; Du et al., 2023). Given the dominant role of retail traders in Chinese markets during this period, the increase in liquidity may have amplified noise trading, thereby inhibiting arbitrage and reducing informational efficiency.

The overall impact of stock liquidity on informational efficiency depends on the relative strength of two competing effects: the informed trading effect and the noise trading effect. The informed trading effect occurs when increased liquidity improves informational efficiency by encouraging informed investors to trade and incorporate private information into stock prices. The noise trading effect occurs when increased liquidity attracts speculative trading, weakening price informativeness. Given China's unique market constraints, such as short-sale restrictions and limited access to derivatives, the net effect of liquidity on informational efficiency remains an empirical question. Thus, we propose:

Hypothesis 1. Stock liquidity is positively correlated with informational efficiency in China.

2.2. Liquidity and default risk

Default risk arises when a firm's cash flow is insufficient to meet financial obligations, which is often influenced by financial positioning and corporate governance (Campbell and Dietrich, 1983; Hsu et al., 2015). Stock liquidity may affect default risk through multiple channels. First, greater liquidity improves access to external financing, reducing the likelihood of financial distress. Second, liquidity-enhanced stock prices reflect firms' fundamental information, which managers can use to improve decision-making, ultimately influencing default risk (Chordia et al., 2008; Foucault and Frésard, 2012; Foucault and Fresard, 2014; Brogaard et al., 2017). Thirdly, higher liquidity can also reduce firm default risk through corporate governance improvement (Ali et al., 2018). Consequently, liquidity can mitigate default risk through two primary mechanisms: 1) the learning channel, where higher liquidity enhances price informativeness, enabling managers to extract private information from stock prices and make better financial and investment decisions (Dow and Gorton, 1997; Foucault and Frésard, 2012; Foucault and Fresard, 2014; Brogaard et al., 2017; Chen et al., 2022); and 2) the governance channel, where liquid markets allow blockholders to monitor management more effectively, disciplining opportunistic behavior and reducing financial distress (Admati and Pfleiderer, 2009; Edmans and Manso, 2011; Edmans et al., 2013).

Prior studies in developed markets (e.g., Brogaard et al., 2017; Nadarajah et al., 2021) confirm that both channels contribute to reducing default risk. However, whether these findings apply to China remains uncertain. The Chinese stock market is characterized by short-sale restrictions, margin trading limits, and narrow price bands, which reduce the informativeness of stock prices (Kim and Rhee, 1997; Nagel, 2005; Bris et al., 2007; Xiong et al., 2017). Furthermore, pervasive state ownership weakens the assumption of firm value maximization, a key requirement for the learning channel to function effectively (Ma et al., 2024).

Additionally, corporate governance in China differs from developed markets, where highly concentrated ownership structures lead to conflicts not just between managers and shareholders (Type I agency problem) but also between controlling shareholders and minority investors (Type II agency problem) (Ko et al., 2016; Carpenter et al., 2021).

Given these factors, we investigate whether stock liquidity plays a significant role in reducing default risk in China:

Hypothesis 2. Increased stock liquidity reduces firm default risk in China.

2.3. Dominant channel: Learning vs. governance

The learning channel suggests that managers extract valuable information from stock prices, improving investment decisions and reducing financial risk (Dow and Gorton, 1997; Chen et al., 2007; Bakke and Whited, 2010; Ye et al., 2023). Empirical research confirms that higher liquidity strengthens the learning channel, leading to better corporate decision-making and lower default risk (Subrahmanyam and Titman, 1999; Luo, 2005; Ouyang and Szewczyk, 2018).

Alternatively, the governance channel operates through the exit threat mechanism, where blockholders sell shares in response to poor management performance, pressuring managers to act in shareholders' best interests (Admati and Pfleiderer, 2009; Edmans, 2009; Edmans and Manso, 2011). Stronger governance reduces agency conflicts, improving investment efficiency and lowering financial distress (Brogaard et al., 2017; Quah et al., 2021; Amihud and Levi, 2023).

However, corporate governance in China differs significantly from that in the U.S. and Europe. Unlike developed markets, where managerial entrenchment (Type I agency problem) is the primary concern, in China, conflicts between controlling and minority shareholders (Type II agency problem) dominate (Rajan, 1992; La Porta et al., 1999; Claessens et al., 2000; Young et al., 2008). Furthermore, political influences in SOEs weaken governance incentives, further reducing stock liquidity's effectiveness in mitigating default risk (Jiang and Kim, 2015). Given these distinct characteristics, we test whether the governance channel dominates the learning channel in China:

Hypothesis 3a. The governance channel better explains the relationship between liquidity and default risk than the learning channel.

Hypothesis 3b. The learning channel better explains the relationship between liquidity and default risk than the governance channel.

2.4. The role of state ownership

State ownership refers to the shares held by central and local governments (Ballester et al., 2020). SOEs serve as strategic assets for economic stability but exhibit weaker corporate governance and lower profitability (Shleifer and Vishny, 1994; Lin et al., 1998; Jiang et al., 2020). As government-controlled entities, SOEs prioritize national policy objectives over profit maximization, which limits the effectiveness of both the learning and governance channels (Carpenter et al., 2021).

Empirical research confirms that SOEs exhibit higher default risk than private firms, particularly in China and other emerging markets (Cornett et al., 2010; Liu et al., 2019; Ballester et al., 2020). Liu et al. (2019) find that firms with high state ownership have greater default risk, and the positive risk-return relationship, typically observed in financial markets, only exists in non-SOEs, further suggesting lower stock price efficiency in SOEs.

Regarding the governance channel, state control reduces blockholder influence and weakens the threat of exit, limiting liquidity's ability to mitigate default risk (Jiang and Kim, 2020). Additionally, SOE managers' compensation is often tied to political promotions rather than firm performance, further reducing governance effectiveness (Ko et al., 2016; Carpenter et al., 2021). Hence, we hypothesize:

Hypothesis 4. State ownership weakens the liquidity–default risk relationship in China.

Hypothesis 5. State ownership weakens the learning channel between stock liquidity and firm default risk.

Hypothesis 6. State ownership weakens the governance channel between stock liquidity and firm default risk.

3. Data, variables, and research methods

3.1. Data

This study adopts the quarterly data of Chinese non-financial listed firms from the first quarter of 2003 to the last quarter of 2017, comprising 102,212 firm-quarter observations. The sample period ends in 2017 to ensure both data availability and institutional comparability. The major market reforms since 2018—including the rollout of the STAR Market, the adoption of the registration-based IPO system, and significant changes in disclosure rules and SOE governance—introduce structural breaks that could confound our analysis. The financial and insurance industry data are excluded due to the unique structure of assets and liabilities in financial and insurance companies.

The research primarily uses two data sources for empirical analyses: China Stock Market & Accounting Research (CSMAR) and Thomson Reuters Tick History (TRTH) from DataScope Select. High-frequency data was collected from TRTH/DataScope to calculate corresponding liquidity metrics. CSMAR provides all the other data, including the daily returns data, balance sheet data, and financial indicators of individual stocks listed in the Shanghai Stock Exchange (SSE) and Shenzhen Stock Exchange (SZSE), as well as the ownership data that includes the state control dummy. All continuous variables are winsorized at the 1 % level, and observations with missing values or under special treatment (marked as "ST" or "*ST") are dropped.

3.2. Variables

Based on the market-based model of Merton (1974), *DD* is the distance to default for a firm, while *EDF* is the corresponding probability of default derived from *DD*. Detailed calculation methods to estimate *DD* and *EDF* are provided in Bharath and Shumway (2008) and Duan et al. (2012). Larger *EDF* and smaller *DD* represent a higher risk of default for firms (Abinzano et al., 2020).

This study utilizes the relative quoted spread (*RQS*) and the number of days with zero returns (*Zeros*) as measures of liquidity, and the daily *RQS* is averaged across all trading days in a quarter to obtain quarterly *RQS*. The daily *RQS* is calculated as below:

$$RQS = \sum_{k=1}^{N} W_{ik} \times \frac{P_{Ask,ik} - P_{Bid,ik}}{P_{M,ik}} \tag{1.1}$$

where $P_{Ask,ik}$ and $P_{Bid,ik}$ are the ask price and bid price in deal *k* of stock *i* respectively[1]; $P_{M,ik}$ is the mid-point price of best ask price and best bid price in deal *k* of stock *i*. This study uses the value-weighted method to receive daily metrics from intraday spreads, and W_{ik} is the proportion of the daily total trading volume for deal *k* of stock *i*. As another liquidity metric, *Zeros* is calculated as the number of days with zero returns in six months and then multiplied by a hundred.

As to the state ownership measures, this study mainly employs a dummy named *SOE*, which is coded as 1 if the sample firm is state-controlled. SOE or non-SOE is classified by CSMAR based on their existing ownership data and the definition of the actual controller. The actual controller refers to the shareholder with the largest shareholding, with the largest right to vote, with more than 30 % of shareholding or vote right, or who can decide the appointment of more than half of the board, in addition to other conditions specified by the China Securities Regulatory Commission (Zeng and Lu, 2006; Beladi et al., 2021).

As one of the mechanism channels between liquidity and default risk, the informational efficiency of stock prices is proxied via return autocorrelation (*Auto*) and price delay in this paper. The price delay is estimated from different aspects in *Delay1* and *Delay2*, both of which are derived from the model of Hou and Moskowitz (2005) as follows,

$$r_{i,t} = \alpha_i + \beta_i R_{m,t} + \sum_{n=1}^{4} \delta_i^{(-n)} R_{m,t-n} + \varepsilon_{i,t} \tag{1.2}$$

where $r_{i,t}$ denotes the return of stock *i* in day *t*, and $R_{m,t-n}$ represents the stock market return in day *t*. Eq. (1.2) is specified as the nonrestricted model, while the restricted model constrains $\delta_i^{(-n)} = 0$.

Based on both the nonrestricted and restricted model, the first delay metric is calculated as follows: $Delay1 = 1 - \frac{R^2_{restricted}}{R^2_{nonrestricted}}$. It

[1] Since the intraday data from SSE and SZSE is a trading snapshot every three seconds, the deal k here means the period k.

measures how quickly stock prices incorporate public information. To distinguish between the impact of lagged market information and the impact of current public information, *Delay2* is constructed as follows: $Delay2 = \frac{\sum_{n=2}^{4}|\varphi_{i,n}|}{|\beta_{i,n}|+\sum_{n=2}^{4}|\varphi_{i,n}|}$.

Two sorts of measurements are applied to evaluate the corporate governance channels: (1) agency conflicts between controlling and minority shareholders, and (2) agency conflicts between managers and owners. The governance in the first category is measured by two proxies: (1) *Balance*, which measures the degree of equity balance between the largest shareholder and other block shareholders. A larger *Balance* suggests large shareholders have more voting rights, which indicates there could be more efficient monitoring from other large shareholders that can alleviate the Type II agency problem. (2) *Top1* measures the weighting of the largest shareholder. Though influential controlling shareholders can effectively monitor the management team, an absolute predominance of controlling shareholders poses a threat to the minority shareholders' interests. The concentrated ownership in Chinese listed firms enables controlling shareholders to effectively discipline managers and ease the manager-shareholder agency problem (monitoring). At the same time, it also leads to conflicts of interest between the controlling and minority shareholders. In addition, the controlling shareholders may extract benefits at the expense of minority shareholders (tunneling). The tunneling effect of the largest shareholders may overwhelm the monitoring effect. To measure the Type I agency problem, the metrics used consist of two other proxies: (1) *Block*, which refers to the aggregate percentage ownership of blockholders who hold at least 5 % of total common shares at the end of the period, and (2) *NBlock*, which represents the number of blockholders.[2] Higher liquidity makes the exit threat more credible, reinforcing the importance of corporate governance.

Several firm characteristics are included as control variables in the regressions to control for other factors known to affect default risk, including return on assets (*ROA*), leverage (*Leverage*), excess return (*Excess*), firm size (*Size*), market-to-book value (*MTB*), the ratio of net property, plant, and equipment to total assets (*Tangibility*), current ratio (*Current*), stock return volatility (*Volatility*), and firm age (*Age*) (Goyal and Wang, 2013; Brogaard et al., 2017; Nadarajah et al., 2021). Moreover, Fang et al. (2009) have proved that increases in stock liquidity improve the firm value, which also reduces the likelihood of bankruptcy. The Tobin Q value (*TobinQ*) is also included as a control variable to eliminate the mechanical relationship between firm value and default risk when exploring the possible mechanisms between liquidity and default risk. All the variables used are listed and explained in Table 1, and the respective data sources are also included.

3.3. Model specifications

3.3.1. Basic model

Before testing channel effects, this study examines the relationship between liquidity and default risk. Specifically, it adopts the fixed effect model with robust standard error; individual and time fixed effects are controlled. The baseline model is defined as follows.

$$DefaultRisk_{i,t} = \alpha + \beta_1 Liquidity_{i,t-1} + \gamma_1 X_{i,t-1} + \theta^{'} Firm + \psi^{'} Quarter + Error_{i,t} \quad \text{Equation Section (Next)} \tag{2.1}$$

Here, *EDF* and *DD* measure the firm default risk, which is represented by *DefaultRisk*. *Liquidity* represents the liquidity measures, including *RQS* and *Zeros*. *X* is a vector of all the controls, including *ROA*, *Volatility*, *Excess* return, *Leverage*, firm *Size*, *Tangibility* ratio, *Current* ratio, *MTB*, and *Age*. The relation between stock liquidity and firm default risk goes both ways. That is, higher stock liquidity might lead to lower default risk, while the more distressed firms might see reduced liquidity. To deal with the issue of reverse causality, the model has lagged all independent variables by one quarter (see Brogaard et al., 2017).

Eq. (2.2) is estimated to assess the informational efficiency channel.

$$\Delta DefaultRisk_{it} = \alpha + \beta \Delta Efficiency_{i,t} + \gamma \Delta Control_{i,t} + Error_{i,t} \tag{2.2}$$

DefaultRisk is measured by *EDF* and *DD*, while the *Efficiency* metrics contain *Auto*, *Delay1*, and *Delay2*. The controls here include *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, *lnE*, *lnD*, and *TobinQ*.

This study assesses the corporate governance channel via the following model:

$$\Delta DefaultRisk_{it} = \alpha + \beta \Delta Governance_{i,t} + \gamma \Delta Control_{i,t} + Error_{i,t} \tag{2.3}$$

The *DefaultRisk* is measured by *EDF* and *DD*, while *Governance* refers to the corporate governance metrics, including *Balance*, *Top1*, *Block*, and *NBlock*. The controls here include *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, *lnE*, *lnD*, and *TobinQ*.

3.3.2. The role of state ownership in the relation between liquidity and default risk

To explore the influence of state ownership, this study adopts the fixed effect model to check the role of SOEs; individual and time fixed effects are controlled. All independent variables are lagged by one quarter to mitigate the issue of reverse causality, including the SOE metric.

[2] Even though the financial reports of Chinese listed firms only report the top 10 shareholders, there is an overwhelming majority of blockholders (with shareholdings of more than 5 %). Only 22 observations in the sample show that these firms may have other blockholders (with their 10th largest shareholder holding slightly more than 5 %). The shareholding data are disclosed in semi-annual and annual reports, while not all quarterly reports contain this information. Consequently, analyses involving governance metrics are conducted using semi-annual data.

Table 1
Variables, definitions, and sources.

Variable	Definition	Data Source
Default risk		
EDF	Expected default frequency, the probability of default risk calculated under the traditional model from Merton (1974)	CSMAR
DD	Distance to default, the quarterly average of the distance to default, measuring how far the firm is away from the default point, following Merton (1974)	CSMAR
Stock liquidity		
RQS	The natural logarithm of the quarterly relative quoted spread, which is the average of the daily RQS calculated using intraday trading data	TRTH
Zeros	The number of days with zero returns in a quarter, which is also an inverse indicator of liquidity	CSMAR
State ownership		
SOE	SOE = 1 if the sample firm is state-controlled; 0 otherwise. The ownership is classified based on their existing ownership data and the definition of the actual controller: 1) the largest shareholding; 2) largest right to vote; 3) shareholding or vote right >30 %; 4) can decide the appointment of more than half of the board; 5) other conditions specified by the China Securities Regulatory Commission	CSMAR
Variables for channels		
Auto	The six-month average of the absolute value of autocorrelation calculated weekly from daily trading data	TRTH
Price delays	$Delay1 = 1 - \frac{R^2_{restricted}}{R^2_{nonrestricted}}$ The nonrestricted model is specified as $r_{i,t} = \alpha_i + \beta_i R_{m,t} + \sum_{n=1}^{4} \delta_i^{(-n)} R_{m,t-n} + \varepsilon_{i,t}$, where $r_{i,t}$ is the return of stock i in day t, and $R_{m,t-n}$ is the stock market return in day t. The restricted model constrains $\delta_i^{(-n)}=0$. $Delay2 = \frac{\sum_{n=2}^{4} \lvert\varphi_{i,n}\rvert}{\sum_{n=1}^{4} \lvert\beta_{i,n}\rvert + \sum_{n=2}^{4} \lvert\varphi_{i,n}\rvert}$	CSMAR
Block	Aggregate percentage ownership of blockholders who hold at least 5 % of total common shares at the end of the period	CSMAR
NBlock	The number of block owners who hold more than 5 % of total shares outstanding	CSMAR
Balance	The shareholding ratio of the 2nd to 10th largest shareholder divided by the shareholding ratio of the first majority shareholder	CSMAR
Top1	The proportion of shareholding for the first majority shareholder (major shareholder governance)	CSMAR
Controls		
ROA	The ratio of return to total assets computed over a quarter	CSMAR
Volatility	Quarterly stock return volatility, computed as the standard deviation of the daily stock return over a quarter	CSMAR
Excess	The excess return calculated from daily trading data	CSMAR
Leverage	The ratio of total debt to total assets	CSMAR
Size	The natural logarithm of total assets	CSMAR
Tangibility	The ratio of net property, plant, and equipment to total assets	CSMAR
Current	The ratio of current assets to current liabilities	CSMAR
MTB	The market-to-book value	CSMAR
Age	The number of years since the firm's listing	CSMAR
TobinQ	The market value of a company divided by its assets' replacement cost	CSMAR

$$\begin{aligned} DefaultRisk_{i,t} = {} & \alpha + \beta_1 Liquidity_{i,t-1} + \beta_2 SOE_{i,t-1} + \beta_3 Liquidity_{i,t-1} \times SOE \\ & + \gamma_1 X_{i,t-1} + \theta' Firm + \psi' Quarter + Error_{i,t} \end{aligned} \tag{2.4}$$

Consistent with Eq. (2.1), *DefaultRisk* represents the firm default risk measured by *EDF* and *DD*. *Liquidity* refers to liquidity measures, including *RQS* and *Zeros*. SOE defines the nature of listed firms, which is coded as 1 if the sample firm is state-controlled. X is a vector of all the controls, including *ROA*, *Volatility*, *Excess* return, *Leverage*, firm *Size*, *Tangibility* ratio, *Current* ratio, *MTB*, and *Age*. The model has lagged all independent variables by one quarter to mitigate the issue of reverse causality.

3.3.3. How state ownership affects the channels

To examine the role of state ownership on learning and governance channels in the relations between liquidity and default risk, the following models are estimated:

$$\begin{aligned} \Delta DefaultRisk_{it} = {} & \alpha + \beta_1 \Delta Efficiency_{i,t} + \beta_2 SOE_{i,t} + \beta_3 SOE_{i,t} \times \Delta Efficiency_{i,t} \\ & + \gamma \Delta Control_{i,t} + Error_{i,t} \end{aligned} \tag{2.5}$$

$$\begin{aligned} \Delta DefaultRisk_{it} = {} & \alpha + \beta_1 \Delta Governance_{i,t} + \beta_2 SOE_{i,t} + \beta_3 SOE_{i,t} \times \Delta Governance_{i,t} \\ & + \gamma \Delta Control_{i,t} + Error_{i,t} \end{aligned} \tag{2.6}$$

DefaultRisk is measured by *EDF* and *DD*. The *Efficiency* metrics contain *Auto*, *Delay1*, and *Delay2*. The *Governance* metrics refer to *Balance*, *Top1*, *Block*, and *NBlock*. *SOE* equals 1 if the sample firm is state-controlled and 0 otherwise. The controls here include *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, *lnE*, *lnD*, and *TobinQ*, following Brogaard et al. (2017) and Nadarajah et al. (2021).

4. Empirical results

4.1. Summary statistics

Table 2 presents summary statistics based on 102,212 firm-quarter observations from Chinese A-share listed companies during the period 2003–2017.

Panel A in Table 2 shows the average default risk, measured by *EDF* and *DD*, are 0.1761 and 3.4539, respectively. Concerning liquidity metrics, the mean of *RQS* and *Zeros* are 2.8087 and 0.0249, respectively.

Descriptive statistics of SOEs and non-SOEs are presented in Panel B. It shows that the default risk measured by *EDF* and *DD* in non-SOEs is higher than that in SOEs, while *RQS* and *Zeros* imply that the stock of SOEs experiences higher liquidity than that of non-SOEs. Also, the results for controls show that the *ROA*, *Volatility*, *Excess* return, *Current* ratio, and *MTB* are smaller in non-SOEs than in SOEs. In contrast, the *Leverage*, firm *Size*, *Tangibility* ratio, and *Age* are larger.

The descriptive statistics for analyzing channels are reported in Panel C. *TobinQ*, which serves as the control variable, has a mean value of 2.1314. The informational efficiency metrics comprise *Auto*, *Delay1*, and *Delay2*, whereas the governance metrics comprise *Balance*, *Top1*, *Block*, and *NBlock*.

Table 2
Descriptive statistics and correlation matrix.

Panel A: Descriptive statistics of the full sample

Variables	N	Mean	Std. Dev.	P25	Median	P75
EDF	102,212	0.1761	0.2981	0	0.0001	0.406
DD	102,212	3.4539	2.9945	0.2379	3.8164	5.4568
RQS	102,212	2.8087	0.4613	2.4860	2.7790	3.1106
Zeros	102,212	0.0249	0.0275	0	0.0167	0.0355
ROA	102,212	0.0109	0.0170	0.0024	0.0089	0.0182
Volatility	102,212	0.2259	0.0942	0.1594	0.2052	0.2723
Excess	102,212	−0.0204	0.2055	−0.1391	−0.0496	0.0569
Leverage	102,212	0.4393	0.2070	0.2762	0.4439	0.5997
Size	102,212	21.8319	1.2375	20.9291	21.6581	22.5212
Tangibility	102,212	0.2434	0.1707	0.1104	0.2090	0.3453
Current	102,212	2.4514	2.9912	1.0486	1.5023	2.4863
MTB	102,212	3.7527	2.9766	1.8918	2.8883	4.5376
Age	102,212	9.0185	6.1055	4	8	14
SOE	102,212	0.497	0.5	0	0	1

Panel B: Descriptive statistics of SOEs and non-SOEs

Variables	G1(SOE = 0)	Mean1	G2(SOE = 1)	Mean2	Mean Diff
EDF	51,412	0.252	50,800	0.100	0.152***
DD	51,412	2.874	50,800	4.041	−1.167***
RQS	51,412	2.860	50,800	2.756	0.104***
Zeros	51,412	0.0280	50,800	0.0210	0.007***
ROA	51,412	0.00900	50,800	0.0130	−0.004***
Volatility	51,412	0.220	50,800	0.232	−0.012***
Excess	51,412	−0.0260	50,800	−0.0140	−0.012***
Leverage	51,412	0.498	50,800	0.379	0.119***
Size	51,412	22.16	50,800	21.50	0.669***
Tangibility	51,412	0.285	50,800	0.201	0.084***
Current	51,412	1.707	50,800	3.205	−1.498***
MTB	51,412	3.209	50,800	4.302	−1.093***
Age	51,412	10.97	50,800	7.041	3.932***

Panel C: Descriptive statistics for the channel analyses

Variables	N	Mean	Std. Dev.	P25	Median	P75
TobinQ	102,212	2.1314	1.3814	1.2759	1.6547	2.4364
Auto	99,426	0.2069	0.1479	0.0855	0.1803	0.3015
Delay1	99,332	0.4208	0.2885	0.1740	0.3569	0.6374
Delay2	99,332	0.6003	0.1899	0.4585	0.5928	0.7387
Balance	49,835	0.8056	0.7425	0.2423	0.5947	1.1357
Top1	49,835	36.7408	15.4434	24.4014	34.9523	48.0533
Block	49,835	48.7099	16.4026	36.66	49.56	60.90
NBlock	49,835	2.0418	1.1155	1	2	3

The sample period is from the first quarter of 2003 to the end of 2017. The dataset includes 102,212 firm-quarter observations from non-financial A-share companies listed on Shanghai and Shenzhen Stock Exchanges. Panel A presents the descriptive statistics for all available variables of the full sample. Definitions of the variables are provided in Table 1. The descriptive statistics contain the mean, standard deviation, and the three quartiles: P25, median, and P75. Panel B lists the descriptive statistics for SOE and non-SOE groups; t statistics * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Panel C shows the descriptive statistics for the variables used in the channel regressions, covering *TobinQ*, informational metrics, and governance metrics.

4.2. Baseline results

Using *EDF* and *DD* to measure default risk, the results from Eq. (2.1) are reported in Table 3. Columns (1) and (2) present the results when the default risk is measured by *EDF*. The coefficients of liquidity metrics are positive and statistically significant at the 1 % level, which suggests that improved liquidity reduces the expected default frequency. Correspondingly, the results using *DD* as the independent variable are shown in Columns (3) and (4). The significantly negative coefficients of *RQS* and *Zeros* mean improved liquidity is conducive to increasing the DD, further confirming the negative relation between liquidity and default risk. In conclusion, the results in Table 3 reveal that stock liquidity increases reduce firm default risk in Chinese stock markets, and this conclusion remains unchanged with different measures of stock liquidity and different default risk metrics.

These findings confirm Hypothesis 2, demonstrating a negative relationship between stock liquidity and default risk in Chinese markets, consistent across multiple liquidity and default risk metrics.

4.3. Channels between liquidity and firm default risk

4.3.1. Learning channel

Turning to channel identification of the relationship between liquidity and default risk, Table 4 reports tests of Eq. (2.2). The coefficients of interest concerning informational efficiency are those of *Auto*, *Delay1,* and *Delay2*. The test of Hypothesis 1 confirms that enhanced stock liquidity facilitates the improvement of informational efficiency.[3] If the learning channel exists, it would be reasonable to expect a positive relationship between informational efficiency and *EDF* measurements and a negative relationship between informational efficiency metrics and *DD*. Table 4 reports insignificant effects for *Auto*, *Delay1,* and *Delay2* with *EDF* (i.e., Columns (1)–(3)), while *Delay1* shows a positive coefficient and insignificant impact on *EDF* in Column (2). Columns (5) and (6) of Table 4 report significantly negative coefficients for all the informational efficiency metrics on *DD*. The coefficient of *Auto* is negative; however, it is not statistically significant. These mixed results suggest that while some informational efficiency measures influence default risk, the evidence for the learning channel in China remains inconclusive. The inconclusive results on the learning effect likely reflect the characteristics of the Chinese stock markets, where retail investors dominate and price movements are often driven by sentiment rather than fundamentals. When prices incorporate more noise than information, managers have limited incentives and ability to learn from market signals. Consequently, only certain measures of informational efficiency show significant effects, suggesting that the learning channel in China remains limited.

4.3.2. Corporate governance channel

Table 5 reports estimates of Eq. (2.3). The coefficients of interest concerning corporate governance are those of *Balance*, *Top1*, *Block*, and *NBlock*. Columns (1)–(4) of Table 5 report the impacts of corporate governance on *EDF* and *DD*, and *Balance* and *Top1* are used to represent the agency problem between controlling and minority shareholders. The negative coefficient for *Balance* in Column (1) and the positive coefficient in Column (3) are both significant at the 1 % level, implying that better governance from equity balance reduces firm default risk. Columns (2) and (4) report significant effects for *Top1* with *EDF* and *DD*. The positive coefficient for *Top1* is statistically significant at the 1 % level, while it negatively and significantly impacts *DD* at the 10 % level. This indicates that increased shareholding of controlling shareholders increases the default risk, which supports the tunneling role of the controlling shareholders.

Block and *NBlock* are also adopted to proxy agency issues from the conflicts of interest between managers and shareholders. The results are shown in Columns (5)–(8) in Table 5. Columns (5) and (7) report insignificant effects for *Block* with *EDF* and *DD*. On the contrary, the coefficients for *NBlock* on *EDF* and *DD* are both significant at the 1 % level. Specifically, the significantly negative coefficient in Column (6) and significantly positive coefficient in Column (8) imply that the improved governance from more block shareholders is conducive to default risk reduction.

These results support the governance channel, confirming that stronger governance reduces default risk, particularly through increased equity balance and more non-controlling blockholders. That is, the improved governance reduces the firm default risk, and the governance channel works in China. More specifically, improved governance from increased equity balance and decreased majority shareholding mitigates firm default risk. Meanwhile, more blockholders in firms significantly contribute to lowering the default risk, even though the impact of block holdings is insignificant. This finding is consistent with the results using two default risk metrics. Overall, these findings suggest that effective governance channels play a crucial role in mitigating default risk in China, highlighting the economic importance of shareholder structure and oversight in shaping firm stability.

4.3.3. Comparing learning vs. governance channels

To investigate the relative explanatory power between the learning and governance channels in the established relationship between liquidity and default risk, this study follows Brogaard et al. (2017) by conducting standardized regressions to compare these two channels. The results are reported in Table 6. Panels A, B, and C compare *Auto*, *Delay1*, and *Delay2* to governance metrics, respectively; Panel D compares two types of agency problems using different governance metrics.

Panel A compares the efficiency metric of *Auto* to governance metrics. The coefficients of standardized *zee_ΔAuto* are all insignificant for regressions using both *zee_ΔEDF* and *zee_ΔDD* as the independent variable. From the aspect of magnitudes for coefficients on

[3] Due to space limitations, the results are not reported here but are available upon request.

Table 3
The relationship between liquidity and default risk.

Dependent variable	*EDF*		*DD*	
	(1)	(2)	(3)	(4)
RQS $_{t-1}$	0.098***		−0.879***	
	(20.41)		(−17.14)	
Zeros $_{t-1}$		0.511***		−3.169***
		(15.12)		(−7.33)
ROA $_{t-1}$	−0.772***	−0.902***	5.571***	6.825***
	(−11.79)	(−13.05)	(8.86)	(10.48)
Volatility $_{t-1}$	0.053***	0.000	−4.434***	−3.839***
	(4.23)	(0.02)	(−28.06)	(−25.32)
Excess $_{t-1}$	−0.039***	−0.019***	0.053*	−0.130***
	(−13.58)	(−7.04)	(1.71)	(−4.35)
Leverage $_{t-1}$	0.728***	0.779***	−6.911***	−7.378***
	(35.37)	(36.30)	(−35.79)	(−37.00)
Size $_{t-1}$	0.087***	0.070***	−0.599***	−0.442***
	(18.64)	(14.84)	(−14.13)	(−10.31)
Tangibility $_{t-1}$	−0.013	−0.004	0.001	−0.096
	(−0.79)	(−0.21)	(0.00)	(−0.54)
Current $_{t-1}$	0.012***	0.013***	−0.095***	−0.105***
	(18.21)	(19.48)	(−14.27)	(−15.65)
MTB $_{t-1}$	−0.009***	−0.012***	0.084***	0.111***
	(−11.42)	(−14.32)	(10.78)	(13.85)
Age $_{t-1}$	0.011**	0.009	−0.036	−0.010
	(2.11)	(1.62)	(−0.80)	(−0.22)
Time fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Constant	−2.424***	−1.761***	23.216***	17.154***
	(−21.20)	(−15.98)	(22.97)	(17.72)
N	99,528	99,528	99,528	99,528
R^2_adjusted	0.754	0.749	0.637	0.632

The table presents the panel analysis of stock liquidity on firm default risk. The firm default risk is measured by *EDF* and *DD,* respectively, and both are calculated based on Merton (1974). The full sample period is from the first quarter of 2003 to the end of 2017, and the sample consists of all non-financial firms listed on the Shanghai and Shenzhen Stock Exchanges during this period. The Liquidity measures include *RQS* and *Zeros*. Control variables comprise *ROA*, *Volatility*, *Excess* return, *Leverage*, firm *Size*, *Tangibility* ratio, *Current* ratio, *MTB*, and *Age*. Both firm and quarter fixed effects are controlled in all regressions;, and standard errors are clustered at the firm level. The t statistics in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4
The informational efficiency channel (learning channel).

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔEDF	*ΔEDF*	*ΔEDF*	*ΔDD*	*ΔDD*	*ΔDD*
ΔAuto	−0.001			−0.040		
	(−0.17)			(−1.18)		
ΔDelay1		0.001			−0.062***	
		(0.36)			(−3.27)	
ΔDelay2			−0.002			−0.060**
			(−0.50)			(−2.23)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.005	0.005	0.005	−0.019	−0.019	−0.019
	(1.05)	(1.06)	(1.05)	(−0.50)	(−0.52)	(−0.51)
N	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.376	0.376	0.376	0.358	0.358	0.358

The table reports the panel regression results with *ΔEDF* as the dependent variable in Columns (1)–(3) and *ΔDD* as the dependent variable in Columns (4)–(6). Δ presents the change of variables between two adjacent periods. To maintain consistency with the governance channel analysis for subsequent comparisons, this table reports the results based on semiannual data. The findings remain robust when the regressions are conducted using quarterly data. *Auto* is the six-month average of the absolute value of autocorrelation calculated weekly from daily trading data. *Delay1* is 1-(R-squared of the restricted model/R-squared of the nonrestricted model), while *Delay2* takes the lags into consideration. All the metrics of *Auto*, *Delay1*, and *Delay2* are inverse indicators of informational efficiency. That is, higher *Auto*, *Delay1,* and *Delay2* imply lower informational efficiency of firm stocks. The differences in efficiency metrics between two adjacent periods are adopted as the independent variables. Other control variables are the differences in *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, *lnE*, *lnD*, and *TobinQ* between adjacent periods. The models control for both firm and time fixed effects in all regressions, and standard errors are clustered at the firm level. The t-statistics are presented in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5
The governance channel.

	Type II agency problem				Type I agency problem			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔEDF	*ΔEDF*	*ΔDD*	*ΔDD*	*ΔEDF*	*ΔEDF*	*ΔDD*	*ΔDD*
ΔBalance	−0.013***		0.075***					
	(−3.76)		(2.71)					
ΔTop1		0.070***		−0.297*				
		(3.05)		(−1.67)				
ΔBlock					0.003		0.111	
					(0.19)		(0.78)	
ΔNBlock						−0.006***		0.036***
						(−3.67)		(2.59)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.004	0.005	−0.017	−0.020	0.005	0.004	−0.017	−0.016
	(1.00)	(1.15)	(−0.46)	(−0.54)	(1.06)	(0.95)	(−0.46)	(−0.43)
N	47,049	47,049	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.377	0.377	0.358	0.358	0.376	0.377	0.358	0.358

The table reports the panel regression results with *ΔEDF* as the dependent variable in Columns (1)–(4) and *ΔDD* as the dependent variable in Columns (5)–(8). Δ presents the change of variables between two adjacent periods. Due to differences in disclosure requirements, the governance indicators are reported in semiannual and annual reports; therefore, we use semiannual data for the governance channel tests. *Balance* is the shareholding ratio of the 2nd to 10th largest shareholder divided by the shareholding ratio of the first majority shareholder, so a higher *Balance* implies better corporate governance. Comparatively, *Top1* captures the shareholding proportion for the first majority shareholder, and a larger *Top1* can improve governance by monitoring management more effectively. However, majority shareholders are commonly controlling shareholders in China, and higher shareholding of *Top1* shareholders also results in tunneling and expropriation, which damages the interests of minority stockholders. *Block* is the aggregate percentage ownership of blockholders who hold at least 5 % of total common shares at the end of the term, and *NBlock* is the number of these block shareholders. Increasing blockholder ownership can improve corporate governance via the threat of exit. The differences in governance metrics between two adjacent periods are adopted as the independent variables. Other control variables are the differences in *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, and *TobinQ* between adjacent periods. The models control for both firm and time fixed effects in all regressions, and standard errors are clustered at the firm level. The t-statistics are presented in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

both channels, the absolute values of the governance coefficients are greater than that of informational efficiency. This implies that the governance channel has greater explanatory power than the efficiency channel. Thus, the corporate governance channel dominates the relationship between stock liquidity and default risk in China.

The results regarding the efficiency metric of *Delay1* are presented in Panel B, demonstrating that the efficiency metric coefficients using *zee_ΔDD* as the independent variable remain significantly negative, indicating the *Delay1* channel has stronger explanatory power than the corporate governance channel. However, when using *zee_ΔEDF* as the independent variable, the corporate governance channel remains more explanatory, while the coefficients of *zee_ΔDelay1* are insignificant.

Similarly, Panel C reports opposite results for *zee_ΔEDF* and *zee_ΔDD*. When *zee_ΔDD* is the explained variable, the coefficients of *Delay2* are significant at the 5 % level, which shows that *Delay2* has larger explanatory power than governance metrics other than *Balance*. When *zee_ΔEDF* is the explained variable, the coefficients of *Delay2* remain insignificant, which means the governance channel dominates.

The results in Panel D also enable us to compare two types of agency problems. The models include *Delay1* to control the efficiency channel after standardization, and it is evident that both agency problems exist. However, the Type II agency conflicts dominate, except when comparing the results of *Top1* and *NBlock* in Columns (4) and (8) in Panel D.

In general, Panel A shows an absolute advantage of the governance channel, while the results in Panel B and Panel C vary with different default risk metrics. In most cases, the corporate governance metrics have larger coefficients of absolute value, and the governance issue focuses on the Type II agency problem – the conflicts of interest between the controlling shareholder and minority shareholders. Thus, the corporate governance channel dominates the liquidity-default risk relationship, aligning with Hypothesis 3a and rejecting Hypothesis 3b. Moreover, the inconsistent results verify that the channels under the established relationship between liquidity and default risk in China differ from those in the US. This also implies that researchers need to focus more on Chinese markets. Furthermore, the pervasive state ownership in China should be the most noteworthy feature, which leads to a unique ownership structure and governance problems. In turn, the price efficiency channel is affected as well.

In conclusion, the unstable significance of the informational efficiency channel implies that managers in Chinese listed firms learn from stock prices to some extent, but the corporate governance channel dominates the underlying mechanism between stock liquidity and default risk, which is contrary to Brogaard et al. (2017). More specifically, the governance quality of the conflicts of interest between the controlling and minority shareholders has the most significant impact. This difference in influence mechanism can be attributed to the differences in the validity of managers' learning hypotheses and the development of corporate governance, both of which are affected by the unique characteristics of SOEs. Therefore, it is possible to explore how state ownership influences the relationship between stock liquidity and firm default risk in the context of prevailing SOEs in China.

Table 6
The relative importance of different channels.

Panel A: Auto vs. governance metrics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	zee_ΔEDF	*zee_ΔEDF*	*zee_ΔEDF*	*zee_ΔEDF*	*zee_ΔDD*	*zee_ΔDD*	*zee_ΔDD*	*zee_ΔDD*
zee_ΔAuto	−0.001	−0.001	−0.001	−0.001	−0.005	−0.005	−0.005	−0.005
	(−0.18)	(−0.18)	(−0.17)	(−0.19)	(−1.17)	(−1.18)	(−1.18)	(−1.17)
zee_ΔBalance	−0.018***				0.012***			
	(−3.76)				(2.71)			
zee_ΔTop1		0.015***				−0.007*		
		(3.05)				(−1.67)		
zee_ΔBlock			0.001				0.003	
			(0.19)				(0.77)	
zee_ΔNBlock				−0.016***				0.011***
				(−3.67)				(2.58)
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.001***	0.001***	0.001***	0.001***	−0.000**	−0.000**	−0.000**	−0.000**
	(6.29)	(6.28)	(6.27)	(6.26)	(−2.46)	(−2.46)	(−2.44)	(−2.44)
N	47,049	47,049	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.377	0.377	0.376	0.377	0.358	0.358	0.358	0.358

Panel B: Delay1 vs. governance metrics.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	zee_ΔEDF	*zee_ΔEDF*	*zee_ΔEDF*	*zee_ΔEDF*	*zee_ΔDD*	*zee_ΔDD*	*zee_ΔDD*	*zee_ΔDD*
zee_ΔDelay1	0.002	0.002	0.002	0.001	−0.015***	−0.016***	−0.015***	−0.015***
	(0.35)	(0.44)	(0.36)	(0.31)	(−3.27)	(−3.31)	(−3.25)	(−3.25)
zee_ΔBalance	−0.018***				0.012***			
	(−3.76)				(2.71)			
zee_ΔTop1		0.015***				−0.008*		
		(3.06)				(−1.73)		
zee_ΔBlock			0.001				0.003	
			(0.20)				(0.68)	
zee_ΔNBlock				−0.016***				0.010**
				(−3.67)				(2.55)
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.001***	0.001***	0.001***	0.001***	−0.000**	−0.000**	−0.000**	−0.000**
	(6.26)	(6.25)	(6.24)	(6.23)	(−2.27)	(−2.27)	(−2.26)	(−2.26)
N	47,049	47,049	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.377	0.377	0.376	0.377	0.359	0.358	0.358	0.359

Panel C: Delay2 vs. governance metrics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	zee_ΔEDF	*zee_ΔEDF*	*zee_ΔEDF*	*zee_ΔEDF*	*zee_ΔDD*	*zee_ΔDD*	*zee_ΔDD*	*zee_ΔDD*
zee_ΔDelay2	−0.002	−0.002	−0.002	−0.002	−0.010**	−0.010**	−0.010**	−0.010**
	(−0.51)	(−0.44)	(−0.50)	(−0.55)	(−2.22)	(−2.26)	(−2.21)	(−2.20)
Zee_ΔBalance	−0.018***				0.012***			
	(−3.77)				(2.71)			
zee_ΔTop1		0.015***				−0.008*		
		(3.05)				(−1.71)		
zee_ΔBlock			0.001				0.003	
			(0.18)				(0.72)	
zee_ΔNBlock				−0.016***				0.010**
				(−3.68)				(2.56)
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.001***	0.001***	0.001***	0.001***	−0.000**	−0.000**	−0.000**	−0.000**
	(6.30)	(6.29)	(6.28)	(6.27)	(−2.29)	(−2.28)	(−2.27)	(−2.27)
N	47,049	47,049	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.377	0.377	0.376	0.377	0.358	0.358	0.358	0.358

(*continued on next page*)

Table 6 (*continued*)

Panel D: Type I vs. Type II agency problem metrics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	zee_dEDF	*zee_dEDF*	*zee_dEDF*	*zee_dEDF*	*zee_dDD*	*zee_dDD*	*zee_dDD*	*zee_dDD*
zee_dDelay1	0.002	0.001	0.002	0.002	−0.015***	−0.015***	−0.015***	−0.015***
	(0.36)	(0.32)	(0.39)	(0.39)	(−3.25)	(−3.25)	(−3.27)	(−3.28)
zee_dbalance	−0.018***	−0.014***			0.012***	0.009*		
	(−3.77)	(−2.59)			(2.68)	(1.87)		
zee_dTop1			0.019***	0.012**			−0.012**	−0.005
			(3.54)	(2.33)			(−2.34)	(−1.19)
zee_dBlock	0.002		−0.009*		0.002		0.009*	
	(0.41)		(−1.71)		(0.52)		(1.82)	
zee_dNBlock		−0.009*		−0.012***		0.006		0.009**
		(−1.95)		(−2.86)		(1.36)		(2.16)
Controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.001***	0.001***	0.001***	0.001***	−0.000**	−0.000**	−0.000**	−0.000**
	(6.26)	(6.25)	(6.25)	(6.24)	(−2.27)	(−2.27)	(−2.27)	(−2.26)
N	47,049	47,049	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.377	0.377	0.377	0.377	0.359	0.359	0.359	0.359

These tables report the panel regression results with *zee_ΔEDF* as the dependent variable in Columns (1)–(4) and *zee_ΔDD* as the dependent variable in Columns (5)–(8). Δ presents the change of variables between two adjacent periods. *ΔEDF* and *ΔDD* are standardized by subtracting their mean value and dividing the difference by the standard deviation, respectively, after which *zee_ΔEDF* and *zee_ΔDD* are produced. Similarly, all the independent variables are standardized in this way. Hence, the coefficients can be interpreted as the impact of a standard deviation variation in the independent variables on the dependent variable in the form of a standard deviation change. All channel metrics referred to in the above are contained here. Specifically, informational efficiency metrics contain *Auto*, *Delay1*, and *Delay2*, while governance metrics contain *Balance*, *Top1*, *Block*, and *NBlock*. Panel A compares *Auto* to governance metrics, and then Panel B and Panel C present comparisons of *Delay1* and *Delay2* to governance metrics, respectively. Finally, Panel D compares two types of agency problems using *Delay1* as an efficiency control. Other control variables are the standardized differences of *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, and *TobinQ* between adjacent periods. The models control for both firm and time fixed effects in all regressions, and standard errors are clustered at the firm level. The t-statistics are presented in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.4. *The moderating role of state ownership*

To explore how state ownership affects the relationship between liquidity and default risk, the results following Eq. (2.4) are reported in Table 7. In the results using *EDF* as the independent variable, the cross-terms of liquidity metrics and *SOE* are significantly (at 1 % level) negative, indicating a weakening effect of state ownership on the relationship between liquidity and default risk. The results using *DD* highlight that the coefficients of interaction terms are positive and statistically significant at the 1 % level. Combined with the negative coefficient of liquidity metrics, the results further verify the weakening effects of state ownership on the relationship between liquidity and default risk. Given these results, it can be concluded that the nature of state ownership weakens the relationship between liquidity and default risk in Chinese stock markets.[4] These findings confirm Hypothesis 4, demonstrating that state ownership weakens the liquidity-default risk relationship in China.

4.5. *How does state ownership affect the channels between liquidity and firm default?*

This study also explores how state ownership affects the informational efficiency channel and corporate governance channel between liquidity and default risk, and the results are shown in Table 8 and Table 9.

Table 8 presents how state ownership affects the informational efficiency channel. Although the results in Columns (1) and (4) are insignificant, the results in Columns (2), (3), (5), and (6) indicate that state ownership strengthens the relationship between informational efficiency and default risk. This means that management in SOEs can learn more effectively from the stock markets compared to non-SOEs, thereby rejecting Hypothesis 5. In China, SOEs are subject to stricter disclosure requirements and greater public scrutiny, which enhance price informativeness and facilitate managerial learning. The market-oriented reforms and performance-linked incentives align managerial interests with shareholder value, further encouraging managers to rely on stock prices for investment decisions. Consequently, managers in Chinese SOEs are more likely to extract useful information from prices, which can help reduce firm default risk.

The influence of state ownership on the governance channel is reported in Table 9, which includes results using different

[4] In addition to the two primary liquidity measures, we also employ the widely used Amihud illiquidity ratio (Amihud, 2002) as an alternative measure of stock liquidity to conduct robustness checks. The results using the Amihud measure are broadly consistent with our main findings, confirming that the observed relationships are not driven by the specific liquidity metrics chosen.

Table 7
The influence of state ownership on the relationship between liquidity and default risk.

Dependent variable	EDF		DD	
	(1)	(2)	(3)	(4)
RQS $_{t-1}$	0.118***		−1.023***	
	(17.79)		(−15.28)	
Zeros $_{t-1}$		0.742***		−6.865***
		(15.04)		(−11.32)
SOE $_{t-1}$	0.102***	−0.002	−0.762***	−0.131
	(4.58)	(−0.25)	(−3.53)	(−1.61)
SOE $_{t-1}$*RQS $_{t-1}$	−0.040***		0.293***	
	(−5.43)		(4.19)	
SOE $_{t-1}$*Zeros $_{t-1}$		−0.559***		8.929***
		(−7.64)		(9.68)
Controls	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Constant	−2.439***	−1.757***	23.339***	17.206***
	(−21.15)	(−15.92)	(22.94)	(17.77)
N	99,528	99,528	99,528	99,528
R^2_adjusted	0.755	0.749	0.637	0.633

The table presents panel regression results examining the moderating role of state ownership on the relationship between stock liquidity and default risk. The firm default risk is measured by *EDF* and *DD,* respectively, and both are calculated based on Merton (1974). The full sample period is from the first quarter of 2003 to the end of 2017, and the sample consists of all non-financial firms listed on the Shanghai and Shenzhen Stock Exchanges during this period. The Liquidity measures include *RQS* and *Zeros*. *SOE* is a dummy variable equal to 1 if the firm is state-owned and 0 otherwise. Control variables comprise *ROA*, *Volatility*, *Excess* return, *Leverage*, firm *Size*, *Tangibility* ratio, *Current* ratio, *MTB*, and *Age*. Both firm and quarter fixed effects are controlled in all regressions, and standard errors are clustered at the firm level. The t-statistics are presented in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 8
Informational channel with SOEs.

	(1)	(2)	(3)	(4)	(5)	(6)
	ΔEDF	ΔEDF	ΔEDF	ΔDD	ΔDD	ΔDD
ΔAuto	0.002			−0.201**		
	(0.34)			(−2.48)		
ΔDelay1		0.002			0.039	
		(0.85)			(1.20)	
ΔDelay2			−0.004			−0.028
			(−1.47)			(−0.73)
SOE	−0.002**	−0.001**	−0.001**	0.039***	0.038***	0.038***
	(−2.41)	(−2.16)	(−2.23)	(4.08)	(4.02)	(3.97)
SOE*ΔAuto	−0.003			0.146		
	(−0.39)			(1.26)		
SOE*ΔDelay1		0.011***			−0.091**	
		(3.86)			(−2.14)	
SOE*ΔDelay2			0.018***			−0.130**
			(5.47)			(−2.56)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.002***	0.002***	0.002***	−0.029***	−0.028***	−0.028***
	(3.77)	(3.68)	(3.71)	(−4.01)	(−3.92)	(−3.88)
N	96,729	96,647	96,647	96,729	96,647	96,647
R^2_adjusted	0.306	0.306	0.306	0.340	0.340	0.340

The table reports the panel regression results with *ΔEDF* as the dependent variable in Columns (1)–(3) and *ΔDD* as the dependent variable in Columns (4)–(6). Δ presents the change of variables between two adjacent periods. *Auto* is the quarterly average of the absolute value of autocorrelation calculated weekly from daily trading data. *Delay1* is 1-(R-squared of the restricted model/R-squared of the nonrestricted model), while *Delay2* takes the lags into consideration. All the metrics of *Auto*, *Delay1*, and *Delay2* are inverse indicators of informational efficiency. That is, higher *Auto*, *Delay1,* and *Delay2* imply lower informational efficiency of firm stocks. The differences in efficiency metrics between two adjacent periods are adopted as the independent variables. Other control variables are the differences in *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, and *TobinQ* between adjacent periods. The models control for both firm and time (semi-annual) fixed effects in all regressions, and standard errors are clustered at the firm level. The t-statistics are presented in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 9
Corporate governance channel with SOEs.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	ΔEDF	*ΔEDF*	*ΔEDF*	*ΔEDF*	*ΔDD*	*ΔDD*	*ΔDD*	*ΔDD*
ΔBalance	−0.006***				0.078			
	(−2.72)				(1.16)			
ΔTop1		0.001***				−0.006		
		(3.99)				(−1.24)		
ΔBlock			0.001***				−0.015***	
			(5.69)				(−3.59)	
NBlock				0.002				−0.067*
				(0.82)				(−1.75)
SOE	0.001	0.001	0.001	0.001	0.013	0.012	0.011	0.014
	(0.92)	(1.51)	(1.61)	(1.51)	(0.86)	(0.78)	(0.74)	(0.99)
SOE*ΔBalance	0.000				0.119			
	(0.23)				(1.45)			
SOE*ΔTop1		−0.000				0.001		
		(−1.01)				(0.16)		
SOE*ΔBlock			−0.001***				0.012**	
			(−3.30)				(2.25)	
SOE*ΔNBlock				−0.006**				0.059
				(−2.15)				(1.29)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	−0.001	−0.001	−0.001	−0.000	0.053***	0.052***	0.051***	0.045***
	(−1.47)	(−1.56)	(−1.50)	(−1.72)	(4.26)	(4.15)	(4.07)	(3.72)
N	47,049	47,049	47,049	47,049	47,049	47,049	47,049	47,049
R^2_adjusted	0.266	0.267	0.267	0.293	0.363	0.363	0.363	0.366

The table reports the panel regression results with *ΔEDF* as the dependent variable in Columns (1)–(4) and *ΔDD* as the dependent variable in Columns (5)–(8). Δ presents the change of variables between two adjacent periods. *Balance* is the shareholding ratio of the 2nd to 10th largest shareholder divided by the shareholding ratio of the first majority shareholder, so a higher *Balance* implies better corporate governance. Comparatively, *Top1* captures the shareholding proportion for the first majority shareholder, and a larger *Top1* can improve governance by monitoring management more effectively. However, majority shareholders are commonly controlling shareholders in China, and higher shareholding of *Top1* shareholders also results in tunneling and expropriation, which damages the interests of minority stockholders. *Block* is the aggregate percentage ownership of blockholders who hold at least 5 % of total common shares at the end of the term, and *NBlock* is the number of these block shareholders. Both *Block* and *NBlock* are positively related to corporate governance via the threat of exit. The differences in governance metrics between two adjacent periods are adopted as the independent variables. Other control variables are the differences in *ROA*, *Volatility*, *Excess*, *Leverage*, *Size*, *Tangibility*, *Current*, *MTB*, *Age*, and *TobinQ* between adjacent periods. The models control for both firm and time (semi-annual) fixed effects in all regressions, and standard errors are clustered at the firm level. The t-statistics are presented in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

governance metrics. Contrary to the informational efficiency channel, state ownership weakens the relationship between corporate governance and default risk for results when *Block* and *NBlock* are used as proxies, while results using other corporate governance metrics show insignificant coefficients for cross terms. That is, the effects of governance changes on controlling-minority agency issues for SOEs do not significantly differ from those for non-SOEs. Therefore, only the governance channel regarding the Type I agency problem is significantly influenced by state ownership. These findings illustrate how state ownership shapes the governance channel in Chinese firms. State ownership weakens the impact of governance mechanisms captured by Block and NBlock, while other governance measures remain largely unaffected. Higher stock liquidity enhances the governance effect through the threat of blockholder exit, but this mechanism is weakened in SOEs. Administrative intervention and policy objectives reduce management's sensitivity to shareholder exit threats, while soft budget constraints further insulate managers from the disciplining effect of blockholder actions. As a result, even with higher stock liquidity, the governance channel through blockholder exit is less effective, reducing the marginal impact of liquidity on default risk and supporting Hypothesis 6.

The empirical results show that state ownership strengthens the relationship between informational efficiency and default risk, which means that management in SOEs can learn more effectively from the stock markets than in non-SOEs. However, state ownership weakens the relationship between corporate governance and default risk for results using *Block* and *NBlock* to proxy for governance, while other results are insignificant. As a consequence, the existence of state ownership strengthens the informational efficiency channel but weakens the corporate governance channel. Combined with the results that state ownership weakens the relationship between liquidity and default risk as a whole, it can be concluded that since the governance effect dominates, state ownership ultimately reduces liquidity's role in mitigating default risk.

5. Conclusion

5.1. Summary of findings

This study examines the relationship between stock liquidity and default risk in Chinese-listed firms, specifically focusing on the moderating role of state ownership. Using quarterly stock trading and corporate financial data from 2003 to 2017, our empirical results confirm that increased stock liquidity significantly reduces default risk, consistent with prior findings in international markets.

However, in contrast to the U.S. and other developed markets, where informational efficiency (learning channel) plays a dominant role (Brogaard et al., 2017), we find that in China, the corporate governance channel is the primary mechanism through which liquidity mitigates default risk. This distinction underscores the unique institutional setting of China's capital markets, where ownership structures and governance mechanisms differ significantly from those in developed economies.

By employing panel regression models with lagged liquidity metrics, our results confirm that both the learning channel (enhanced informational efficiency) and the governance channel contribute to reducing default risk. However, the governance effect, particularly through mitigating Type II agency conflicts, is the dominant force. Furthermore, our findings reveal that state ownership weakens this relationship by diluting the effectiveness of governance improvements, ultimately reducing the risk-reducing benefits of stock liquidity.

While state ownership enhances informational efficiency, allowing SOE managers to extract more insights from stock prices, this benefit is outweighed by weaker governance mechanisms. As a result, state ownership strengthens the learning channel but weakens the governance channel, leading to an overall weaker relationship between liquidity and default risk.

5.2. Policy implications

The findings of this study offer significant implications for policymakers, regulators, and market participants, particularly in China and other emerging economies with a high prevalence of state ownership. Strengthening stock liquidity remains a crucial mechanism for reducing firm default risk by improving both informational efficiency and corporate governance. Policymakers should prioritize market-deepening initiatives, including the development of stronger regulatory frameworks, enhanced market infrastructure, and more transparent disclosure requirements. These measures would facilitate improved price discovery, enhance investor confidence, and enable firms to benefit from the risk-reducing effects of stock liquidity.

For SOEs, however, the benefits of stock liquidity are significantly weaker due to soft budget constraints and government-imposed strategic objectives. While increased liquidity enhances price informativeness and allows SOE managers to make better-informed decisions, these advantages are offset by governance structures that shield SOEs from external market discipline. The weak disciplinary effect of liquidity in SOEs underscores the need for corporate governance reforms to improve oversight mechanisms, strengthen board independence, and reduce excessive government intervention. Additionally, improving the transparency of government subsidies and clearly delineating commercial and policy-driven objectives in SOEs would help mitigate governance inefficiencies.

A balanced approach that enhances both informational efficiency and governance mechanisms is necessary to maximize the benefits of stock liquidity in reducing default risk. While SOEs gain some advantages from improved learning effects due to their privileged access to market information, these do not fully compensate for their weaker governance structures. Future regulatory efforts should focus on fostering a more robust governance framework while ensuring that SOEs can leverage market signals more effectively. Addressing these structural issues would contribute to a more stable and transparent financial system, particularly in economies where state intervention plays a central role in corporate decision-making.

CRediT authorship contribution statement

Lingling Zhao: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Vito Mollica:** Writing – review & editing, Supervision, Resources, Funding acquisition. **Yun Shen:** Writing – review & editing, Validation, Project administration, Methodology. **Qi Liang:** Supervision, Resources, Funding acquisition.

Author statement

We confirm that:

1)The manuscript is original and has not been published elsewhere, nor is it currently under consideration for publication by another journal.

2)All authors have contributed significantly to the work and have read and approved the final version of the manuscript.

3)There are no conflicts of interest to declare.

4)All data and analyses are performed in accordance with relevant ethical standards.

5)This paper is funded by Macquarie University, National Natural Science Foundation of China (Grant No. 71872127), and the Chinese National Funding of Social Sciences (Grant No. 24BJY194).

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