A Study of The Effect of Stock Liquidity on Enterprise Risk-Taking Level

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Abstract. Stock liquidity, as one of the important market characteristics of enterprises, not only affects the financing of listed enterprises, but also affects the risk decision of enterprise management, which in turn affects enterprise risk-taking level. In order to deeply explore the impact of stock liquidity on enterprise risk-taking level, this paper selects all the data of Shanghai and Shenzhen A-share listed companies from 2000 to 2023 in the Cathay Pacific CSMAR database as samples, and eliminates data from financial sector firms, and from companies designated as ST or ST*. Additionally, it excludes any instances where key financial metrics are incomplete or absent.After that, we carry out the descriptive statistics and correlation analysis of the samples, and conduct a analysis of the impact of stock liquidity on enterprise risk-taking level. Meanwhile, descriptive statistics and correlation analysis are carried out on the samples, and a two-way fixed-effects model regression is conducted around the impact of stock liquidity on enterprise risk-taking level, and lagged one period method, replacing the explained variables method and instrumental variables method are chosen to conduct the robustness test. Finally, it is concluded that stock liquidity is significantly positively correlated with enterprise risk-taking level, but there is no difference between the level of significance of the state-owned enterprises and that of the non-state-owned enterprises.And the conclusions obtained are robust.

Keywords: Stock Liquidity, Enterprise Risk-Taking Level, Two-Way Fixed Effects Regression Model, Robustness Test, Heterogeneity Test.

1. Introduction

At present, China's economic development environment of risk and uncertainty coexist, by the new crown epidemic, many enterprises operating worse, the development and survival of enterprises inevitably suffered a huge challenge, the enterprise risk-taking level also suffered different degrees of blow. The enterprise risk-taking level is one of the important factors affecting enterprise investment decision-making, will directly affect the accumulation of capital, business performance and development of enterprises and even survival. Because although the choice of investment in low-risk and low-yield projects can also improve business performance, promote enterprise capital accumulation, but investments in ventures that are both high-yield and high-risk have the potential to rapidly increase a company's value. Such investments can also expedite the advancement of technological innovation within the enterprise. This approach not only fosters sustainable growth for the business but also contributes to the broader community by generating substantial benefits.Therefore, enhancing enterprise risk-taking level can help to increase enterprise scale and promote enterprise development internally, and accelerate the upgrading and transformation of the whole industry externally, promote the sustainable growth of China's economy and enhance the overall welfare of the society.

In recent years, scholars have discussed and researched the ways to enhance enterprise risk-taking level in various aspects, including internal factors such as executive incentives, innovation inputs, corporate governance, and external factors such as industrial policies and economic development, and most importantly, stock liquidity as one of the important features of market microstructure. Stock liquidity is the barometer of the stock market, and the soundness and comprehensive growth of the capital market has an inestimable core value. The soundness and comprehensive growth of the capital

market has an inestimable core value, and also has a profound impact on the financing environment, investment decision and risk management of enterprises.

Therefore, this paper studies the impact of stock liquidity on enterprise risk-taking level in theory, practice and policy. The theoretical significance lies in the fact that it cannot only enrich the financial theory, but also expand the research on enterprise risk-taking level. The practical significance includes guiding corporate decision-making, optimising the allocation of resources in the financial market, and enhancing investor protection. The policy significance is that it provides a basis for policy making and promotes the opening up and internationalisation of financial markets.

Consequently, the present study concentrates on the lens of stock liquidity. It encompasses a comprehensive dataset of A-share companies listed on the Shanghai and Shenzhen stock exchanges, spanning the years 2000 to 2023. The objective is to delve into the interplay between stock liquidity and enterprise risk-taking level through the method of empirical analyses, and then provide a basis for enriching and improving the theoretical research and research in the field of enterprise risk-taking level. The study aims to delve into the interplay between stock liquidity and enterprise risk-taking level through empirical analysis, and to provide new perspectives and insights for enriching and improving the theoretical research and practical exploration of enterprise risk-taking level.

2. Literature review

2.1. Economic consequences of stock liquidity

By reading the literature,it is found that Can Huang and Qingtrans Jiang (2024) suggest that stock liquidity can affect the development of the firm through governance effect, information effect and short-sightedness effect.Among them, governance effect and information effect are the positive impacts of stock liquidity on firms, while short-sightedness effect is the negative impacts of stock liquidity on firms[1].

Governance effects, emphasising the governance effects of ‘voice’ (voting) and ‘exit threat’ (reduction of holdings) of large shareholders in firms with high stock liquidity. Chan Huang and Qingtrans Jiang (2024) analyse that, on the one hand, there is the ‘voice’ mechanism of large shareholders in firms with high stock liquidity, which reduces the buying cost of investors when the firm’s stock liquidity increases, and therefore facilitates the formation of multiple large shareholders, who will ‘speak out’ through the ‘voice’ mechanism. These multiple major shareholders will improve corporate governance by ‘speaking out’; on the other hand, it is the mechanism of ‘exit threat’ of major shareholders [1]. Chen, Y (2019) et al. argue that if the majority shareholders ‘exit’, it will send negative signals to the market, which will lead to the decline of corporate share price, so the majority shareholders can improve corporate governance by issuing the ‘exit threat’, and the exit cost of the majority shareholders is reduced when the stock When stock liquidity increases, the exit cost of major shareholders decreases, which makes the governance effect of ‘exit threat’ more credible [2].

Information effect, Can Huang and Qingtrans Jiang (2024) argue that when a firm’s stock liquidity increases, informed traders can better conceal their trading behaviours, thus incentivising investors to tap into the firm’s private information, which in turn solves the problem of information asymmetry between investors and firms [1]. Jiang,F and others (2017) argued that higher stock liquidity is prone to be more preferred by investors and can better motivate investors to dig into the private information of the company, while the informational effect of stock liquidity reduces the information asymmetry between investors and the company during the process of investors digging into the information of the company[3].

The short-sighted effect of institutional investors, Can Huang and Qingtang Jiang (2024) suggest that stock liquidity may also bring negative impacts on firms, when stock liquidity increases, the cost of entry and exit of institutional investors is lower, which may lead to the institutional investors become ‘quick in and quick out’ short-term investors. This may lead institutional investors to become ‘fast-in, fast-out’ short-term investors, and company managers may pursue short-term interests more than long-term interests in order to cater for short-sighted institutional investors[1].Chang,X and

others (2017)found that higher stock liquidity attracts more short-term institutional investors, which makes corporate managers hide negative news as much as possible to satisfy the preferences of these short-term institutional investors, and corporate management also chooses more projects with short-term benefits at the expense of long-term benefits[4].

2.2. Factors affecting enterprise risk-taking level

The enterprise risk-taking level reflects the enterprise's risk appetite for investment projects (Boubakri et al.,2013) [5], The lower the enterprise risk-taking level is, the more conservative the enterprise's investment preference is, and the more cautious its attitude towards investment is, and the reasonable and moderate enhancement of enterprise risk-taking level is crucial for the expansion and maturation of corporate entities. By reviewing the current body of literature, it becomes evident that the factors affecting enterprise risk-taking level Can be categorized into two distinct groups: intrinsic elements and extrinsic elements.

In terms of internal influences, Siyi Liu (2023) suggested that the internal factors of enterprise risk-taking level mainly include internal governance factors such as management characteristics and equity structure [6]. Lei Gao and others (2020) argue that multiple large shareholders can potentially affect enterprise risk-taking level in the course of business operations [7]. Meiying Wang and others (2020) pointed out that in the process of mixed ownership reform of state-owned enterprises, the existence of large shareholders can make the internal supervision and checks and balances on management further strengthened, which is conducive to improving the enterprise risk-taking level, and the stronger the supervisory ability of the other large shareholders, the more significant the positive effect is [8]. Rui Peng and others (2020) analysed that when SOEs implement a nuclearisation strategy, the investment efficiency of the firms will increase substantially, and the firms' investments will be biased towards high-risk projects, and their risk-taking level will also increase [9].

In terms of external influences, Siyi Liu (2023) argues that the main external factors of enterprise risk-taking level are macro policies, financial development, marketisation process and so on [6]. According to Heyang Han (2023), the external environment influences the enterprise risk-taking level factors mainly focus on the macroeconomic environment, government policy system and the external governance environment [10]. However, in addition to the influence of the macro-environment, banks, as an important source of credit funding channels for enterprises, Yue Cheng and Bo Li (2021) found that the level of competition among banks will have a positive effect on the enterprise risk-taking level of SMEs, and this process depends on the transmission of financing constraints [11]. Yilu Deng (2021) and others suggest that from a regulatory perspective, empirical analyses have tested that non-punitive regulation has a significant effect on enterprise risk-taking level, for example, the enterprise risk-taking level will increase after the issuance of financial reporting enquiry lags [12].

2.3. Literature comment

On the one hand, stock liquidity can affect the development of a company through governance effect, information effect and short-sightedness effect by combing the relevant literature. On the other hand, it can be found that the existing literature mainly researches and analyses the enterprise risk-taking level from the perspectives of enterprise external factors and enterprise internal factors, in which the enterprise external factors mainly include the macroeconomic environment, the governmental policy system and the external governance environment, while the enterprise internal factors mainly include the internal governance factors such as the management characteristics, the shareholding structure, and so on. The internal influences of firms mainly include management characteristics, equity structure and other internal governance factors. However, the investigations into the correlation between stock liquidity and enterprise risk-taking level is still not perfect, and there is little literature focusing directly on the association between stock liquidity and enterprise risk-taking level for in-depth analysis. Drawing from this foundation, the present study undertakes an empirical analysis to assess the influence of stock liquidity on enterprise risk-taking level, in order to

explore whether stock liquidity can really affect enterprise risk-taking level, as well as to analyse the direction of the impact and role.

3. Theoretical analysis and research hypothesis

3.1. Conceptual definition

3.1.1 Stock liquidity

Stock liquidity refers to the ease with which stocks can be bought and sold in the market, or the speed and ease with which stocks can be converted into cash. In more liquid markets, investors can buy and sell large quantities of stock quickly and cheaply without causing large price swings; conversely, in less liquid markets, buying and selling stock can be difficult and costly, and can cause large price swings [13].

3.1.2 Enterprise risk-taking level

Enterprise risk-taking level refers to the level of risk that an enterprise is willing and able to take in its business and investment decision-making process. The concept encompasses an enterprise's attitude to decision-making in the face of uncertainty, its ability to identify and assess risks, and its actual risk-taking behaviour and consequences [10].

3.2. Theoretical analysis

This paper argues that when stock liquidity is elevated, it will lead to a significant increase in the enterprise risk-taking level due to the sensitivities of the investment risk in the secondary market, the issuance cost of the stock, and the performance sensitivities of the management's compensation.

In terms of investment risk in the secondary market, higher stock liquidity reduces the cost of capital by lowering the amount of investment risk in the secondary market [14]. And a lower cost of capital leads to higher enterprise risk-taking level at different levels [15].

In terms of stock issuance costs, higher stock liquidity is associated with lower stock issuance costs. firms with lower stock liquidity are likely to have higher implied costs of external financing, such as higher bank investment fees and higher costs of equity [16]. However, if firms that are less constrained by financing have a higher tolerance for failure and favour risk-taking projects, which in turn increases the enterprise risk-taking level [17].

In terms of management's pay performance sensitivity, an increase in stock liquidity affects management's sensitivity to pay performance, making management more favourable to risk-taking projects, which in turn raises the enterprise risk-taking level [13]. Management incentives can motivate management to choose projects that take on more risk [18].

3.3. Research hypothesis

According to the existing literature and theoretical analysis, this paper analyses the possible impact of stock liquidity on enterprise risk-taking level as follows.

When stock liquidity increases, firstly, it will reduce the risk of investment in the secondary market, leading to the reduction of the cost of capital, and then the management will be more inclined to choose high-return, high-risk projects, and ultimately improve the enterprise risk-taking level; secondly, higher stock liquidity will reduce the issuance cost of stocks, reduce the constraints of enterprise financing, make the enterprise more tolerant to failure, and make the management prefer to take the risk, and finally improve the enterprise risk-taking level. reduce the constraint of enterprise financing, which makes the enterprise's tolerance of failure increase, and the management prefers to take risky projects, which finally leads to the increase of enterprise risk-taking level; finally, when the stock liquidity is increased, the managers will also have greater incentives to implement more risky investment projects in expectation of obtaining more returns, which makes the Finally, when stock liquidity increases, managers will also have greater incentives to implement riskier investment projects in the hope of obtaining more returns, thus increasing enterprise risk-taking level.

At the same time, in state-owned enterprises, executive salaries are subject to strict standards and ceiling restrictions, and equity incentives may have limited motivational effects on executives in state-owned enterprises, so they may negatively choose risky investment projects; on the contrary, in non-state-owned enterprises, executives have greater discretionary power, which is conducive to the implementation of equity incentives, and therefore executives in non-state-owned enterprises may have a greater preference for risk-taking projects, leading to the enterprise risk-taking level increases. Therefore, this paper argues that compared with state-owned enterprises, when stock liquidity is increased, the effect of stock liquidity of non-state-owned enterprises on the enhancement of enterprise risk-taking level may be more obvious from the perspective of management's pay performance sensitivity.

In light of the preceding theoretical discussions, this study proposes the following hypotheses:

H1: Stock liquidity is significantly and positively related to the enterprise risk-taking level.

H2: The positive effect of stock liquidity on enterprise risk-taking level is more significant for non-state-owned firms compared to state-owned firms.

4. Research design

4.1. Sample selection and data sources

In order to study the impact of stock liquidity on enterprise risk-taking level, for the empirical analysis, this study utilizes data from all A-share companies listed on China's SSE and the Shanghai Stock Exchange.Meanwhile in order to increase the amount of data and the reliability of the results, the time interval of this paper selects the period from 2000 to 2023. After that, this paper processed the aggregated data as follows:

(1) The sample of companies with ST or ST* was excluded;

(2) The sample of companies listed in the financial sector was excluded;

(3) Samples with missing values of the explanatory variables and explained variables are excluded;

Through the above series of processing, this study compiles a dataset encompassing 35,812 yearly financial records, derived from the annual reports of 4,088 publicly traded corporations. The financial information for these corporations was sourced exclusively from the Cathay Pacific CSMAR database.

4.2. Selection of variable indicators

4.2.1 Explanatory variable

Stock liquidity refers to the ease or difficulty of stock liquidity, which provides the basis for stock pricing in the stock market. stock liquidity in general will be considered comprehensively from four perspectives: market depth, elasticity, breadth and timeliness.

Yu Fang and Muya Su (2024) analysed various liquidity indicators suitable for China's stock market environment, and the results show that among the indicators for measuring stock market liquidity, the bid-ask spread indicator is not representative, and more suitable for China's environment is the Amihud indicator, which can be used as a representative measurement tool for stock market liquidity [19]. In view of this situation, this paper selects the Amihud indicator as the core explanatory variable, aiming to accurately assess the liquidity status of individual stocks in China's stock market.The Amihud measure is calculated by dividing a security's return by its trading volume across a specified timeframe, thereby assessing the stock price's responsiveness to changes in trading activity. Notably, significant price swings in a security's value are often indicative of heightened sensitivity to trading volume (i.e., sharp upward or downward movements) are reflected in a high Amihud indicator value, which usually implies that the stock is relatively illiquid; on the other hand, if the increase or decrease in the trading volume of a stock has little impact on the smoothness of the stock price, i.e., if the price fluctuates more gently, then the Amihud indicator is low, which signals that the stock has a relatively high level of stock liquidity[19].

4.2.2 Explained variable

The explained variable is enterprise risk-taking level, and relevant literature has proposed indicators to measure enterprise risk-taking level, including financial and operating performance indicators and market performance indicators, which are Earnings Volatility (Boubakri et al.,2013) [5] and volatility of equity returns (Min Zhang,2015) [20]. Therefore, this paper uses earnings volatility (Risk1) and stock return volatility (Risk2) as proxy variables for enterprise risk-taking level.

（1）Earnings Volatility (Risk1)

In order to mitigate the industry and cyclical effects, the firm's annual industry-adjusted profitability level Adj_ROA is first calculated, i.e., each firm's ROA by industry and by year minus the mean value of ROA in the same industry and in the same year; and then the standard deviation of the sample firms is calculated in rolling regressions with a five-year observation period, which is recorded as the enterprise risk- taking level, calculated as shown in equation (1) and equation (2).

$$Adj_ROA = \frac{EBIT_NET_{i,t}}{ASSET_{i,t}} - \frac{1}{X}\sum_{K=1}^{X}\frac{EBIT_NET_{i,t}}{ASSET_{i,t}} \tag{1}$$

$$Risk1_{i,t} = \sqrt{(\frac{1}{T-1}\sum_{t=1}^{T}(Adj_ROA_{i,t} - \sqrt{\frac{1}{T}\sum_{t=1}^{T}(Adj_ROA_{i,t})^2}} \mid T = 5 \tag{2}$$

（2）Stock Earnings Volatility (Risk2)

To mitigate the industry and cyclical effects, the firm's annual industry-adjusted earnings level Adj_ROE is first calculated, i.e., each firm's ROE by industry by year minus the average value of ROE in the same industry by year; and then the standard deviation of the sample firms is calculated in rolling regressions with a five-year observation period, which is recorded as the enterprise risk-taking level, calculated as shown in equation (3) and equation (4). In this paper, Risk2 is used as a replacement explained variable for robustness testing.

$$Adj_ROE = ROE_{i,t} - \frac{1}{X}\sum_{K=1}^{X}ROE_{i,t} \tag{3}$$

$$Risk2_{i,t} = \sqrt{(\frac{1}{T-1}\sum_{t=1}^{T}(Adj_ROE_{i,t} - \sqrt{\frac{1}{T}\sum_{t=1}^{T}(Adj_ROE_{i,t})^2}} \mid T = 5 \tag{4}$$

4.2.3 Control variable

Reference Heyang Han (2023)[10] and Qinqin Yan (2021)[13] et al. on the factors affecting the enterprise risk-taking level, this paper selects firm size, asset-liability ratio, Tobin's Q, capital intensity, cash ratio, ratio of ownership by the first largest shareholder, KZ index, net cash flow from operations, and cash holdings as the control variables for the various factors that may affect the enterprise risk -taking level, and All control variables are assessed the initial year of the sample, coinciding with the time of both earnings volatility and stock return volatility. The control variable are as follows:

Firm Size (Sales). Firm size is the natural logarithm of a firm's total assets, which to some extent represents its competitive advantage in the marketplace. The larger the firm in order to maintain and consolidate its position in the market tends to choose more risk-taking projects, so the larger the firm, enterprise risk-taking level is generally higher.

Asset-Liability Ratio (Lev). This term denotes the proportion of a company's total obligations relative to its total holdings, indicating the extent to which the assets safeguard against the fulfillment of financial obligations. Enterprises with higher asset-liability ratios may have a higher proportion of liabilities, so the proportion of owner's equity is lower, and it is difficult to support the supply of more funds in terms of capital flow, and the ability of the enterprise to repay its debts decreases, which may ultimately lead to a decrease in the enterprise risk-taking level.

Tobin’s Q (TuobinQ). The Tobin's Q ratio, which is calculated by dividing a company's market value by its total assets, serves as an indicator of corporate growth. If Tobin's Q that exceeds 1, which suggests that the market perceives the firm's value as inflated,shareholders are more optimistic about the development prospects of the enterprise, which is good information for the management of the enterprise, and the management will be more willing to undertake high-risk investment projects due to the positive signals brought by the market. Therefore, it is widely accepted that a higher Tobin’s Q will increase the enterprise risk-taking level.

Capital Intensity (Inten). Capital intensity refers to the ratio of fixed assets to total assets, reflecting the high degree of dependence on capital in an industry or production process. An increase in capital intensity is typically associated with elevated risk levels and, consequently, a higher cost of capital, the lower the current asset ratio and the lower the enterprise risk-taking level.

Cash Radio (Cash radio). Cash ratio refers to the sum of money funds and trading financial assets as a proportion of current liabilities, generally used to measure the liquidity of the enterprise’s assets. The higher the cash ratio, the higher the cash flow of the enterprise, the greater the ability to provide funds to the outside world, the greater the ability to repay the funds, and the greater the enterprise risk-taking level.

Shareholding Ratio of the first shareholder (Sh_First). The shareholding ratio of the first largest shareholder refers to the percentage of total shares held by the largest shareholder in the company, which can reflect the controlling power and control of the large shareholders in the company. The shareholding ratio of the first largest shareholder shows a negative correlation with enterprise risk-taking level, i.e., the higher the shareholding ratio of the first largest shareholder, the more the voice, and the higher the probability of making mistakes, which leads to a lower enterprise risk-taking level.

KZ Index (KZ). The KZ index is a financial indicator that is mainly used to measure the underlying profit or return risk of an asset. It consists of two components, the Kicker (K-value) and the Z-score (Z-value), where the K-value reflects the underlying earnings risk, and the Z-score measures the relationship between the asset’s price and the underlying earnings. assets with a high KZ-index usually imply a higher level of potential risk, resulting in a lower enterprise risk-taking level.

Operating Net Cash Flow (Cashflow). Operating net cashflow is the net amount of cash inflows less cash outflows generated by a company in its normal operating activities, reflecting the cash flows generated by the company’s operating activities, and is one of the most important indicators used to measure the financial health of a company. The higher the operating net cash flow, the stronger the ability to generate cash flow, the greater the ability to provide funds externally, the greater the ability to repay funds, and the higher the enterprise risk-taking level.

Cash Holding (Cash). Cash holdings refers to the ratio of the sum of the enterprise’s monetary funds and trading financial assets to the enterprise’s total assets, the more cash holdings of the enterprise, the more capital protection can be provided to upstream and downstream enterprises, the lower the risk of illiquidity faced by the enterprise, enterprise risk-taking level is also higher.

Table.1. Definition of variables

Variable type	Variable name	Variable symbol	Variable meaning
Explained variable	Earnings volatility	Risk1	Standard deviation of industry-adjusted ROA calculated on a rolling basis over t-t+5 years
	Stock earnings volatility	Risk2	Standard deviation of industry-adjusted ROE calculated on a rolling basis for years t-t+5
Explanatory variable	Indicators of illiquidity	Amihud	Equity return/Equity turnover
Control variable	Firm size	Sales	Ln (Total assets of the company at the end of the year)
	Asset-liability ratio	Lev	Total liabilities at end of period/Total assets at end of period
	Tobin's Q	TuobinQ	Market value/Total assets
	Capital intensity	Inten	Fixed assets/Total assets
	Cash radio	Cash radio	(Money funds + Financial assets held for trading)/Current liabilities
	Shareholding ratio of the first shareholder	Sh_First	Number of shares held by the largest shareholder / Number of shares held by all shareholders
	KZ index	KZ	Measuring the underlying profit or return risk of an asset
	Operating net cash flow	Cashflow	Operating cash inflow - Operating cash outflow
	Cash holding	Cash	(Money funds + Financial assets held for trading)/Total assets

4.3. Construction of the model

This paper focuses on the impact of stock liquidity on enterprise risk-taking level and constructs a two-way fixed effects regression model as shown in equation (5).

$$Risk1 = \beta_0 + \beta_1 Amihud_{i,t} + \gamma Controls_{i,t} + \delta Year_t + \theta Industry_i + \varepsilon_{i,t} \quad (5)$$

Where subscript i represents firms, subscript t represents year, Risk1 represents earnings volatility, Amihud represents illiquidity indicators, and Control represents control variables, including firm size (Sales), gearing (Lev), and capital intensity (Inten). In this paper, we use Year year fixed effects, Industry industry fixed effects to avoid the various situations in which individuals may change during the sample interval for the random error term. This paper focuses on the coefficient of stock illiquidity Amihud, if it is statistically significant less than 0, it means that the lower the enterprise stock illiquidity, the higher its enterprise risk-taking level, i.e., the higher the stock liquidity, the higher the enterprise risk-taking level, the hypothesis The hypothesis is valid.

5. Empirical analysis

In this paper, STATA16 software is uniformly used to process and analyse the data, selected from 2000-2023, involving 4088 companies and 35812 sample observations.

5.1. Descriptive statistics

Table 2 reports the results of descriptive statistics for all variables.

As can be seen from Table 2, the means of Risk1 and Risk2 are 0.099 and 0.35, respectively, and the standard deviations are 0.976 and 0.347, respectively, indicating that there is little fluctuation between the data, but both have a right-skewed tendency, which suggests that a small portion of the enterprise risk-taking level is relatively high, pulling up the overall sample enterprise risk-taking level.Compared with Risk2, Risk1 is more volatile, so it is necessary to use Risk2 for the stability test.

From the analysis of the descriptive results of the stock liquidity indicator, the mean value of the Amihud indicator is 0.433, the standard deviation is 5.632, the maximum value is 558.276, the minimum value is 0, the data difference is large, there is a clear rightward sloping situation, indicating that more enterprises are still trading in the downturn stage, the liquidity of this part of the enterprise needs to be improved, but at the same time there are also part of the enterprise Trading activities are more frequent, in general the fluctuation of Amihud indicator is within the controllable range.

Control variables can reflect the industry characteristics and enterprise characteristics of listed companies, in the selected sample, firm size (Sales), asset-liability ratio (Lev), KZ index (KZ) do not differ much, the sample distribution is relatively average. There is a greater degree of variation in other indicators, which suggests inconsistency in performance between different firms in terms of future development, earning capacity, and the stock of cash flow from activities in which the firm operates.

Overall, the stability of the sample data is relatively high and well represented.

Table.2. Results of descriptive statistics

Variable	Obs	Mean	Std.Dev.	Min	Max
Risk1	35812	0.099	0.976	0	62.263
Risk2	35812	0.35	0.347	0	14.264
Amihud	35812	0.433	5.632	0	558.276
Sales	35812	22.086	1.285	15.577	28.337
Lev	35812	0.44	0.216	0.007	9.699
TuobinQ	35812	2.047	2.471	0.625	259.146
Inten	35812	2.773	10.1	0	1538.881
Cash radio	35812	0.852	2.587	-0.611	218.783
Sh_First	35812	33.937	15.064	1.84	89.99
KZ	35812	1.712	2.892	-11.464	20.517
Cashflow	35812	7.57e+08	5.10e+09	-3.18e+10	2.25e+11
Cash	35812	1.89e+09	7.43e+09	44757.33	2.64e+11

5.2. Relevance analysis

Table 3 reports the correlation coefficients between all the variables in the main regression as a way of analysing the interrelationships between the variables.

It can be seen that the Amihud indicator and Risk1 are significantly negative at the 1% level, which initially shows that stock illiquidity is negatively correlated with enterprise risk-taking level, i.e. there is a positive correlation between stock liquidity on enterprise risk-taking level, i.e. a firm's stock liquidity is positively related to enterprise risk-taking level, i.e., the stronger stock liquidity is, the higher enterprise risk-taking level is.

For the control variables, enterprise risk-taking level and Tobin's Q (TuobinQ), KZ index are all significantly positive at the 10% level. When the above two indicators increase, enterprise risk-taking level will also increase. And both firm size (Sales) and shareholding of the first largest shareholder (Sh_First) are significantly negatively correlated with enterprise risk-taking level.

Regarding the results of this analysis, only the correlation between operating net cash flow (Cashflow) and cash holdings (Cash) is 0.584, and the correlation coefficients between all other variables are less than 0.5, which is in the reasonable range of interpretability, in order to further

judge whether there is a multicollinearity problem between the variables, this paper chooses the multicollinearity test.

Table.3. Correlation analysis results

Variables	Risk1	Amihud	Sales	Lev	Tuobin Q	Inten	Cash radio	Sh_First	KZ	Cashflow	Cash
Risk1	1.000										
Amihud	-0.048*(0.000)	1.000									
Sales	-0.023*(0.000)	-0.042*(0.000)	1.000								
Lev	0.008(0.111)	-0.063*(0.000)	0.369*(0.000)	1.000							
Tuobin Q	0.020*(0.000)	0.015*(0.005)	-0.244*(0.000)	-0.113*(0.000)	1.000						
Inten	0.004(0.495)	-0.011*(0.034)	-0.008(0.135)	0.007(0.190)	0.005(0.381)	1.000					
Cash radio	-0.003(0.595)	0.018*(0.001)	-0.134*(0.000)	-0.311*(0.000)	0.064*(0.000)	0.019*(0.000)	1.000				
Sh_First	-0.016*(0.003)	-0.005(0.337)	0.142*(0.000)	0.042*(0.000)	-0.093*(0.000)	-0.022*(0.000)	0.004(0.448)	1.000			
KZ	0.013*(0.014)	-0.082*(0.000)	-0.058*(0.000)	0.575*(0.000)	-0.003(0.543)	0.040*(0.000)	-0.255*(0.000)	-0.006(0.236)	1.000		
Cashflow	-0.006(0.246)	-0.011*(0.030)	0.349*(0.000)	0.060*(0.000)	-0.030*(0.000)	-0.012*(0.023)	-0.021*(0.000)	0.091*(0.000)	-0.070*(0.000)	1.000	
Cash	-0.004(0.487)	-0.032*(0.000)	0.477*(0.000)	0.124*(0.000)	-0.047*(0.000)	-0.006(0.257)	-0.014*(0.008)	0.068*(0.000)	-0.064*(0.000)	0.584*(0.000)	1.000

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; robust values adjusted for heteroskedasticity are in parentheses.

5.3. Multi-collinearity analysis

Table 4 reports the results of the multicollinearity test.

In order to specifically determine whether there is a problem of multicollinearity between the variables, a multicollinearity test was conducted between the explanatory variables and all the control variables. As can be seen from Table 4, none of the VIF values exceed 5, indicating that there is no multicollinearity between all variables.

Table.4. Results of multiple covariance test

Variable	VIF	1/VIF
Lev	2.03	0.492280
Sales	1.78	0.561651
Cash	1.75	0.570479
KZ	1.75	0.572588
Cashflow	1.54	0.648158
Cash radio	1.13	0.887666
TuobinQ	1.08	0.929006
Sh_First	1.03	0.971936
Amihud	1.01	0.990596
Inten	1.00	0.996601
Mean VIF	1.41	

5.4. Hausman test

Table 5 reports the results of the Hausman test.

Before using the fixed effects regression model, the Hausman test was performed to determine whether to choose the fixed effects model or the random effects model. As can be seen in Table 5, the coefficient of Hausman test is 15.77 and its p-value is equal to 0.0458, which is significant at the statistical level of 5 per cent, indicating that it passes the endogeneity test, and therefore, this paper chooses to use the fixed effects regression model.

Table.5. Hausman test results

	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) Std.err.
Amihud	-0.03671	-0.0330192	-0.0036908	0.0024908
Sales	-0.0171027	-0.019664	0.0025613	0.0021558
Lev	0.0838509	0.101943	-0.018092	0.0142808
TuobinQ	0.0037787	0.0047852	-0.0010065	0.0008406
Inten	-0.0000334	-0.0000672	0.0000338	0.0001664
Cash radio	-0.0004678	-0.0002625	-0.0002053	0.0008539
Sh_First	-0.0003686	-0.0007289	0.0003603	0.0001331
KZ	-0.004308	-0.0018249	0.0013942	0.0009602
Cashflow	9.04e-14	-3.89e-13	4.79e-13	5.45e-13
Cash	8.14e-13	1.14e-12	-3.03e-13	4.15e-13
Hausman test statistic			15.77	
Hausman test p-value			0.0458	

5.5. Two-way fixed effects regression model

Table 6 reports the main regression results.

This paper uses Amihud indicator, Risk1 indicator, and all control variables to conduct empirical tests according to equation (5), and the regression results are shown in Table 6. From Table 6, it can be seen that the main explanatory variable, Amihud indicator, is significantly negative at 1% level with enterprise risk-taking level; which suggests that firm's stock liquidity will significantly positively affect the enterprise risk-taking level, which supports hypothesis H1.

As shown in Table 6, among the control variables, asset-liability ratio (Lev) and enterprise risk-taking level are significantly positive at the 5% level, i.e., the higher the asset-liability ratio is, the higher the enterprise risk-taking level is, and the enterprise will be able to take more risks in the future; TuobinQ is also significantly positive at the 10% level, which indicates that enterprise risk-taking level will be positively affected by stock liquidity. TuobinQ is also significantly positive with enterprise risk-taking level at 10% level, which means that when the enterprise value is overvalued, the enterprise will have more investment opportunities and funds for risky investment.

Table.6. Main regression results

	Risk1
Amihud	-0.035*** (-8.917)
Sales	-0.025*** (-4.708)
Lev	0.083** (2.454)
TuobinQ	0.004* (1.889)
Inten	0.000 (0.434)
Cash radio	-0.001 (-0.566)
Sh_First	-0.000 (-0.622)
KZ	-0.001 (-0.538)
Cashflow	0.000 (0.237)
Cash	0.000 (1.033)
_cons	0.714*** (6.280)
N	35812
R^2	0.004
F	11.526

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; robust values adjusted for heteroskedasticity are in parentheses.

5.6. Robustness test

In exploring the association between stock liquidity and enterprise risk-taking level, there is a need to be alert to potential endogeneity issues.The problem of reverse causality is particularly common: does higher stock liquidity contribute to higher enterprise risk-taking level, or do firms with higher enterprise risk-taking level cause higher stock liquidity, and there may also be measurement errors and possible omission of key variables. In view of this, this paper employs the lagged one-period,

substitution of explained variable and instrumental variables methods to test for the existence of endogeneity.

5.6.1 Lag one phase

Table 7 reports the lagged one-period regression results.

Enterprise risk-taking level generally refers to long-term, future, high-return risky investment activities, the effect of stock liquidity on enterprise risk-taking level may have a strong relative lag, in order to further mitigate the possible reverse causality problem between stock liquidity and In order to further mitigate the possible reverse causality problem between stock liquidity and enterprise risk-taking level, this paper uses lagged one-period stock liquidity (Lamihud) to conduct the robustness test, and the results are shown in Table 7. It can be seen that the lagged one-period stock illiquidity indicator is also significantly negative at the 1% level with enterprise risk-taking level, which can be determined that the conclusion is more robust, and the improvement of stock liquidity can improve the future enterprise risk-taking level.

Table.7. Lagged one-period regression results

	Risk1
Lamihud	-0.034*** (-7.241)
Sales	-0.023*** (-3.559)
Lev	0.058 (1.461)
TuobinQ	0.002 (0.734)
Inten	0.001 (0.759)
Cash radio	-0.002 (-0.592)
Sh_First	-0.001 (-1.299)
KZ	-0.002 (-0.585)
Cashflow	0.000 (0.232)
Cash	0.000 (0.565)
_cons	0.687*** (4.966)
N	26640
R^2	0.003
F	7.299

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; robust values adjusted for heteroskedasticity are in parentheses.

5.6.2 Substitution of explained variables

Table 8 reports the results of the regression with replacement of explained variables.

In this paper, stock return volatility (Risk2) is used as the explanatory variable for the stability test and the results are shown in Table 8. It can be seen that Amihud is still significantly negative at the 1% level for enterprise risk-taking level after replacement, which is consistent with the main

regression results, indicating that the findings of this paper remain unchanged and proving that the hypotheses are relatively robust.

Table.8. Results of regression with replacement of explained variables

	Risk2
Amihud	-0.049*** (-38.398)
Sales	-0.000 (-0.215)
Lev	-0.024** (-2.214)
TuobinQ	-0.001 (-1.323)
Inten	-0.000 (-1.355)
Cash radio	0.000 (0.152)
Sh_First	-0.000 (-0.467)
KZ	0.001* (1.821)
Cashflow	0.000 (1.602)
Cash	-0.000* (-1.917)
_cons	0.509*** (13.931)
N	35812
R^2	0.045
F	149.850

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; robust values adjusted for heteroskedasticity are in parentheses.

5.6.3 Instrumental variable method (IVM)

This paper refers to the approach of JingXuan Zhong (2023) [21], Two-stage regression (2SLS) is used to detect possible endogeneity problems in the main regression. Drawing on other literature of the same type [21], this paper uses the difference between individual stock liquidity and the average of all stock liquidity of its corresponding industry in the corresponding year as the instrumental variable selected for this test.

Table 9 reports the results of the DWH test.

In this paper, the original explanatory variable Amihud is first tested for endogeneity and the results of the test are shown in Table 9. As can be seen from the table, the p-value of the DWH test is less than 0.01, which indicates that the explanatory variable rejects the original hypothesis at the 1% level of significance, and the original hypothesis of the DWH test is that the explanatory variable is completely exogenous, and therefore, as can be seen from the results of the test, the explanatory variable is endogenous.

Table.9. DWH test results

Name	Test results	P-value
Durbin(score) chi2(1)	51.1258	0.0000
Wu-Hausman F (8,35800)	51.1818	0.0000

Table 10 reports the results of the weak instrumental variables test.

As can be seen from Table 10, the test result shows that the minimum eigenvalue is 54,283.9, which is greater than the Wald test corresponding to all the significance levels in the table, and the Wald test corresponding to the significance level of 5% in the table is 16.38, which rejects the original hypothesis that 'the instrumental variable is a weak instrumental variable', i.e., the instrumental variable selected in this paper is a strong instrumental variable. Therefore, it is reasonable to choose the difference between individual stock liquidity and the average value of all stock liquidity of the corresponding industry in the corresponding year as the instrumental variable.

Table.10. Weak instrumental variable test results

Minimum eigenvalue statistic=54283.9				
2SLS relative bias	5%	10%	20%	30%
2SLS size of nominal 5% Wald test	16.38	8.96	6.66	5.53
LIML size of nominal 5% Wald test	16.38	8.96	6.66	5.53

Table 11 reports the regression results after controlling for endogenous variables.

According to the first stage regression in Table 11, the instrumental variable IV is significantly positive at the 1% level, and the regression coefficient with the original explanatory variables is as high as 0.999, which indicates that it is reasonable to select it as an instrumental variable; subsequently, looking at the second stage regression results, the value of the regression coefficient of Amihud is -0.119, which is significantly negative at the 1% level, which indicates that even when controlling the original explanatory variables of the endogeneity problem, the regression result is still significant, and the level of significance remains unchanged, which fully verifies that there is a significant negative correlation between non-stock liquidity and enterprise risk-taking level, i.e., stock liquidity has a significant positive correlation with enterprise risk-taking level. This conclusion is fully verified after the study of endogeneity. This finding remains robust after controlling for endogeneity issues.

Table.11. Regression results after controlling for endogenous variables

Variant	2SLS	
	First stage	Second stage
	Amihud	Risk1
IV	0.999*** (0.004)	
Amihud		-0.119*** (0.005)
Controls	Control	Control
Constant	4.098*** (0.107)	0.614*** (0.115)
Year&Ind	Control	Control
N	35812	35812
R^2	0.6063	0.0027

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; robust values adjusted for heteroskedasticity are in parentheses.

5.7. Heterogeneity Test

Table 12 reports the results of the heterogeneity test. Where (1) represents non-state-owned enterprises and (2) represents state-owned enterprises.

Based on hypothesis H2 and the nature of property rights of listed companies, this paper conducts enterprise heterogeneity test based on the property rights attributes divided into state-owned

enterprises and non-state-owned enterprises, and the results are shown in Table 12. As can be seen from the table, regardless of state-owned enterprises or non-state-owned enterprises, their Amihud indicators are significantly negative to enterprise risk-taking level (Risk1) at the 1% level, which indicates that there is no obvious heterogeneity between the two, and it is not possible to verify the hypothesis H2.

The reason may be: although non-state-owned enterprises are different from state-owned enterprises, there is no clear policy regulation on the salary ceiling of executives in non-state-owned enterprises, and enterprises can decide the salary level of executives independently according to their own situation and market demand; however, with the intensification of market competition and the continuous improvement of the enterprise governance structure, more and more non-state-owned enterprises begin to pay attention to the reasonableness and fairness of the compensation of executives, and to avoid the overly high level of compensation. To avoid the negative impact on the enterprise and employees, so many non-state-owned enterprises have also limited the upper limit of executive salary, equity incentives for non-state-owned enterprise executives incentive role gradually reduced, resulting in non-state-owned enterprise executives' negative choice of risk investment projects.

Table.12. Results of heterogeneity test

	(1) Non-state-owned enterprises	(2) State-owned enterprises
	Risk1	Risk1
Amihud	-0.037*** (-2.687)	-0.039*** (-2.761)
Sales	-0.016** (-2.290)	-0.020** (-2.195)
Lev	0.081 (1.111)	0.091** (1.970)
TuobinQ	0.008 (0.826)	0.003 (0.915)
Inten	0.001 (1.420)	-0.000 (-1.514)
Cash radio	-0.001 (-0.963)	0.001 (0.722)
Sh_First	-0.000 (-1.290)	-0.000 (-1.446)
KZ	-0.001 (-0.169)	0.001 (0.514)
Cashflow	-0.000 (-0.305)	0.000 (1.303)
Cash	0.000** (1.981)	0.000 (1.298)
_cons	0.529*** (3.078)	0.606*** (2.721)
N	18735	14367
R^2	0.003	0.007

Note: ***, ** and * indicate significance at the 1 per cent, 5 per cent and 10 per cent levels, respectively; robust values adjusted for heteroskedasticity are in parentheses.

6. Conclusions

6.1. Conclusions

This paper investigates the relationship between stock liquidity and enterprise risk-taking level of China's listed Shanghai and Shenzhen A-share enterprises, and adopts the research method of two-way fixed-effects regression model, and adopts the methods of lagging one period, replacing the explained variables and instrumental variables method to conduct the robustness test, and the conclusions are as follows: stock liquidity and enterprise risk-taking level show a significant positive relationship, but there is no difference in the significant level between state-owned enterprises and non-state-owned enterprises, i.e., hypothesis H1 is verified and the conclusion is robust.

Drawing from the preceding analysis, this study offers the subsequent suggestions.

For investors, when making investment choices need to pay more attention to the enterprise risk-taking level, because enterprise risk-taking level higher enterprises tend to pay more attention to their own long-term development; at the same time, investors try to choose the stock market liquidity of the strong, because the liquidity of the strong means that At the same time, investors should try to choose stocks with higher liquidity in the stock market, because higher liquidity means higher enterprise risk-taking level in the future.

For listed companies, they should pay attention to the positive impact of stock liquidity on corporate governance, endeavour to improve the quality of their information disclosure and profitability, and strive to gain the trust and support of a wide range of investors to enhance stock liquidity, and thus enhance the enterprise risk-taking level; at the same time, they should also pay attention to the sensitivity of executives to compensation performance, and pay attention to the sensitivity of executives to compensation performance. At the same time, we should also pay attention to the sensitivity of executives to pay performance, and appropriately improve the incentives of executives, so as to motivate the management of enterprises to more actively engage in those challenging but lucrative returns, which are conducive to the growth of long-term corporate value of the investment projects, and ultimately achieve the goal of optimising the capital structure of enterprises.

As for the regulator, it can formulate relevant policies to release the liquidity of the stock market and continuously increase the efficiency of resource allocation in the capital market, so as to provide sufficient financial support for the investment activities of listed companies.

6.2. Innovations and perspectives in research

Research innovations: In the relevant studies on stock liquidity and enterprise risk-taking level, scholars at home and abroad mainly focus on the relationship between stock liquidity and capital market characteristics or enterprise characteristics, and the relationship between enterprise risk-taking level and capital market characteristics and enterprise characteristics. characteristics, and enterprise risk-taking level with capital market characteristics and firm characteristics, and little literature focuses directly on the association between stock liquidity and enterprise risk-taking level. This paper enriches the research in these two fields, devotes itself to revealing and elaborating the intrinsic connection between the two, and explores the link between stock liquidity and enterprise risk-taking level based on the perspective that stock liquidity affects enterprise risk-taking level, which has certain practical significance. This has certain practical guidance significance.

Research perspectives: This paper believes that the measurement of stock liquidity can be further improved in the future by considering the introduction of a multivariate indicator system to portray the multidimensional characteristics of stock liquidity more comprehensively; at the same time, by further combing through the literature, we can pay attention to more factors that may affect the enterprise risk-taking level and add them as control variables into the study.

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