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Controlling Shareholder Pledges and Cost of Equity Capital: Analyzing Empirical Evidence from A-Share Listed Companies

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Abstract

With the constant increase in China's stock pledge transactions, controlling shareholders' equity pledges may result in inadequate investment, which government regulatory authorities, investors, and financial management departments should be aware of. Taking China's A-share listed companies from 2013 to 2019 as a sample, this paper examines the impact of controlling shareholder pledge on equity capital cost. It is found that the equity capital cost of listed companies increases significantly after controlling shareholder pledge, and high-quality audit reports help reduce the influence of controlling shareholder pledge on it. In addition, the mechanism test shows that controlling shareholder pledge impacts the equity capital cost by reducing stock liquidity and increasing the tunneling behavior of large shareholders. Further research shows that under controlling shareholder pledges, improving the quality of information disclosure can help reduce the equity capital cost, while stock price risk can increase the equity capital cost.

Keywords Controlling shareholder pledge · Equity capital · Audit quality · Business operations · Financing cost · China

Introduction

Compared with traditional financing, equity pledge financing features a simple implementation process, no restrictions on the use of funds, and fewer regulatory constraints. Therefore, the equity pledge business has developed rapidly in China in recent years and has become an important way of financing controlling shareholders. Although the pledge financing of the controlling shareholder is the personal behavior of the actual controller,

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when the share price falls and the controlling shareholder cannot cover the short position, the personal behavior of the controlling shareholder will turn into a problem for the listed company and incur the risk of a control transfer, thus affecting the business operation (Song & Song, 2019). Studies by many scholars have indicated that controlling shareholder pledges will increase the debt financing cost of listed companies (Wu et al., 2020; Zhai et al., 2020; Wang & Qian, 2021), and in terms of impact mechanism, the quality of information disclosure and tunneling behavior of large shareholder play an intermediary role (Wang & Qian, 2021). So, will controlling shareholder pledges have the same impact on equity capital cost? What is its influence mechanism? In the context of controlling shareholder pledges, are there other factors that affect equity capital cost?

According to the existing research, Wang et al. (2019) have studied the impact of controlling shareholder pledge on equity capital cost, but their research sample is derived from the data of listed companies from 2003 to 2014, and the robustness test of the research conclusion is not carried out (Rossi et al., 2015). The Measures on Stock Pledge Repo Transaction and Registration and Clearing Operations (Trial) have been implemented in China since 2013. In previous years, the controlling shareholder pledge could only be carried out through an over-the-counter pledge. Its financing threshold is high, financing convenience is poor, and the number of samples is small. Therefore, there may be selection bias in its samples. In addition, Wei and Mao (2021) studied the correlation between the controlling shareholder pledge and the capital cost of listed companies and believed that corporate governance helps mitigate its impact, but the mechanism of action is not tested in this paper. Based on the research results, this paper studies the impact of controlling shareholder pledge on equity capital costs based on the data of listed companies from 2014 to 2019 (Gay, 2014). The findings of this paper are as follows: (1) Controlling shareholder pledge has improved the equity capital cost of listed companies, and high-quality audit reports are helpful to ease their correlation; (2) In terms of impact mechanism, controlling shareholder pledge has an impact on equity capital cost of listed companies by reducing the stock liquidity and increasing the tunneling behavior of large shareholder; (3) In the context of controlling shareholder pledge, improving the quality of information disclosure is beneficial to reducing equity capital cost of listed companies, while when stock price risk is large, equity capital cost of listed companies will be correspondingly increased.

The research contributions and possible innovations of this paper are as follows: Firstly, based on the data of listed companies after the implementation of the Measures on Stock Pledge Repo Transaction and Registration and Clearing Operations (Trial) by the China Securities Regulatory Commission, this paper expands the research on equity capital cost from the perspective of controlling shareholder pledge and audit quality. Although the existing literature has studied issues concerning controlling shareholder pledges and equity capital costs, few scholars have studied them from the perspective of audit quality. Secondly, this paper finds out that the controlling shareholder pledge has two influence mechanisms on equity capital cost, i.e., stock liquidity and tunneling behavior of large shareholders. However, the existing literature has not studied the mechanism of controlling shareholder pledges' influence on equity capital cost from the perspective of stock liquidity. Thirdly, this paper studies other factors that affect equity capital cost under the background of controlling shareholder pledges. In addition to information disclosure

quality factors, we find that stock price risk also affects it. The research in this paper has profound implications for investors, listed companies, and security regulatory authorities.

Literature Review and Research Hypotheses

Equity Pledge

Academic circles have carried out much research on the issue of equity pledges. Zheng et al. (2014) support that in the case of the existence of a controlling shareholder pledge, the majority shareholders will have a stronger motivation to carry out asset-stripping against the listed company, and the economic consequences may be more serious. Furthermore, Xie et al. (2017) found that equity-pledged companies will indirectly increase the share price of listed companies by earnings management to improve the performance of listed companies. Also, Pan et al. (2018) studied the impact of controlling shareholder pledges on commercial credit financing and found that suppliers can identify the increased risks brought by the listed company controlling shareholder pledge and reduce commercial credit financing to the listed company. Likewise, Liao et al. (2018) found that the listed companies with controlling shareholder pledges are more likely to introduce a "high bonus" dividend policy.

In addition, Ma and Zhang (2020) studied the issue of controlling shareholder pledge from the perspective of investor relations and found that after controlling shareholder pledge, listed companies will improve the level of investor relations management by optimizing communication guarantees and other means (Barbaroux, 2014). Xu et al. (2020) believed that during the period of controlling shareholder pledges, listed companies are more likely to make performance commitments for mergers and acquisitions, and the signed performance commitments have a higher value and a longer commitment period (Mabrouk & Boubaker, 2020; Xu & Huang, 2021). Hu et al. (2020) found that the level of charitable donations of listed companies will increase significantly when the controlling shareholders pledge their equity. The closer the share price of listed companies is to the liquidation line, the stronger the controlling shareholders' charitable donation motivation will be. Weifeng et al. (2021) studied the issue of share pledge from the perspective of share repurchase and found that when a listed company has a controlling shareholder pledge or a high proportion of pledge, the listed company is more likely to carry out share repurchase. Zhang et al. (2021) also found that there is a U-shaped relationship between the controlling shareholder pledge and the corporate default risk. In the initial stage of the controlling shareholder's equity pledge, the increase of the pledge proportion will reduce the listed company's default risk, but when the controlling shareholder pledge proportion reaches a certain threshold, the increase of the equity pledge proportion will increase the corporate default risk (Metel'skaya, 2021). Wang and Qian (2021) studied the issue of debt financing cost concerning controlling shareholder pledge and listed companies and found that controlling shareholder pledge increased the debt financing cost of listed companies, while the quality of information disclosure and tunneling behavior of large shareholders played an intermediary role in its impact process (Sahiti & Smith, 2017).

Equity Capital Cost

Scholars in China have published a lot of research literature on equity capital cost. Ye and Luz (2004) studied the influencing factors of equity financing cost of listed companies in China and found that the β coefficient of listed companies is the main influencing factor, while debt ratio, enterprise size, market-to-book ratio, and other factors will also have a substantial impact on it. Jiang (2009) believed that corporate governance could significantly reduce financing costs, and the impact on equity capital cost is greater than the impact on debt financing. Xu (2013) studied the equity capital cost of listed companies from the perspective of information quality and believed that improving the quality of accounting information is beneficial to reducing the equity capital cost of listed companies and maximizing corporate value (Barbaroux, 2014; Kryzanowski et al., 2021). Through the study of the nature of ultimate ownership and equity financing costs, Xiao and Yin (2015) found that central enterprises have lower equity financing costs than local state-owned enterprises and private enterprises, while there is no significant difference in equity financing costs between private enterprises and local state-owned enterprises. Through research on the risk of the stock price collapse, Yu (2017) found that the higher the risk of stock price collapse of listed companies, the higher their equity capital cost, and this relationship is more significant in private enterprises. Based on the data of listed companies from 2003 to 2014, Wang et al. (2019) studied the relationship between controlling shareholder pledges and equity capital cost. They believed that controlling shareholder pledge improved equity capital cost and that the tunneling behavior of large shareholders played an intermediary role in the process. However, the research data may have selective bias, and the robustness of the research conclusion has not been tested.

According to the recent research results, Luo et al. (2020) tested the impact of the length of the annual report on the equity capital cost of listed companies, believing that the longer the annual report, the lower the equity capital cost of listed companies and this effect of reduction is stronger in non-state-owned enterprises and companies not audited by the "big four." Sun et al. (2021) also believed that the posting, commenting, and forwarding number of Microblog texts by the entrepreneur would affect the enterprise's equity capital cost (Cheng et al., 2021; Sahiti & Smith, 2017). The more the posting, commenting, and forwarding, the lower the enterprise's equity capital cost. Wang and Ye (2015) believed that corruption and equity capital cost were significantly positively correlated, and media attention could alleviate the positive correlation. Khlif et al. (2019) believed that a mandatory internal control audit is beneficial to reducing the equity capital cost of an enterprise, and this effect is achieved by lowering enterprise risks, reducing information asymmetry, and principal-agent relationship. Guo and Huang (2021) found that the high-speed railway operation significantly reduced the equity capital cost of listed companies. Wang and Guo (2021) studied the relationship between dividend policy and equity capital cost and believed that the semi-strong dividend policy is beneficial to reducing the equity financing cost of the company, and its reducing effect is more evident in a company with a higher agency cost. Wei and Mao (2021) studied the relationship between controlling shareholder pledge, corporate governance, and financing cost and considered that the controlling shareholder pledge has an impact on equity

capital cost and debt financing cost, and its impact on equity capital cost is greater than the impact on debt capital cost (Liu & Tian, 2021). While corporate governance can help mitigate the impact of the controlling shareholder pledge on the cost of capital, the impact mechanism was not tested in the study.

From the above documents, we can find that scholars' research on equity capital cost mainly focuses on the impact of corporate governance, information disclosure quality, internal control audit, annual report length, dividend policy, and other factors on it. However, only a few articles have studied the changes in equity capital cost in listed companies after the pledge of controlling shareholder's equity. Based on the current research results and the data of listed companies from 2014 to 2019, this paper attempts to answer the following research questions: (1) What impact does the controlling shareholder pledge have on the equity capital cost of listed companies? Does audit quality help reduce this impact? (2) What is the impact of a controlling shareholder pledge on equity capital cost? In addition to the tunneling mechanism of major shareholders, is there any other mechanism? (3) In the context of controlling shareholder pledges, are there other factors affecting equity capital cost?

Theoretical Analysis and Research Hypotheses

According to the existing research, controlling shareholder pledge increases the risk of a corporate control transfer, and according to the signaling theory, behaviors that lead to a decrease in corporate value or an increase in risk will send a negative signal that an enterprise may have financial difficulties (Wu et al., 2020), increasing the financial risk of the enterprise. According to the principle of matching returns with risks, when the risks of an enterprise increase, the necessary return rate required by investors will also increase, thus increasing the equity capital cost of the company (Luo et al., 2020).

In addition, the research of information risk theory showed that the company-specific information risk is not dispersible, which will affect the company's equity capital cost and debt financing cost. There are three main sources of information risk: information disclosure quality, revenue quality, and corporate governance level (Jiang, 2009). Zheng et al. (2014) believed that after the equity pledge by the controlling shareholders, the controlling shareholders would be more likely to "empty" the listed company through related party transactions, capital occupation, and other means. Also, it is possible to manipulate the financial data of listed companies through earnings management, forge the business performance, and reduce the quality of information disclosure (Wang & Qian, 2021; Bilel, 2020; Huang et al., 2018; Xu & Huang, 2021). It may also increase the risk preference of the controlling shareholders, encourage the listed companies to invest in high-risk projects, and lead to over-investment (Zhang et al., 2017b), which affect the quality of information disclosure and revenue of the company and thus affect the financing cost of the company.

Moreover, the behaviors, such as capital occupation and related party transactions, may be caused by the controlling shareholder pledge that reduces the quality of information disclosure, making it impossible for other shareholders to make investment judgments based on complete information (Fan & Wong, 2002). This

phenomenon increases the adverse selection cost and bid-ask spread of shares in the short term (Welker, 1995) while reducing the investors' trust in listed companies, abandoning investment, and reducing the stock liquidity in the long term (De Jong et al., 2020; Kim & Verrecchia, 2001). The higher the proportion of controlling shareholder pledge, the poorer the liquidity of the shares (Ke et al., 2020); according to Amihud and Mendelson (1986), the decrease in stock liquidity will lead to the increase in equity capital cost. Based on the above analysis, we propose the first research hypothesis in this paper as follows:

H1: Controlling shareholder pledges increases the equity capital cost of listed companies.

Fan and Wong (2005) believed that a high-quality external audit could effectively identify the encroachment of controlling shareholders, help reduce the probability that corporate financial information is distorted by management errors, improve the quality of corporate information disclosure, and constrain earnings management of listed companies (Tang et al., 2019). In addition, a high-quality external audit enables the listed companies to have a better information environment so that other major shareholders can identify the opportunistic behaviors of the controlling shareholders at a lower cost (Huang et al., 2018; Li et al., 2020; Sandhu & El-Gohary, 2022; Wang & Jiang, 2017). Therefore, a high-quality external audit releases the signal of earnings quality, which indicates that the external supervision organization approves the operating results of the enterprise. Investors will undoubtedly pay attention to the supervision function of external audits and thus react to issues such as enterprise risk judgment and equity capital cost. Zeng and Wentao (2021) researched the equity capital cost of listed companies from the perspectives of key audit matters and mandatory internal control audits, respectively. They considered that crucial audit matters and mandatory internal control audits are helpful in reducing the equity capital cost of listed companies. Based on the above analysis, we propose the second research hypothesis in this paper as follows:

H2: High-quality external audit helps restrain the influence of controlling shareholder pledge on the equity capital cost of listed companies.

Research Design

Data Sources and Sample Selection

Before 2013, the controlling shareholders could only make equity pledge financing through an over-the-counter pledge, which significantly restricted the scale and convenience of financing; After 2013, the over-the-counter pledge operations developed rapidly and gradually became the major financing method for the majority shareholders. Therefore, this paper selects the A-share listed companies from 2014 to 2019 as the sample for research. In order to ensure the robustness of the research results, the data are filtered according to the following criteria: (1) removing ST and *ST samples; (2) removing the financial industry samples; (3) removing the samples without

regression analysis data; after the above processing, the data of 10,777 listed companies are obtained in this paper. In order to eliminate the influence of extreme values, winsorization is carried out for all the data in this paper at 1% and 99% quantiles. The data used in this paper are from the CSMAR database and the author's manual collation. The regression analysis is processed by Stata15 software.

Definition of Key Variables

Equity Capital Cost

This paper applies the PEG model proposed by Easton in 2004 to calculate the equity capital cost of listed companies. Mao et al. (2012) studied several common calculation methods of equity capital cost and considered that equity capital cost calculated by the PEG model could better capture various risk factors and is more suitable for China's capital market. Therefore, this paper uses the PEG model to calculate the equity capital cost of listed companies. The specific calculation formula is as follows:

$$Re_{i,t} = \sqrt{(\mathrm{EPS}_{i,t+2} - \mathrm{EPS}_{i,t+1})/P_{i,t}} \tag{1}$$

Formula (1) represents the equity capital cost of Company I in Period T, the earnings per share forecast by analysts of Company i in Period $t+2$, the earnings per share forecast by analysts of Company i in Period $t+1$, and the stock price of Company i at the end of Period T.

Controlling Shareholder Pledge

In this paper, the controlling shareholder pledge is represented by $\mathrm{Pledge}_{i\,t}$ and calculated in two ways. First, according to the research of Xu and Wang (2021), Xu et al. (2020), and Ma and Zhang (2020), it is represented by the number of shares pledged by the controlling shareholders/the total number of shares held by the controlling shareholders (the equity pledge ratio PLD-RATE1i, t). The other is based on the research of Zhang et al., (2017a, b) and Zhou and Hua (2021), which is measured by the ratio of the number of shares pledged by the controlling shareholders to the total number of shares in the company (the equity pledge ratio PLD-RATE2i, t).

Audit Quality

This paper uses the research methods of Xu (2018) and Dong and Sun (2021) for reference and predicts the probability of an accounting firm issuing a standard unqualified opinion through regression model (2):

$$\begin{aligned} Mao_{i,t} = {} & \beta_0 + \beta_1\ \mathrm{Quick}R_{i,t} + \beta_2 AR_{i,t} + \beta_3\ \mathrm{Other}_{i,t} + \beta_4 \mathrm{Inv}_{i,t} + \beta_5 \mathrm{ROA}_{i,t} \\ & + \beta_6 \mathrm{Loss}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{Size}_{i,t} + \beta_9 \mathrm{Age}_{i,t} + \beta_{10} \mathrm{Industry} + \beta_{11} \mathrm{Year} + \varepsilon_{i,t} \end{aligned} \tag{2}$$

In Formula (2), $\mathrm{Quick}R_{i,\,t}$ represents the conservative quick ratio (sum of cash, transactional financial assets, bills receivable, and accounts receivable divided

by current liabilities). $AR_{i,\,t}$ represents the ratio of accounts receivable to total assets. $\text{Other}_{i,\,t}$ represents the ratio of other receivables to total assets, and $\text{Inv}_{i,\,t}$ represents the ratio of inventories to total assets. $\text{ROA}_{i,\,t}$ represents a return on total assets, and $\text{Loss}_{i,\,t}$ represents whether the company has a deficit this year. $\text{Lev}_{i,\,t}$ represents the asset-liability ratio. $\text{Size}_{i,\,t}$ represents the size of the company. $\text{Age}_{i,\,t}$ represents the listing term of the company.

After obtaining the probability of an accounting firm issuing a standard unqualified opinion through model (2), we use the actual audit opinion issued by the firm (i.e., $\text{Opinion}_{i,\,t}$), decreasing the probability of issuing a standard unqualified opinion and taking the negative absolute value of the difference to measure the audit quality. Where the actual audit opinion issued by the firm is a standard unqualified opinion, the value is 1; otherwise, the value is 0. The specific calculation model of audit quality is as follows:

$$AQ_{i,t} = -|Opinion_{i,t} - Mao_{i,t}| \tag{3}$$

In the above formula, $\text{Opinion}_{i,\,t}$ represents the audit opinion issued by the certified public accountant, and $AQ_{i,\,t}$ represents the audit quality. The higher the value, the higher the audit quality.

Model Building

Based on the research results of Guo and Huang (2021) and Jiang (2009), this paper constructs the following regression model to study the influence of controlling shareholder pledge on the equity capital cost of listed companies:

$$\text{PEG}_{i,t} = \alpha_0 + \alpha_1 \text{Pledge}_{i,t} + \alpha_2 \text{Controls}_{i,t} + \sum \text{Ind} + \sum \text{Year} + \varepsilon_{i,t} \tag{4}$$

In order to study the role of audit quality in the process of controlling shareholder pledge that affects the equity capital cost of listed companies, this paper applies Formula (5) to study the research results of Wu et al. (2020).

$$\text{PEG}_{i,t} = \alpha_0 + \alpha_1 \text{Pledge}_{i,t} + \alpha_2 \text{Pledge}_{i,t} \times AQ_{i,t} + \alpha_3 \text{Controls}_{i,t} + \sum \text{Ind} + \sum \text{Year} + \varepsilon_{i,t} \tag{5}$$

In Formula (4) and Formula (5), $\text{PEG}_{i,\,t}$ is a dependent variable, representing the equity capital cost of listed companies. $\text{Pledge}_{i,\,t}$ is an independent variable representing the controlling shareholder pledgee. $\text{Pledge}_{i,\,t} \times AQ_{i,\,t}$ is the cross-term between equity pledge and audit quality, which is used to express the influence of the dual factors of controlling shareholder pledge and audit quality on equity capital cost.

The control variables selected in this paper are as follows: the first majority shareholder's shareholding ratio ($\text{Top1}_{i,\,t}$), growth ($\text{Growth}_{i,\,t}$), tangible asset ratio ($\text{Fixass}_{i,\,t}$), asset operation efficiency ($\text{Assetturn}_{i,\,t}$), profitability ($\text{ROA}_{i,\,t}$), cash flow ($\text{Cashflow}_{i,\,t}$), institutional investor's shareholding ratio ($\text{Inst}_{i,\,t}$), market-to-book ratio ($\text{BM}_{i,\,t}$), listing time ($\text{Age}_{i,\,t}$), asset-liability ratio ($\text{Lev}_{i,\,t}$), and company size ($\text{Size}_{i,\,t}$).

Table 1 Definition table of variables

Variable name	Symbol	Formula description
Equity capital cost	$PEG_{i,t}$	According to the PEG model proposed by Easton (2004), see the text for the specific process
Controlling shareholder pledge ratio	$PLD\text{-}RATE1_{i,t}$	Number of shares pledged by controlling shareholders/number of shares held by controlling shareholders at the end of the year
Controlling shareholder pledge ratio	$PLD\text{-}RATE2_{i,t}$	Number of shares pledged by controlling shareholders at the end of the year/total share capital of the company
Audit quality	$AQ_{i,t}$	The calculation method of Xu (2018) is detailed in the text
Shareholding ratio of major shareholders	$Top1_{i,t}$	Shareholding ratio of the first majority shareholder
Growth	$Growth_{i,t}$	Year-on-year growth rate of operating income
Percentage of tangible assets	$Fixass_{i,t}$	Fixed assets/total assets
Asset operation efficiency	$Assetturn_{i,t}$	Turnover of total assets
Profitability	$ROA_{i,t}$	Return on total assets
Cash flow	$Cashflow_{i,t}$	Net cash flows from operating activities/total assets
Institutional investors' shareholding ratio	$Inst_{i,t}$	Shares held by institutional investors/total equity
Market-to-book ratio	$BM_{i,t}$	Net carrying assets of the company/market value of shares
Time to market	$Age_{i,t}$	The listing period of the company
Asset-liability ratio	$Lev_{i,t}$	Total liabilities/total assets
Company size	$Size_{i,t}$	Natural logarithm of total assets
Annual variable	$Year_{i,t}$	Annual virtual variable
Industry variable	$Ind_{i,t}$	Industry virtual variable

Meanwhile, all the regression analysis results in this paper control the annual fixed effect and industry fixed effect and carry out cluster processing at the corporate level. The definitions of the main variables in this paper are shown in Table 1.

Descriptive Statistics

Table 2 lists the descriptive statistics of the key variables in this paper by whether there is a controlling shareholder pledge and *T*-tests the key variables. As can be seen in Table 2, the growth rate of equity capital cost and operating income of the companies without controlling shareholder pledge is significantly lower than that of the companies with controlling shareholder pledge. This result indicates that the equity capital cost of the companies with controlling shareholder pledge Company is higher, and their growth rate of operating income is higher than that of the companies with controlling shareholder pledge.

From the perspective of the controlling shareholder pledge variable, the controlling shareholder pledge ratio $PLD\_RATE1_{i,t}$-mean value and the controlling shareholder pledge ratio $PLD\_RATE2_{i,t}$-mean value are 0.554 and 0.175, respectively, indicating that the average pledged shares of the controlling shareholder account for 55.4% of the actual controller's shareholding and 17.5% of the total shares of the listed company. From the perspective of other variables, except for the debt ratio index, the remaining variables of companies without controlling shareholder pledges are significantly larger than those of companies with controlling shareholder pledges. It indicates that the shareholding ratio of the first majority shareholder, tangible assets ratio, asset operation efficiency, profitability, cash flow, institutional

Table 2 Descriptive statistical table

	No controlling shareholder pledge				With controlling shareholder pledge				*T value*
	Mean	*SD*	*Min*	*Max*	*Mean*	*SD*	*Min*	*Max*	
$PEG_{i,t}$	0.098	0.037	0.022	0.225	0.106	0.039	0.022	0.225	−10.22
$PLD\_RATE1_{i,t}$	0.000	0.000	0.000	0.000	0.554	0.297	0.000	1.000	-
$PLD\_RATE2_{i,t}$	0.000	0.000	0.000	0.000	0.175	0.127	0.000	1.000	-
$Top1_{i,t}$	0.360	0.157	0.085	0.731	0.324	0.131	0.085	0.731	13.07
$Growth_{i,t}$	0.171	0.383	−0.582	3.030	0.274	0.497	−0.582	3.030	−12.12
$Fixass_{i,t}$	0.222	0.172	0.002	0.694	0.190	0.141	0.002	0.694	10.36
$Assetturn_{i,t}$	0.677	0.444	0.059	2.514	0.617	0.396	0.059	2.514	7.46
$ROA_{i,t}$	0.050	0.053	−0.339	0.187	0.042	0.059	−0.339	0.187	6.89
$Cashflow_{i,t}$	0.059	0.066	−0.162	0.240	0.044	0.068	−0.162	0.240	11.47
$Inst_{i,t}$	45.718	23.650	0.046	87.272	37.116	22.084	0.046	87.272	19.51
$BM_{i,t}$	0.607	0.271	0.000	1.152	0.549	0.252	0.000	1.152	11.46
$Age_{i,t}$	11.600	7.568	0.000	26.000	8.714	6.366	0.000	26.000	21.41
$Lev_{i,t}$	0.423	0.199	0.060	0.908	0.424	0.194	0.060	0.908	−0.19
$Size_{i,t}$	22.692	1.394	19.816	26.152	22.317	1.137	19.816	26.152	15.26
N	5396				5381				

investors' shareholding, market-to-book ratio, listing period, and company size of the company without controlling shareholder pledge are significantly larger than those of companies with controlling shareholder pledge.

Empirical Results Analysis

Results of Principal Regression Analysis

Columns (1) and (2) of Table 3 report the influence of the controlling shareholder pledge on equity capital cost, which shows that the regression coefficients of the controlling shareholder pledge ratio $PLD\_RATE1_{i,t}$ and the pledge ratio $PLD\_RATE2_{i,t}$ are 0.0052 and 0.0132, respectively, and are significant at the significance level of 1%. This shows that the controlling shareholder pledge increases the equity capital cost of listed companies, which verifies research hypothesis 1 of this paper.

Columns (3) and (4) of the following table report the impact of audit quality on equity capital cost in the case of controlling shareholder pledges. According to the regression results of columns (3) and (4), the regression coefficients of cross-terms $PLD\_RATE1_{i,t} \times AQ_{i,t}$ and $PLD\_RATE2_{i,t} \times AQ_{i,t}$ are −0.0153 and −0.0415, respectively, and are significant at the significance level of 5%. This shows that under the background of controlling shareholder pledge, the improvement of audit quality reduces equity capital cost, and high-quality external audit helps reduce the influence of controlling shareholder pledge on equity capital cost. The research hypothesis of Hypothesis 2 holds water.

Robustness Test

In order to solve the endogenous effects caused by some unobservable factors or missing variables, this paper adopts the following three methods to test the robustness: (1) regression of instrumental variables; (2) propensity score matching; (3) calculation of equity capital cost with other models and perform regression analysis again.

Regression of Instrumental Variables

This paper uses the method of Xie et al. (2016) to test the endogeneity of the relationship between controlling shareholder pledges and equity capital cost. Specifically, this study uses the average pledge ratio of the same year and industry Ind_PledgeD1 (the mean value of industry controller shareholder pledge ratio $PLD\_RATE1_{i,t}$), the average pledge ratio Ind_PledgeD2 (the mean value of industry controller shareholder pledge ratio $PLD\_RATE2_{i,t}$), the average pledge ratio Pro_PledgeD1 (the mean value of controlling shareholder pledge ratio $PLD\_RATE1_{i,t}$ in the same province), and the average pledge ratio Pro_PledgeD2 (the mean value of controlling shareholder pledge ratio $PLD\_RATE2_{i,t}$ in the same province) in the same year and the same region as a tool variable of the controlling shareholder pledge. Also, this study replaces the controlling shareholder pledge ratio $PLD\_RATE1_{i,t}$, and the controlling shareholder

Table 3 Analysis of the level of controlling shareholder pledge and equity capital cost of listed companies

Variable	Controlling shareholder pledge and equity capital cost		Controlling shareholder pledge, audit quality, and equity capital cost	
	$PEG_{i,t}$*(1)*	$PEG_{i,t}$*(2)*	$PEG_{i,t}$*(3)*	$PEG_{i,t}$*(4)*
$PLD\_RATE1_{i,t}$	0.0052***		0.0046***	
	(4.13)		(3.61)	
$PLD\_RATE2_{i,t}$		0.0132***		0.0118***
		(3.95)		(3.45)
$PLD\_RATE1_{i,t} \times AQ_{i,t}$			−0.0153**	
			(−2.312)	
$PLD\_RATE2_{i,t} \times AQ_{i,t}$				−0.0415**
				(−1.984)
$Top1_{i,t}$	−0.0187***	−0.0218***	−0.0185***	−0.0216***
	(−5.88)	(−6.77)	(−5.80)	(−6.69)
$Growth_{i,t}$	0.0011	0.0012	0.0010	0.0011
	(1.29)	(1.42)	(1.17)	(1.31)
Fixass	0.0004	0.0003	0.0001	0.0001
	(0.12)	(0.09)	(0.03)	(0.00)
$Assetturn_{i,t}$	0.0048***	0.0047***	0.0052***	0.0051***
	(3.58)	(3.54)	(3.81)	(3.78)
$ROA_{i,t}$	0.0133	0.0125	0.0173*	0.0156
	(1.37)	(1.30)	(1.68)	(1.52)
$Cashflow_{i,t}$	−0.0076	−0.0077	−0.0075	−0.0076
	(−1.19)	(−1.20)	(−1.15)	(−1.16)
$Inst_{i,t}$	−0.0001**	−0.0001**	−0.00005**	−0.00005**
	(−2.32)	(−2.39)	(−2.05)	(−2.13)
$BM_{i,t}$	0.0230***	0.0229***	0.0237***	0.0236***
	(9.41)	(9.38)	(9.60)	(9.56)
$Age_{i,t}$	−0.0005***	−0.0005***	−0.0005***	−0.0005***
	(−6.23)	(−6.25)	(−6.36)	(−6.36)
$Lev_{i,t}$	0.0217***	0.0215***	0.0210***	0.0209***
	(7.11)	(7.06)	(6.84)	(6.80)
$Size_{i,t}$	0.0033***	0.0034***	0.0032***	0.0033***
	(5.61)	(5.71)	(5.26)	(5.35)
_cons	0.0103	0.0104	0.0142	0.0144
	(0.75)	(0.75)	(1.02)	(1.03)
N	10,777	10,777	10,589	10,589
Industry/year	Yes			
Adj-R^2	0.1723	0.1719	0.1738	0.1731

Z values adjusted by clustering at the company level are shown in brackets. ***, **, and * are significant at 1%, 5%, and 10%, respectively

pledge ratio PLD_RATE2$_{i,\ t}$, respectively, and then carries on the two-stage regression through the IV-Tobit model to solve the endogeneity issue.

Table 4 reports the results of the first and second stages of regression for the instrumental variables. The regression results of the first stage of columns (1) and (2) show that the regression coefficients of the instrumental variables Ind_PledgeD1 and Pro_PledgeD are significantly positive at the significance level of 1%, with fitting values of 0.6778 and 0.5931, respectively, indicating that the model has good explanatory power. The regression results of the second stage of columns (3) and (4) show that the chi-square value of the Wald exogeneity test is significant at the significance level of 1%, indicating that the tool variables meet the exogeneity requirements. In addition, the regression coefficients of PLD_RATE1$_{i,\ t}$ and PLD_RATE2$_{i,\ t}$ are all significantly positive at the significance level of 1%, indicating that after using the tool variable to alleviate endogeneity, the controlling shareholder pledge is still significantly and positively correlated with equity capital cost of listed companies, which is consistent with the previous research conclusion.

Propensity Score Matching

In the process of using the propensity score matching method to solve endogeneity, this paper uses the dummy variable of whether there is a controlling shareholder

Table 4 Robustness test for regression of tool variables

Item	First stage		Second stage	
	PLD_RATE1$_{i,t}$*(1)*	PLD_RATE2$_{i,t}$*(2)*	PEG$_{i,t}$*(4)*	PEG$_{i,t}$*(6)*
Ind_PledgeD1$_{i,t}$	0.5701***			
	(16.81)			
Pro_PledgeD1$_{i,t}$	0.3894***			
	(11.40)			
Ind_PledgeD2$_{i,t}$		0.6771***		
		(24.13)		
Pro_PledgeD2$_{i,t}$		0.3258***		
		(11.34)		
PLD_RATE1$_{i,t}$			0.0113***	
			(8.98)	
PLD_RATE2$_{i,t}$				0.0331***
				(8.72)
Controls	Controls			
Industry/year	Controls			
N	10,777	10,777	10,777	10,777
Adj-R^2	0.6778	0.5931	-	-
F/Chi^2	247.46	171.73	28.15	26.56
Wald test			3761.55	3754.63

Due to the article length, the regression analysis results of the control variables are not reported in Table 4. Readers who are interested in the results may obtain them from the author

pledge to regress the control variable to obtain the scores of each observed value and matches the companies that have the controlling shareholder pledge with the companies that do not have the controlling shareholder pledge to obtain matching samples. In the specific analysis, we also referred to the research of Xie et al. (2016) and selected the first majority shareholder's shareholding ratio, operating income growth rate, total assets turnover rate, tangible assets ratio, cash flow ratio, market-to-book ratio, corporate nature, asset-liability ratio, and corporate size as the matching variables. A 1:3 matching was made using nearest neighbor matching on whether the controlling shareholder was pledged, and we brought the matched samples into the model for regression analysis again.

Columns (1) and (2) of Table 5 report the results of bringing PSM matched samples into the model for analysis. As can be seen from Table 5, after the PSM method is used to mitigate endogeneity, the variables $\text{PLD\_RATE1}_{i,t}$ and $\text{PLD\_RATE1}_{i,t}$ of the controlling shareholder pledge are still significantly positively correlated with the equity capital cost of listed companies, which is consistent with the previous research conclusion.

Replace Dependent Variable

In addition to the PEG model, the MPEG model is also a commonly used model in academia to measure equity capital cost, which is proposed by Easton (2004). According to the research results of Mao et al. (2012), in addition to the PEG model, equity capital cost calculated using the MPEG model can also be better applied to the Chinese market, and the research effect is also better than other models frequently used in domestic and foreign research. The specific calculation formula of the MPEG model is as follows:

$$Re_{i,t} = \sqrt{(\text{EPS}_{i,t+2} - Re_{i,t} \times \text{DPS}_{i,t+1} + \text{EPS}_{i,t+1})/P_{i,t}} \tag{6}$$

In the above formula, $\text{Re}_{i,t}$ is the equity capital cost, $\text{EPS}_{i,t+2}$ is the earnings per share forecast by the analysts of i stock in $t+2$ period, $\text{EPS}_{i,t+1}$ is the earnings per share forecast by the analysts of i stock in $t+1$ period, $\text{P}_{i,t}$ is the closing price of i

Table 5 PSM matching and robustness test after changing dependent variables

Item	PSM match		Change dependent variable	
	$\text{PEG}_{i,t}(1)$	$\text{PEG}_{i,t}(2)$	$\text{MPEG}_{i,t}(3)$	$\text{MPEG}_{i,t}(4)$
$\text{PLD\_RATE1}_{i,t}$	0.0061***		0.0043***	
	(4.33)		(2.59)	
$\text{PLD\_RATE2}_{i,t}$		0.0166***		0.0116***
		(4.34)		(2.61)
Controls	Controls			
Industry/year	Controls			
N	7228	7228	10,777	10,777
Adj-R^2	0.25	0.25	0.2318	0.2316

stock in t period, and $DPS_{i,\,t+1}$ is the dividend per share forecast by the analysts of $t+1$ period.

After calculating the company's equity capital cost using the MPEG model, we substituted it into the model and regressed it again. Columns (3) and (4) of Table 5 report the correlation between controlling shareholder pledges and equity capital cost calculated by the applicable MPEG model. We can also see that the regression coefficients of $PLD\_RATE1_{i,\,t}$ and $PLD\_RATE2_{i,\,t}$ are positively correlated with equity capital cost at the significance level of 1%, which indicates that the research conclusion of a positive correlation between controlling shareholder pledge and equity capital cost is still robust after changing the dependent variable.

Impact Path Test Analysis

The impact of a controlling shareholder pledge on equity capital cost may include the following: First, a controlling shareholder pledge may affect the liquidity of the company's shares, which may affect equity capital cost. Guo and Huang (2021) found that the operation of high-speed rail affected the stock liquidity and information disclosure quality of listed companies, which affected equity capital cost when studying the impact of the operation of high-speed rail on equity capital cost. Secondly, controlling shareholder pledges may increase agency costs and induce tunneling behavior of large shareholders. Investors may increase the equity capital cost of listed companies after identifying such tunneling behavior of large shareholders to mitigate the potential risks brought by tunneling behavior of large shareholders. In order to confirm the above conduction path, we will further examine it in the following analysis to clarify the conduction path of controlling shareholder pledges affecting equity capital cost.

Impact on Stock Liquidity

We will use Model (7) to study the impact of controlling shareholder pledges on the stock liquidity of listed companies. The specific model is as follows:

$$\mathrm{Tover}_{i,t} = \alpha_0 + \alpha_1 \mathrm{Pledge}_{i,t} + \alpha_2 \mathrm{Controls}_{i,t} + \sum \mathrm{Ind} + \sum \mathrm{Year} + \varepsilon_{i,t} \tag{7}$$

In the above formula, $TOVER_{i,\,t}$ represents the stock liquidity. We referred to the research results of Xiong and Su (2014) and used the daily average turnover rate of listed companies. The specific calculation formula is as follows:

$$\mathrm{Tover}_{i,t} = \frac{1}{D_{i,t}} \sum_{d=1}^{D_{i,t}} \left(\frac{\mathrm{VOL}_{i,t,d}}{\mathrm{LNS}_{i,t,d}}\right) \tag{8}$$

In Formula (8), $VOL_{i,\,t,\,d}$ represents the number of shares traded on day d of year for t of i shares, $LNS_{i,\,t,\,d}$ is the number of shares in circulation on day d of year t of i shares, and $D_{i,\,t}$ is the total number of trading days in year t of i shares. In addition,

the remaining variables of Formula (8) are consistent with the variable definitions of the principal regression model (10). If controlling shareholder pledge reduces the stock liquidity of listed companies, we expect the sign of PLD_RATE1$_{i,t}$ and PLD_RATE2$_{i,t}$ to be significantly negative.

Columns (1) and (2) of Table 6 report the results of regression analysis of the effect of controlling shareholder pledge on corporate liquidity. Among them, PLD_RATE1$_{i,t}$ and PLD_RATE2$_{i,t}$ are all significantly negatively correlated with stock liquidity at the significance level of 1%. The regression results confirm that the higher the level of controlling shareholder pledge of listed companies, the poorer the liquidity.

Impact on Tunneling Behavior of Large Shareholders

Based on the above research, we intend to use model (9) to study the influence of controlling shareholder pledge on the tunneling behavior of large shareholders.

$$\mathrm{PEG}_{i,t} = \alpha_0 + \alpha_1 \mathrm{Pledge}_{i,t} + \alpha_2 \mathrm{Controls}_{i,t} + \sum \mathrm{Ind} + \sum \mathrm{Year} + \varepsilon_{i,t} \quad (9)$$

In the above formula, Occupy$_{i,t}$ represents the tunneling behavior of large shareholders. According to Wang and Qian (2021), we use the ratio of other receivables to total assets to represent it. We expect that controlling shareholder pledge increases the tunneling behavior of large shareholders, and the regression coefficients of PLD_RATE1$_{i,t}$ and PLD_RATE2$_{i,t}$ are significantly positive.

Column (3) and column (4) of Table 6 report the regression analysis results of the effect of controlling shareholder pledge on the tunneling behavior of large shareholders, which show that the regression coefficients of the variables PLD_RATE1$_{i,t}$ and PLD_RATE2$_{i,t}$ are 0.0027 and 0.006, respectively, and significant at the significance level of 5% and 10%, respectively, indicating that controlling shareholder pledge has significantly increased the tunneling behavior of major shareholders of listed companies.

Table 6 Path analysis table of the effect of controlling shareholder pledge on equity capital cost

Item	Controlling shareholder pledge and liquidity		Controlling shareholder pledge and tunneling behavior of large shareholders	
	Tover$_{i,t}$*(1)*	Tover$_{i,t}$*(2)*	Occupy$_{i,t}$*(3)*	Occupy$_{i,t}$*(4)*
PLD_RATE1$_{i,t}$	−0.4813***		0.0027**	
	(−7.99)		(2.50)	
PLD_RATE2$_{i,t}$		−1.2140***		0.0060*
		(−7.33)		(1.81)
Controls	Controls			
Industry/year	Controls			
N	10,774	10,774	10,777	10,777
Adj-R^2	0.453	0.4521	0.0266	0.0266

Intermediary Effect Test

The above research results show that the controlling shareholder pledge reduces the stock liquidity of the listed companies and increases the tunneling behavior of large shareholders. In order to further verify whether it is the path where the controlling shareholder pledge affects equity capital cost, we also conducted an intermediate effect test. Based on the method used by Wen et al. (2004) to test the intermediate effect, we established the model as follows:

$$\mathrm{PEG}_{i,t} = \alpha_0 + \alpha_1 \mathrm{Pledge}_{i,t} + \alpha_2 \mathrm{Controls}_{i,t} + \sum \mathrm{Ind} + \sum \mathrm{Year} + \varepsilon_{i,t} \quad (10)$$

$$\mathrm{Mediator}_{i,t} = \beta_0 + \beta_1 \mathrm{Pledge}_{i,t} + \beta_2 \mathrm{Controls}_{i,t} + \sum \mathrm{Ind} + \sum \mathrm{Year} + \varepsilon_{i,t} \quad (11)$$

$$\mathrm{PEG}_{i,t} = \gamma_0 + \gamma_1 \mathrm{Pledge}_{i,t} + \gamma_2 \mathrm{Mediator}_{i,t} + \gamma_3 \mathrm{Controls}_{i,t} + \sum \mathrm{Ind} + \sum \mathrm{Year} + \varepsilon_{i,t} \quad (12)$$

In the above model, model (10) is consistent with the principal regression model; the variables $\mathrm{Mediator}_{i,t}$ in the model (11) are intermediate variables, which in this paper refer to stock liquidity $\mathrm{TOVER}_{i,t}$ and majority shareholder occupation $\mathrm{Ocuppy}_{i,t}$, respectively; model (12) adds intermediate variable $\mathrm{Mediator}_{i,t}$ on the basis of the principal regression model (10).

As the above model contains multiple independent variables, the concept of complete intermediate effect has no practical significance, so we only need to examine the significance of $\mathrm{Pledge}_{i,t}$ coefficient in model (10), $\mathrm{Pledge}_{i,t}$ coefficient in model (11), and $\mathrm{Pledge}_{i,t}$ coefficient and $\mathrm{Mediator}_{i,t}$ coefficient in model (12). For the regression results of model (10) and model (11), we have reported them in the principal regression analysis and the above-mentioned conduction path analysis, respectively. The results show that the regression coefficients of $\mathrm{Pledge}_{i,t}$ are significant. Therefore, only the regression analysis results of model (12) are reported in the intermediate effect reporting results in Table 7. If the intermediate effect holds, the regression coefficients of $\mathrm{Pledge}_{i,t}$ and $\mathrm{Mediator}_{i,t}$ shall be significant. If the regression result of model (12) confirms this, it indicates that the influence of controlling shareholder pledge on equity capital cost is realized through the intermediate variables $\mathrm{TOVER}_{i,t}$ and $\mathrm{Octuppy}_{i,t}$.

The analysis results of columns (1) and (2) in Table 7 show that when the intermediate variable is $\mathrm{TOVER}_{i,t}$, the regression coefficients of $\mathrm{Pledge}_{i,t}$ are significantly positive. In contrast, the regression coefficients of $\mathrm{TOVER}_{i,t}$ are all -0.0015, which will be significant at the significance level of 1%, indicating that the lower the liquidity of the stock, the higher the equity capital cost of listed companies on the premise of controlling shareholder pledge. The results confirm that part of the influence of controlling shareholder pledge on equity capital cost of listed companies is achieved through the intermediate variable of stock liquidity, and the reduction of stock liquidity is a path for controlling shareholder pledge to increase equity capital cost. Similarly, it can be seen in columns (3) and (4) of Table 7 that when the intermediate variable is $\mathrm{Ocuppy}_{i,t}$, the regression coefficients of $\mathrm{Pledge}_{i,t}$ are

Table 7 Analysis table of intermediary effect between controlling shareholder pledge and equity capital cost

Item	Controlling shareholder pledge and stock liquidity		Controlling shareholder pledge and tunneling behavior of large shareholders	
	$PEG_{i,t}$*(1)*	$PEG_{i,t}$*(2)*	$PEG_{i,t}$*(3)*	$Occupy_{i,t}$*(4)*
$PLD\_RATE1_{i,t}$	0.0046***		0.0051***	
	(3.68)		(4.05)	
$PLD\_RATE2_{i,t}$		0.0118***		0.0130***
		(3.52)		(3.87)
$TOVER_{i,t}$	–0.0015***	–0.0015***		
	(−6.95)	(−7.01)		
$Occupy_{i,t}$			0.0309**	0.0315**
			(2.02)	(2.05)
Controls	Control			
Industry/year	Control			
N	10,774	10,774	10,777	10,777
Adj-R^2	0.1744	0.174	0.1728	0.1723

significantly positive. In contrast, the regression coefficients of $Occupy_{i,t}$ are 0.0309 and 0.0315, respectively, and are significant at the significance level of 5%, indicating that under the background of controlling shareholder pledge, the more serious the tunneling behavior of large shareholders, the higher the equity capital cost of listed companies. This analysis confirms that the influence of controlling shareholder pledge on the equity capital cost of listed companies is partially achieved through the intermediary variable of tunneling behavior of large shareholders, and the increase of tunneling behavior of large shareholders is another path for controlling shareholder pledge to influence equity capital cost.

Further Analysis and Discussion

Controlling Shareholder Pledge, Information Disclosure Quality, and Equity Capital Cost

Signaling theory holds that information disclosure provides investors with useful accounting information for decision-making by reducing information asymmetry. High-quality accounting information helps investors judge the future cash flows of the company and reduce the β coefficient and equity capital cost of the company (Luo & Wang, 2015); the research by Guo and Huang (2021) also showed that the quality of accounting information and stock liquidity are two paths that affect equity capital cost. After the equity pledge by the controlling shareholder, in order to mitigate the risk of liquidation brought by the equity pledge, the listed company may gloss over the company's operating data by manipulating the company's performance, thus deteriorating the quality of information disclosure of the

listed company, reducing the credibility of financial information, and exacerbating the information asymmetry inside and outside the company (Wang & Qian, 2021). Therefore, we believe that in the context of controlling shareholder pledges, the poorer the quality of information disclosure of listed companies, the higher their equity capital cost. In order to study the impact of information disclosure quality on equity capital cost under the background of controlling shareholder pledge, we used the following formula:

$$\mathrm{PEG}_{i,t} = \alpha_0 + \alpha_1 \mathrm{Pledge}_{i,t} + \alpha_2 \mathrm{Pledge}_{i,t} \times \mathrm{Abs}DA_{i,t} + \alpha_3 \mathrm{Controls}_{i,t} + \sum \mathrm{Ind} + \sum \mathrm{Year} + \varepsilon_{i,t} \tag{13}$$

In the above formula, $\mathrm{Abs}DA_{i,\,t}$ represents the quality of corporate information disclosure, which we measure using the absolute value of the manipulated accruals calculated by the Modified Jones Model. Specifically, we adopt the Modified Jones Model, regress it by year and industry to obtain abnormal accruals, and then take the absolute value as an alternative indicator of information disclosure quality. The higher the value, the stronger the earnings manipulation of listed companies is, and the worse the information disclosure quality is. The remaining variable definitions of Formula (12) are consistent with the variable definitions of the principal regression model (10). We expect that the regression coefficient of cross-term $\mathrm{Pledge}_{i,\,t} \times \mathrm{Abs}DA_{i,\,t}$ is significantly positive; i.e., the poorer the information disclosure quality of listed companies, the higher their equity capital cost.

Columns (1) and (2) of Table 8 report the impact of the quality of information disclosure on the equity capital cost of listed companies in the context of controlling shareholder pledge. The results show that the regression coefficients of cross-terms $\mathrm{PLD\_RATE1}_{i,\,t} \times DA_{i,\,t}$ and $\mathrm{PLD\_RATE2}_{i,\,t} \times DA_{i,\,t}$ are 0.0345 and 0.0808, respectively, and are significant at the significance level of 1%, indicating that under the background of controlling shareholder pledge, the poorer the information disclosure quality of listed companies, the higher their equity capital cost.

Controlling Shareholder Pledge, Stock Price Risk, and Equity Capital Cost

After controlling shareholder pledges, if the listed company's share price continues to fall, the controlling shareholders will face greater pressure of pledge and closing and the risk of control transfer. When investors pay attention to the company's stock price risk, they may raise their equity capital cost to offset the impact of stock price risk. Xu and Wang (2021) believed that when the share price continues to fall, the greater the risk of control transfer of listed companies, the more likely they are to adopt tax avoidance measures. Xu and Wang (2021) found that the larger the stock price risk of the listed companies, the stronger their motivation to use the performance promise of merger and acquisition for market value management. Hu et al. (2020) examined the impact of controlling shareholder pledges on charitable donations from listed companies in the case of "bull market" and "bear market." This paper also draws on the research ideas of the above scholars to test the impact of stock price risk on equity capital cost

Table 8 Controlling shareholder pledge and information disclosure quality

Item	Controlling shareholder pledge and information disclosure quality		Controlling shareholder pledge and stock price risk	
	$PEG_{i,t}$*(1)*	$PEG_{i,t}$*(2)*	$PEG_{i,t}$*(3)*	$PEG_{i,t}$*(4)*
$PLD\_RATE1_{i,t}$	0.0033**		0.0032**	
	(2.25)		(2.20)	
$PLD\_RATE2_{i,t}$		0.0082**		0.0079**
		(2.22)		(1.98)
$PLD\_RATE1_{i,t} \times Abs DA_{i,t}$	0.0226**			
	(2.27)			
$PLD\_RATE2_{i,t} \times Abs DA_{i,t}$		0.0254***		
		(2.66)		
$PLD\_RATE1_{i,t} \times Risk_{i,t}$			0.0046***	
			(2.74)	
$PLD\_RATE2_{i,t} \times Risk_{i,t}$				0.0121**
				(2.46)
Controls	Yes			
Industry/year	Yes			
N	10,407	10,407	10,777	10,777
Adj-R^2	0.1698	0.1695	0.1736	0.1729

under the background of controlling shareholder pledges. Specifically, we studied it using the following formula:

$$PEG_{i,t} = \alpha_0 + \alpha_1 Pledge_{i,t} + \alpha_2 Pledge_{i,t} \times Risk_{i,t} + \alpha_3 Controls_{i,t} + \sum Ind + \sum Year + \varepsilon_{i,t} \quad (14)$$

In the above formula, $Risk_{i,t}$ represents stock price risk. We use the research method of Jun et al. (2020) for reference and compare the monthly average return rate of the listed company's stock market with a zero-return rate. If the stock market's monthly average market return rate is less than zero, $Risk_{i,t}$ will be 1, indicating the existence of stock price risk; otherwise, $Risk_{i,t}$ will be 0, indicating the absence of stock price risk. Among them, the regression coefficient of $Pledge_{i,t} \times Risk_{i,t}$ indicates the influence of controlling shareholder pledges and stock price risk on equity capital cost. We expect that the regression coefficient of the cross-term $Pledge_{i,t} \times Risk_{i,t}$ is significantly positive because in the context of controlling shareholder pledge, the larger the stock price risk, the greater its impact on equity capital cost.

Column (3) and column (4) of Table 8 report the impact of stock price risk on equity capital cost in the context of controlling shareholder pledges. Among them, the cross-terms $PLD\_RATE1_{i,t} \times Risk_{i,t}$ and $PLD\_RATE2_{i,t} \times Risk_{i,t}$ have positive regression coefficients, which are significant at the significance level of 1% and 5%, respectively. Therefore, under the background of the controlling shareholder pledge, the larger the stock price risk of a listed company, the higher its equity capital cost.

Conclusions and Implications

Theoretical Implications

Based on signaling theory and information risk theory, this paper takes A-share listed companies from 2014 to 2019 as samples to study the influence of controlling shareholder pledge on equity capital cost. The results show that controlling shareholder pledge increases the equity capital cost of listed companies, while high-quality external audit helps suppress its positive correlation. Path research shows that there is some intermediate effect between stock liquidity and tunneling behavior of large shareholders behavior. Controlling shareholder pledges increases the equity capital cost of listed companies by reducing the liquidity of corporate shares and increasing the tunneling behavior of large shareholders. In addition, we tested the robustness of the research conclusion by employing instrumental variable regression and the tendency matching score method, and replacing the equity financing cost index. The results confirmed that the positive correlation between controlling shareholder pledges and equity capital cost was valid. Furthermore, we studied the incremental effect of controlling shareholder pledge on equity capital cost from the perspective of information disclosure quality and stock price risk. We found that under the background of controlling shareholder pledge, the poorer the information disclosure quality of listed companies, the higher their equity capital cost; the larger the stock price risk, the higher the equity capital cost.

By examining the influence of the controlling shareholder pledge on equity capital cost and its mechanism of action, this paper increases the understanding of the issue of the controlling shareholder pledge and enriches the research content of equity capital cost. It broadens the knowledge of corporate financing behavior and provides micro-level empirical evidence for understanding the economic consequences of controlling shareholder pledges.

Managerial Implications

First, for the regulatory level, in order to control the overall risk of listed companies and reduce the financing costs of listed companies, the size of the controlling shareholder pledge shall be limited to a certain extent. The research in this paper shows that controlling shareholder pledges will reduce the stock liquidity of listed companies and increase the tunneling behavior of large shareholders, thus increasing the equity capital cost of listed companies, which is not conducive to the operation of listed companies. Second, standardize capital market financing and vigorously strengthen external supervision. External supervision is conducive to regulating the operation of listed companies, increasing investors' confidence, and reducing the influence of controlling shareholder pledges on equity capital cost. Third, pay attention to the capital market infrastructure, improve the quality of information disclosure of listed companies, and pay attention to the impact of stock price risk on listed companies, all of which are of great significance to the long-term development of the capital market.

Ideas for Future Research

Our research has several limitations that point us in the right direction for the future. First, we can look into how equity pledges affect enterprise innovation, which is critical for business transformation and upgrading. Second, the vast majority of publicly traded companies have failed to disclose the projects and various purposes of capital investment, making it impossible to investigate the impact of equity pledge on enterprise innovation in terms of the specific purposes of equity pledge, which is a problem that will be investigated in the future. Third, the influence of equity commitment on firm innovation is an essential topic for future research, according to the use objects of equity financing funds.

Furthermore, China's officials updated key rules and regulations in 2018 to encourage stock repurchases, with the goal of correcting stock prices and guiding them to their actual value. However, the China Securities Regulatory Commission and other institutions should tighten their oversight of stock repurchases to prevent publicly traded companies from concealing their actual financial situation through stock repurchase and abusing stock repurchase to artificially inflate stock prices. With this, listed businesses' information environments and corporate governance must be strengthened, information asymmetry must be reduced, and controlling shareholders' activities, such as opportunism, must be effectively monitored. Lastly, the correlation between the controlling shareholder pledge and the capital cost of listed companies believed that corporate governance is helpful to mitigate its impact, but the mechanism of action is not tested in this paper and can be researched in future articles.

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Data Availability The data are available from the authors upon reasonable request.

Declarations

Conflict of Interest The authors declare no competing interests.

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