

Study on the Relationship between Short Selling Regulations and Corporate Equity Financing Costs

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Abstract

As capital market regulation has been progressively refined, and as short-selling mechanisms have continued to widen in scope, the question of whether short-selling rules affect corporate equity financing costs—and through which channels they do so—has moved to the foreground of scholarly inquiry. Focusing on A-share listed firms on the Shanghai and Shenzhen stock exchanges over the 2015–2024 period, the study draws on the quasi-natural experiment generated by the phased liberalisation of margin trading regulation and, with a multi-period difference-in-differences framework, conducts a structural test of the effects of short-selling regulation on corporate equity financing costs as well as the mechanisms through which those effects operate. The empirical results point in a consistent direction: short-selling regulation reduces corporate equity financing costs. That inference, importantly, remains intact across a series of robustness checks, including alternative proxy-variable specifications, propensity score matching, and placebo tests. Turning to the transmission channels—this is where the pattern becomes more analytically interesting—the mechanism tests suggest an intermediary pathway whereby short-selling regulation raises firms' cash dividend payout ratios while also strengthening market value assessments, with investor risk premiums correspondingly compressed and financing costs, in turn, pushed downward.

Keywords

Short-selling Regime; Equity Financing Costs; Margin Trading.

1. Introduction

Since reform and opening-up, China's capital markets have expanded at high speed. By the end of 2025, the number of listed firms on the A-share market had reached 5,469, and aggregate market capitalisation stood at roughly RMB 123 trillion, thereby cementing the market's status as the world's second-largest equity market. Yet, for all the scale achieved, frictions relative to more mature markets remain difficult to ignore: information asymmetry is still pronounced, pricing efficiency remains underdeveloped, and the cost of equity financing stays comparatively high—most clearly for small and medium-sized enterprises. Against this institutional backdrop, and with the dual aims of lowering financing costs and improving market efficiency, China has continued to press forward with reform measures.

On 31 March 2010, the pilot programme for margin trading was formally launched, and across the years that followed, repeated rounds of expansion were introduced. By 2025, the number of stocks eligible for margin trading had risen substantially to about 3,693, while the range of eligible instruments (ETFs included) had widened to more than 5,400. Regulatory policy, for its part, has likewise been refined on an ongoing basis in recent years. Since 2024, for example, regulators have fully suspended short selling of restricted shares and, in an effort to contain operational risk, shifted the settlement arrangement for short-selling transactions to

T+1. Also relevant here, the 2019 revisions to margin trading rules eased risk-control indicators and enlarged the set of admissible collateral. Added to that, the registration-based reforms applied to the STAR Market and the Second Board Market allow newly listed shares to be sold short from the first day of trading. Taken together, the introduction and gradual calibration of the short-selling mechanism have pushed China's capital market from one-way trading toward a two-way trading structure. From that follows the central point: a systematic inquiry into how short-selling systems affect the cost of corporate equity financing is of clear importance.

Existing literature has systematically explored the economic consequences of short-selling systems across market efficiency and corporate governance dimensions, generating substantial empirical evidence concerning corporate disclosure, investment decisions, innovation behaviour, and stakeholder responses. Concurrently, research on equity financing costs indicates their dependence on multiple factors including institutional environments, governance mechanisms, and investor behaviour. Nevertheless, research examining the relationship between short-selling regulations and corporate equity financing costs remains relatively limited. Particularly against the backdrop of China's gradual expansion of its margin trading system, systematic testing of the impact mechanisms and contingency conditions on equity financing costs remains inadequate. Therefore, this paper conducts further empirical analysis within the context of China's institutional evolution, employing a quasi-natural experiment methodology to investigate whether and how short-selling regulations affect corporate equity financing costs.

2. Theoretical Analysis and Research Hypotheses

2.1. Direct Impact of Short-Selling Regulations on Corporate Equity Financing Costs

Early strands of theoretical research in the traditional literature held that short-selling mechanisms enhance the informational efficiency of capital markets. Under the constraint hypothesis, before short-selling mechanisms were introduced, corporate managers were in a position to manipulate reported earnings in order to obtain private benefits. Yet once such manipulation was detected by outside market participants, reputational damage or tangible economic losses would follow, with management directly implicated. As short sellers enrich the information content embedded in prices and bring corporate risk-taking into clearer view, both the likelihood and the speed of exposure of managerial misconduct rise, which in turn weakens managerial incentives to engage in such behaviour. Precisely because managerial conduct is disciplined in this way, the mechanism is termed the constraint hypothesis.

With the advent of short-selling, the market shifts from a one-sided trading structure to a two-sided one. In quantitative terms, short-seller participation enlarges the investor base, and, once short-selling constraints are relaxed, trading frequency increases. On the qualitative side, short sellers are commonly viewed as more professional, more experienced, and more "sophisticated" investors. When their trading decisions are transmitted into the market price formation process (that transmission being central here), market information gains both greater depth and additional dimensions, while misinformation is more readily corrected. Given a better information environment, investor uncertainty about a firm's future earnings declines; as that uncertainty recedes, so too does the risk premium required by investors, and the firm's equity financing costs are consequently blueuced.

Based on the foregoing analysis, this paper proposes the following hypothesis:

H1: All other things being equal, short-selling regulations significantly reduce corporate equity financing costs.

2.2. Mechanism of Short Selling Regulations' Impact on Corporate Equity Financing Costs

2.2.1. Mediating Effect of Corporate Dividend Distribution

Under signal transmission theory, cash dividends function as a salient market signal through which management conveys operating stability and sufficiently strong cash flow. In markets equipped with short-selling mechanisms, by contrast, external monitoring becomes markedly more intense: when performance falls short or information quality is perceived as deficient, short selling and share-price declines are easily triggered. Against this disciplinary setting, management is incentivized to raise cash dividends so as to stabilize expectations and lessen exposure to short-selling risk, thereby transmitting a favorable signal to the market (Zhao Wenqing, Wang Jing, 2017)[1].

Drawing jointly on dividend signaling theory and the Gordon model, an increase in cash dividends, taken in isolation, directly raises the cost of equity financing; once the accompanying positive signal is priced in, however, the relevant risk premium may fall and share prices may rise, with the result that financing costs are offset or may even decline. At the same time, higher cash dividends improve market perceptions, constrain the discretionary cash flow available to management, and, by doing so, reduce agency costs as well as financing expenses. Zhao Wenqing, Wang Jing. (2017)[2].

Based on the foregoing analysis, this paper proposes the following hypotheses:

H2: Short-selling regulations reduce corporate equity financing costs by elevating cash dividend payout levels.

2.2.2. Mediating Effect of Market Value

According to valuation and market efficiency theories, short-selling mechanisms enhance the market's ability to discern a firm's true value, thereby improving valuations and influencing equity financing costs. Firstly, short-selling mechanisms strengthen market information production. Short sellers proactively uncover and disclose negative information, mitigating information asymmetry and aligning firm valuations more closely with intrinsic value. Within the Fama-French framework, short-selling optimises pricing efficiency by reducing the book-to-market ratio (BM), thereby lowering equity financing costs. Secondly, the short-selling regime exerts an external oversight effect, compelling firms to enhance disclosure quality and corporate governance standards. This improves profitability and operational stability, elevating market expectations for future cash flows. Consequently, valuations rise and BM decreases, reducing financing costs via the risk premium channel. Chen Min, Peng Jianhui. (2005)[3].

From a risk-return perspective, improved valuations reduce investors' perceived risk and demanded risk premiums. Thus, by enhancing information efficiency and governance standards, short-selling regimes ultimately lower equity financing costs through improved market valuations and reduced BM.

Based on the foregoing analysis, this paper proposes the following hypotheses:

H3: Short-selling regulations reduce corporate equity financing costs by elevating market value.

3. Research Design

3.1. Sample Selection and Data Sources

This study investigates the impact of short-selling regulations on corporate equity financing costs. Consequently, annual data from A-share listed companies on the Shanghai and Shenzhen stock exchanges between 2015 and 2024 were selected as the sample. Data were sourced from

the Guotai An (CSMAR) database, with certain variables manually calculated and processed to obtain final figures. The sample data underwent the following treatments:

(1) Financial sector firms were excluded. (2) Firms initially included in the securities lending list but subsequently removed were excluded. (3) Firms designated as ST (Special Treatment) were excluded. (4) Samples with missing dependent or control variables were excluded. (5) All continuous variables underwent 1% level trimmed tailing to prevent potential bias from outliers.

3.2. Variable Selection

The specific definitions of each variable are presented in Table 1.

Table 1. Variable Definitions

Variable Category	Variable Name	Symbol	Calculation Method
Dependent Variable	Cost of Equity Financing	Rs	$Rs = D1 / (P + g)$, where D1 is the dividend for the next period, P is the current share price, and g is the dividend growth rate
Explanatory Variable	Short selling indicator	Short	0 indicates the company is not on the securities lending list for the current year; 1 indicates the company is on the securities lending list for the current year
Moderator variable	Cash Dividend per Share	DPS	Cash dividend per share = Total cash dividends / Total number of shares in circulation
	Book-to-market ratio	BM	BM = Book value / Market value. A higher value indicates that the company's market value is relatively lower.
Control Variables	Company size	Size	Take the logarithm of total assets at year-end
	Management Ownership Ratio	MgmtOwn	Proportion of shares held by directors, supervisors and senior management relative to total share count
	Controlling shareholder shareholding ratio	CtrlOwn	Prioritise controlling shareholder shareholding ratio; if the report does not disclose the controlling shareholder, select the largest shareholder's shareholding ratio
	Financial leverage ratio	Lev	Ratio of total liabilities to total assets at year-end
	Capital Intensity	PPE	The ratio of fixed assets to total assets at the end of the year
	Price-to-earnings ratio	PE	Price-to-earnings ratio = Year-end closing price / (Net profit for the year / Paid-up capital at year-end)
	Cash flow status	Cash	Ratio of net cash flow from operating activities for the year to total assets at the beginning of the year
	Capital Expenditure	Capex	Absolute amount of capital expenditure = Cash paid for operating leases + Cash paid for the acquisition and construction of fixed assets, intangible assets and other long-term assets - Net cash recovered from the disposal of fixed assets, intangible assets and other long-term assets, then divided by total assets

3.3. Model Construction

Drawing upon the classical multi-period DID approach, Beck, T., Levine, R., & Levkov, A.(2010)[4]. the dummy variable $Short_{i,t}$ measures whether a firm is in a shortable state. The basic model is presented as follows:

$$Rs_{i,t} = \alpha + \beta Short_{i,t} + \gamma Controlvariables_{i,t} + Firm_i + Year_t + \delta_{i,t} \quad (1)$$

In Model 1, $Rs_{i,t}$ is the dependent variable representing the equity financing cost of $Firm_i$ in $Year_t$; $Short_{i,t}$ is the explanatory variable indicating whether short selling is permitted; $\gamma Controlvariables_{i,t}$ constitutes the set of control variables; $Firm_i$ denotes the firm fixed effect; $Year_t$ represents the year fixed effect; and $\delta_{i,t}$ is the residual term. The regression primarily focuses on the regression coefficient β . When the dependent variable is measured by Rs, a significantly negative β supports Hypothesis H1, indicating that the short-selling regime significantly reduces corporate equity financing costs.

To further explore the mechanism through which short-selling regulations affect corporate equity financing costs, this paper constructs a mediation model following Jiang Ting's (2022) [5]. operational recommendations for mediation analysis:

$$Mediator_{i,t} = \alpha_1 + \beta_1 Short_{i,t} + \gamma_1 Controlvariables_{i,t} + Firm_i + Year_t + \delta_{i,t} \quad (2)$$

where $Mediator_{i,t}$ denotes the mediating variables, comprising the dividend per share (DPS) and the book-to-market ratio (BM). Model (2) examines the influence of the short-selling regime on the mediating variables.

4. Empirical Analysis

4.1. Descriptive Statistics and Correlation Analysis

4.1.1. Descriptive Statistics

The descriptive statistics for the main variables across the entire sample are presented in Table 2. The table reveals notable variations in equity financing costs among different enterprises. The mean value of the explanatory variable short-selling indicator (Short) stands at 0.412, indicating that approximately 41.2% of the sample companies were included in the list of securities eligible for short selling during the sample period. Regarding the control variables, the sample listed companies exhibit a high degree of equity concentration. The median price-to-earnings ratio (PE) stands at 38.52 with a standard deviation of 118.34, indicating substantial valuation disparities among the sample firms.

Table 2. Descriptive Statistics for the Full Sample

	N	Mean	SD	Min	P25	Medium	P75	Max
Rs	12456	0.008	0.015	0	0.002	0.006	0.012	0.185
Short	12456	0.412	0.492	0	0	0	1	1
DPS	12456	0.152	0.198	0	0	0.08	0.24	1.25
BM	12456	0.685	0.342	0.125	0.425	0.612	0.856	2.145
Size	12456	22.456	1.287	19.623	21.567	22.312	23.189	26.234
Management Ownership	12456	15.234	18.672	0	0.156	6.123	29.456	74.567
CtrlOwn	12456	35.178	14.234	9.234	24.123	33.456	44.567	77.234
Lev	12456	0.412	0.192	0.052	0.263	0.401	0.551	0.892
PPE	12456	0.203	0.151	0.003	0.089	0.175	0.284	0.723
PE	12456	76.234	118.342	5.892	21.456	38.523	73.456	892.456
Cash	12456	0.067	0.078	-0.218	0.023	0.062	0.108	0.325
Capital Expenditure	12456	0.046	0.043	0	0.016	0.034	0.064	0.241

4.1.2. Correlation Analysis

Table 3 presents the correlation coefficients among the primary variables, with no evidence of multicollinearity issues. The correlation analysis results preliminarily validate the hypothesis that short-selling regulations may reduce corporate equity financing costs. Regarding the

relationship between control variables and equity financing costs, company size (Size), management ownership ratio (MgmtOwn), controlling shareholder ownership ratio (CtrlOwn), price-to-earnings ratio (PE), and cash flow status (Cash) are significantly negatively correlated with equity financing costs, with correlation coefficients of -0.142, -0.068, -0.095, -0.156, and -0.134 respectively. Conversely, financial leverage (Lev), capital intensity (PPE), and capital expenditure (Capex) showed significant positive correlations with equity financing costs, with correlation coefficients of 0.123, 0.089, and 0.045 respectively. Regarding the mediating variables, the dividend per share (DPS) and the book-to-market ratio (BM) were found to be significantly positively correlated with equity financing costs at the 1% confidence level, with correlation coefficients of 0.178 and 0.201 respectively.

Table 3. Correlation Analysis

	Rs	Short	DPS	BM	Size	Manageme nt Own	CtrlOw n	Lev	PPE	PE	Cash	Cape x
Rs	1											
Short	-0.087** *	1										
DPS	0.178** *	0.045**	1									
BM	0.201** *	-0.062** *	0.089** *	1								
Size	-0.142** *	0.523** *	0.123** *	-0.234** *	1							
Manageme nt Ownership	-0.068** *	-0.312** *	0.056**	0.045*	-0.378** *	1						
CtrlOwn	-0.095** *	-0.023*	0.078** *	0.034	0.045** *	0.134***	1					
Lev	0.123** *	0.198** *	-0.045*	0.067** *	0.567** *	-0.267***	-0.008	1				
PPE	0.089** *	-0.012	-0.023	0.078** *	0.032** *	-0.125***	0.039** *	0.017	1			
PE	-0.156** *	-0.089** *	-0.067** *	-0.234** *	-0.256** *	0.014	-0.072** *	-0.081** *	0.033** *	1		
Cash	-0.134** *	0.082** *	0.045**	-0.089** *	0.006	0.044***	0.107** *	-0.172** *	0.201** *	-0.167** *	1	
Capital expenditur e	0.045**	-0.028** *	0.012	0.023	-0.025**	0.118***	0.057** *	-0.006	0.352** *	-0.041** *	0.223** *	1

4.2. Benchmark Regression Analysis

Table 4 reports the fixed-effects regression results of the short-selling regime on firms' equity financing costs. Findings indicate that firms eligible for securities lending experienced an average reduction of 0.002 percentage points in their equity financing costs relative to the control group. Although the numerical value is small, considering that the mean Rs in the sample is 0.008 and the median is 0.006, it can be estimated that the implementation of the short-selling regime reduced firms' equity financing costs by approximately 25%. Overall, the estimation results for Short align with theoretical expectations, supporting Hypothesis H1 that the short-selling regime significantly reduces corporate equity financing costs.

Compared to models controlling for firm-specific fixed effects, those controlling for industry fixed effects demonstrated superior overall model fit. However, given the stricter specification

of firm-specific fixed effects, subsequent regressions employed a dual fixed-effects model controlling for both firm and year. Regarding the results of the control variables, the variables that were significant in both models were consistent: equity financing costs were significantly negatively correlated with firm size (Size), price-earnings ratio (PE), and cash flow status (Cash), and significantly positively correlated with financial leverage ratio (Lev) and capital intensity (PPE). This indicates that larger firms with higher valuations and more abundant cash flows have lower financing costs, while firms with higher leverage levels and capital intensity have relatively higher financing costs.

Table 4. Benchmark Regression Results

	(1) Rs	(2) Rs
	Company Controlled	Industry Controlled
Short	-0.002***	-0.002***
	(-3.456)	(-4.789)
Size	-0.001***	-0.001***
	(-5.234)	(-8.567)
Management Ownership	-0.000*	-0.000***
	(-1.789)	(-3.234)
CtrlOwn	-0.000	-0.000**
	(-0.456)	(-2.123)
Lev	0.003***	0.004***
	(2.567)	(5.678)
PPE	0.002**	0.003***
	(2.234)	(3.456)
PE	-0.000***	-0.000***
	(-8.234)	(-12.567)
Cash	-0.004***	-0.005***
	(-3.789)	(-6.234)
Capital Expenditure	0.001	0.001
	(-1.234)	(-1.567)
_Cons	0.034***	0.028***
	(6.789)	(10.234)
N	12456	12456
R ²	0.078	0.156
Adjusted R ²	0.076	0.148
Year	Yes	Yes
Industry	No	Yes
Company	Yes	No

Note: Values in brackets denote t-values adjusted for cluster-wise standard errors. *p<0.1, **p<0.05, ***p<0.01; same applies below.

4.3. Robustness Tests

4.3.1. Parallel Trend Test

To examine whether the cost of equity financing for firms in this study's regression model satisfies the parallel trend assumption prior to short selling, this research adopts the methodology employed by Li, O. Z., Liu, H., & Ni, C. K. (2017) and Xiong Jiakai (2019)[6-7]. constructing the following dynamic equation:

$$Rs_{i,t} = \alpha + \beta_{-3}Pre3_{i,t} + \beta_{-2}Pre2_{i,t} + \beta_0Current_{i,t} + \beta_1Post1_{i,t} + \beta_2Post2_{i,t} + \beta_3Post3_{i,t} + \gamma Controlvariables_{i,t} + Firm_i + Year_t + \delta_{i,t} \quad (3)$$

Here, the model introduces $Pre_{i,t}$, $Current_{i,t}$, $Post_{i,t}$ a set of dummy variables reflecting the temporal position of the event where a firm becomes a shortable security. Specifically, $Current_{i,t}$ takes a value of 1 in the year the firm becomes a shortable security. For the j-years preceding (or j-years following) the firm becoming a shortable security, $Pre_{i,t}$ ($Post_{i,t}$) takes a value of 1, otherwise 0. Particularly, $Pre3_{i,t}=1$ ($Post3_{i,t}=1$) represents the period 3 years preceding (or 3 years following) the firm becoming a shortable security and the preceding (or following) period.

As illustrated in Figure 1, both β_{-3} and β_{-2} are not significantly different from zero at the 5% significance level. This indicates that prior to becoming eligible for securities lending, there was no significant difference in equity financing costs between the treatment group and the control group, thus satisfying the parallel trends assumption. Notably, β_0 not being significantly different from zero suggests a certain lag effect of the policy, as the equity financing costs in the year a firm became eligible for securities lending showed no significant difference from the control group. Furthermore, $\beta_1, \beta_2, \beta_3$ differ significantly from zero at the 5% significance level and are negative, indicating that after becoming eligible for short selling, the equity financing costs of firms decrease significantly. This suggests that the reduction in equity financing costs following short selling is not temporary but persists.

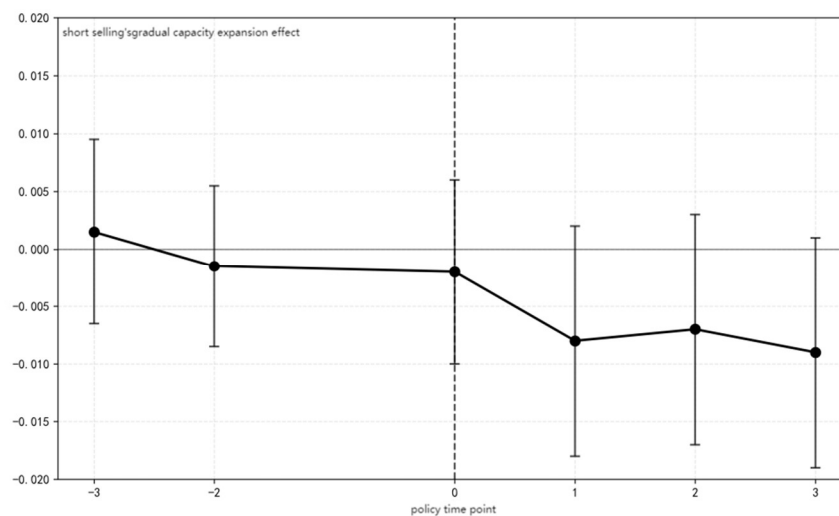


Figure 1. Parallel Trend Test

4.3.2. Alternative Approach to Measuring Key Variable Level

(1) Alternative Measures of Equity Financing Costs

To enhance the robustness of the findings, regression analyses employing alternative equity financing cost metrics were conducted. Beyond the Gordon model (Rs), the PEG model represents a commonly used approach for measuring equity financing costs. Building upon the Gordon model, the PEG model incorporates the influence of earnings growth rates. Table 5 presents the regression results for the dependent variable using the PEG model metric, based on the processed sample and with other conditions held constant. The results indicate that the estimated coefficient for the dependent variable is significantly negative, supporting Hypothesis H1.

Table 5. Regression Results Using Alternative Dependent Variables

	(1) Rs_PEG
Short	-0.002**
	(-2.234)
Size	-0.001***
	(-4.567)
MgmtOwn	-0.000
	(-1.234)
CtrlOwn	-0.000
	(-0.234)
Lev	0.003**
	(2.123)
PPE	0.002*
	(1.789)
PE	-0.000***
	(-7.456)
Cash	-0.003**
	(-2.567)
Capex	0.001
	(-1.123)
_Cons	0.031***
	(5.234)
N	12456
R ²	0.072
Adjusted R ²	0.070
Year	Yes
Company	Yes

(2) Alternative Measures of Short Selling Intensity

The primary regression model in this paper employs dummy variables with values of 0 or 1 as explanatory variables. This section introduces alternative variables. Firstly, in most studies, this variable measures qualitative short-selling threats. As the dummy variable indicates inclusion on the securities lending list, it serves as a pre-emptive measure of short-selling activity. Secondly, to determine whether a company is actually subject to short selling or the extent of such activity, academia typically employs quantitative indicators such as short selling intensity. Thirdly, within China's margin trading system, the lists for margin financing and securities lending are nearly identical. Relying solely on this list to measure short selling intensity fails to accurately distinguish the effects of margin financing and securities lending. This paper employs two ex post indicators—short selling volume (Short1) and proportion of short selling value (Short2)—as alternative measures of the explanatory variable. Boehmer & Wu (2013), Massa, M., Zhang, B., & Zhang, H. (2015), Li, Z., Chen, C., & Lin, B. (2015), Zhang Xuan, Zhou Peng & Li Chuntao (2016) [8-11]. Table 6 presents regression results for the base sample, using Short1 and Short2 respectively to measure the explanatory variable while holding other conditions constant. The regression results indicate that, regardless of which indicator is employed, the estimated coefficients for the explanatory variable are significantly negative, supporting Hypothesis H1.

Table 6. Regression Results with Alternative Measures of the Explanatory Variable

	(1) Rs	(2) Rs
	Short Volume	Short Amount
Short1	-0.018**	
	(-2.234)	
Short2		-0.356**
		(-2.123)
Size	-0.001***	-0.001**
	(-4.567)	(-2.345)
Management Ownership	-0.000	-0.000
	(-1.456)	(-1.234)
CtrlOwn	-0.000	-0.000
	(-0.234)	(-0.123)
Lev	0.003**	0.004***
	(2.234)	(3.456)
PPE	0.002*	0.002
	(1.789)	(1.456)
PE	-0.000***	-0.000**
	(-7.567)	(-2.234)
Cash	-0.004***	-0.003**
	(-3.456)	(-2.567)
Capital Expenditure	0.001	0.001
	(-1.123)	(1.012)
_Cons	0.033***	0.032***
	(6.234)	(5.567)
N	12456	12456
R ²	0.077	0.075
Adjusted R ²	0.075	0.073
Year	Yes	Yes
Company	Yes	Yes

4.3.3. Propensity Score Matching

A potential issue with constructing a multi-period DID model using the margin trading pilot programme as a quasi-natural experiment lies in the possible endogeneity of target firm selection. To mitigate the effects of observable heterogeneity, this paper further constructs a propensity score matching (PSM) sample for testing. Given that PSM results are sensitive to matching criteria, caliper range, and whether resampling is permitted, and that excessive sample loss may introduce bias, this study explores multiple matching approaches. Luo, J., Ni, X., & Tian, G. (2020) [12]. Except for Row (1), which employs probit estimation, all other analyses utilise logit models to estimate propensity scores. The caliper range is set at 0.05 standard deviations of the propensity score, retaining only samples within the common range. Results indicate that, apart from significant sample loss in non-replacement matching, other methods exhibit minimal differences in sample loss and average treatment effect (ATT), all significant at the 1% level. The inclusion of control group individuals with identical propensity scores also exerts negligible influence on outcomes.

Table 7. Results of Different PSM Methods

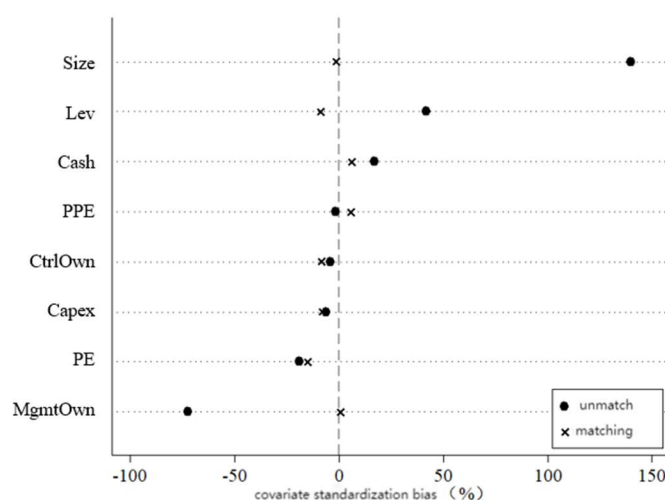
	PSM Method	Observation Loss	Treatment Group ATT	Control Group ATT	ATT Difference	t-statistic
(1)	1:1 Neighbourhood Matching - Probit	523	0.0072	0.0091	-0.0019	-3.45
(2)	1:1 Nearest Neighbour Matching	516	0.0073	0.0092	-0.0019	-3.78
(3)	Without replacement 1:1 nearest neighbour matching	6234	0.0074	0.0089	-0.0015	-2.89
(4)	Radius matching	516	0.0073	0.0092	-0.0019	-3.78
(5)	1:2 Nearest Neighbour Matching	516	0.0073	0.0091	-0.0018	-4.56
(6)	Nuclear matching	516	0.0073	0.0091	-0.0018	-3.89
(7)	Local linear regression matching	516	0.0073	0.0091	-0.0018	-4.56

Taking the one-to-one nearest neighbour matching in row (2) of the above table as an example, the PSM method and results are presented.

First, all subjects were divided into a treatment group (Short=1) and a control group (Short=0) based on the explanatory variable Short. Subsequently, a logit model incorporating main regression control variables and year effects was employed to estimate the probability of a target company becoming a securities lending target, i.e., the PSM propensity score. The estimated coefficients from this regression were then used to estimate the treatment effect for the observed sample values. Finally, within a 0.05 caliper range, each treatment group individual is matched to a unique nearest neighbour control using propensity scores, excluding all individuals failing the overlap assumption.

Table 8. Sample Size Distribution Before and After Matching

	Individuals removed	Matched Individuals	Total
Control group	21	7234	7255
Treatment group	495	4706	5201
Total	516	11,940	12456

**Figure 2.** Standardised Mean Differences in Covariates Between Groups

The matched sample comprised 11,940 firm-year observations. Subsequently, paired t-tests and Wilcoxon rank-sum tests were applied to examine differences in means and medians, respectively. Results indicated that post-matching, the mean difference between groups decreased from 38.2% to 7.1%, while the median difference narrowed from 18.5% to 7.3%. PSM matching significantly reduced disparities between the two groups.

To mitigate endogeneity concerns, following the methodology of Rosenbaum & Rubin (1984) [13], a one-to-one nearest neighbour matching approach was employed to identify control group samples for the target company. These matched samples were subsequently used in regression analysis. Results indicate that the Short coefficient for the independent variable remains significantly negative at the 1% significance level post-matching, with the magnitude of the regression coefficient showing virtually no change, thus maintaining the original findings.

Table 9. Regression Results for Matched Samples Post-PSM

	(2) Rs
	Matching post-sample
Short	-0.002***
	(-3.789)
Size	-0.001***
	(-4.567)
Management Ownership	-0.000
	(-1.234)
CtrlOwn	-0.000
	(-0.234)
Lev	0.003***
	(2.890)
PPE	0.002*
	(1.789)
PE	-0.000***
	(-9.567)
Cash	-0.004***
	(-4.234)
Capex	0.001
	(-1.123)
_Cons	0.031***
	(6.234)
N	11940
R ²	0.082
Adjusted R ²	0.080
Year	Yes
Company	Yes

4.3.4. Placebo Effect Test

To rule out the possibility that the baseline regression estimates were merely an artefact of random variation, a placebo test was implemented. More precisely, the set of securities designated as eligible for short selling, together with the entry year, was randomly reassigned to generate placebo samples. On that basis, the main regression specification was re-estimated 500 times, with the corresponding coefficient estimates and standard errors retained (the resulting distribution is reported in Figure 3).

As Figure 3 makes clear, the mean of the coefficients obtained after randomisation lies very near zero, whereas it remains clearly separated from the true estimate of -0.002. Across most of these simulated estimates, the associated p-values exceed 0.1 and therefore do not satisfy conventional significance thresholds. Under such random assignment, then, the policy effect is generally indistinguishable from zero. The underlying implication is straightforward: the baseline regression results are unlikely to be driven by unobservable factors or sheer chance, which in turn supports the robustness of the study's conclusions.

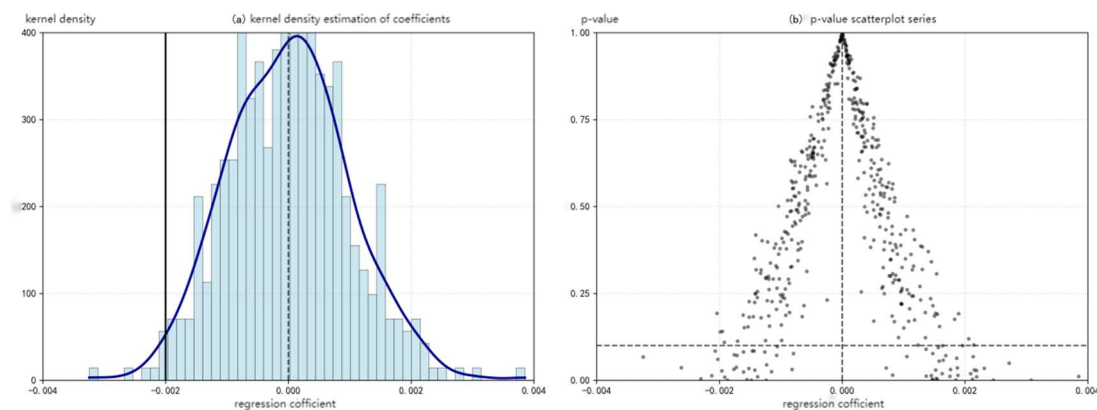


Figure 3. Placebo Test

4.4. Mediating Effect Test

Table 10. Results of Mediating Effect Test

	(1) DPS	(2) BM
Short	0.018***	-0.045**
	(3.234)	(-2.567)
Size	0.012***	-0.089***
	(4.123)	(-6.789)
Management Ownership	0.001**	0.001
	(2.234)	(0.456)
CtrlOwn	0.001***	-0.001
	(3.456)	(-0.789)
Lev	-0.023***	0.123***
	(-3.789)	(4.234)
PPE	-0.008	0.045**
	(-1.234)	(2.567)
PE	-0.000	-0.001***
	(-1.456)	(-5.678)
Cash	0.089***	-0.234***
	(5.234)	(-4.567)
Capex	-0.012	0.023
	(-1.123)	(1.456)
_Cons	-0.156***	0.789***
	(-3.456)	(8.234)
N	12456	12456
R ²	0.124	0.189
Adjusted R ²	0.122	0.187
Year	Yes	Yes
Company	Yes	Yes

Table 10 presents the regression estimates for the mediation analysis. In Column (1), the effect of short-selling regulations on cash dividends per share (DPS) is examined; in Column (2), attention shifts to the book-to-market ratio (BM). As shown in Column (1), the estimated coefficient on short-selling regulations (Short) for DPS is 0.018 and statistically significant at the 1% level, indicating that short-selling regulations raise firms' cash dividends per share. By contrast, Column (2) shows that the coefficient on the short-selling regime (Short) for BM is -0.045 and statistically significant at the 5% level. Read substantively, this negative coefficient suggests that the short-selling regime blueuces the book-to-market ratio, thereby lending support to Hypothesis H3—namely, that it strengthens corporate market value.

Taken together, these results suggest two mediating channels through which the short-selling regime lowers corporate equity financing costs: higher cash dividends per share and a lower book-to-market ratio (that is, enhanced market value). Along the first path, the constraints embedded in the regime induce firms to distribute more cash dividends, a response that signals favorable market expectations and dampens investors' perceived risk, thereby easing equity financing costs. Along the second, by improving corporate market value and, relatedly, market valuation in the securities market, the regime correspondingly blueuces firms' equity financing costs.

5. Result

This study draws on A-share listed firms traded on the Shanghai and Shenzhen stock exchanges over the 2015–2024 period. Using data from the CSMAR database and taking the quasi-natural experiment generated by the gradual liberalisation of the margin trading system as the empirical entry point, it applies a multi-period difference-in-differences model to examine, in a systematic manner, how short-selling regulation bears on corporate equity financing costs. The principal findings are as follows:

(1) Short-selling regulation exerts a statistically discernible cost-blueucing effect on corporate equity financing. In the benchmark regressions, after firm fixed effects and year fixed effects are introduced alongside a set of firm-level control variables, firms newly incorporated into the shortable securities list exhibit a significant decline in equity financing costs. Read more substantively, the introduction of short-selling mechanisms appears to compress investor risk premiums and, by that route, ease firms' financing burdens.

(2) On the robustness front, the findings remain notably stable. Once parallel-trend tests were used to verify the multi-period DID specification, a series of robustness checks followed, including the substitution of alternative measures of equity financing costs, the replacement of short-selling intensity indicators, propensity score matching, and placebo tests. Across these sequential re-estimations, the central conclusion did not shift (a useful sign, methodologically speaking); the empirical results therefore retain stability and reliability.

(3) Mechanism tests further suggest that corporate cash dividend payouts and market valuations serve as partial mediators in the pathway through which short-selling regulation affects equity financing costs. More specifically, short-selling regulation raises firms' cash dividend levels and improves market valuation, which in turn lowers investors' perceived risk through signal-transmission and risk-pricing channels, thereby compressing equity financing costs.

6. Conclusion

Grounded in the empirical results, several policy recommendations emerge. As an initial step, the short-selling mechanism should be expanded incrementally through a tieblue regulatory architecture, risk-control procedures and real-time surveillance should be

tightened, and severe penalties should be imposed on malicious short selling and market manipulation; in parallel, guidance provided to corporations on short-selling policies ought to be strengthened as well.

With respect to firms' internal and external governance arrangements, enterprises should be encouraged to establish stable dividend policies and valuation-management systems, to refine information disclosure practices, and under stronger regulatory discipline to lower equity financing costs and associated risk premia.

References

- [1] Zhao, W. Q., & Wang, J. (2017). Margin trading and listed companies' cash dividend policies. *Investment Research*, 36(07), 66–78.
- [2] Wang, X. M. (2010). Dividend policy, investor protection and equity financing costs. *Accounting Journal (Mid-Month Edition)*, (08), 103–105.
- [3] Chen, M., & Peng, J. H. (2005). An empirical study on the reciprocal relationship between financing behaviour and market value of listed companies. *Industrial Economics Research*, (04), 8–14.
- [4] Beck, T., Levine, R., & Levkov, A. (2010). Big bad banks? The winners and losers from bank deregulation in the United States. *Journal of Finance*, 65(5), 1637–1667.
- [5] Jiang, T. (2022). Mediating and moderating effects in empirical studies of causal inference. *China Industrial Economics*, 410(05), 117–119.
- [6] Li, O. Z., Liu, H., & Ni, C. K. (2017). Controlling shareholders' incentive and corporate tax avoidance: A natural experiment in China. *Journal of Business Finance & Accounting*, 44(5–6), 697–727.
- [7] Xiong, J. C., Guo, X. J., & Hu, C. (2019). Short selling and corporate tax avoidance: A quasi-natural experiment based on margin trading. *Research in Financial Economics*, (05), 122–136.
- [8] Boehmer, E., & Wu, J. (2013). Short selling and the price discovery process. *Review of Financial Studies*, 26(2), 287–322.
- [9] Massa, M., Zhang, B., & Zhang, H. (2015). The invisible hand of short selling: Does short selling discipline earnings management? *The Review of Financial Studies*, 28(6), 1701–1736.
- [10] Li, Z., Chen, C., & Lin, B. (2015). Does short-selling improve pricing efficiency in China's stock market? Evidence from a natural experiment. *Economic Research Journal*, 50(4), 13.
- [11] Zhang, X., Zhou, P., & Li, C. T. (2016). Short selling and earnings quality: Evidence from financial restatements. *Journal of Finance Research*, (08), 175–190.
- [12] Luo, J., Ni, X., & Tian, G. (2020). Short selling and corporate tax avoidance: Insights from a financial constraint view. *Pacific-Basin Finance Journal*, 61.
- [13] Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, 70(1), 41–55.