

The Impact Mechanism of Short Selling on Major Shareholders' Tunneling Behavior

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Abstract

Tunneling by major shareholders poses a significant challenge to China's emerging capital market. As the capital market reform deepens, figuring out how to effectively curb such tunneling and protect minority investors has become crucial. This paper looks at whether relaxing short selling restrictions – an outside market force – can influence major shareholders' tunneling behavior. Our results show that the short selling mechanism can curb tunneling by strengthening minority shareholders' "exit threat," creating a synergy between market forces and internal corporate governance. This suggests that short selling works as an effective market-based tool to protect minority investors, providing empirical support for regulators who want to improve short selling rules.

Keywords

Deregulation of Short Selling; Tunneling; Exit Threat; External Monitoring.

1. Introduction

Short selling is a transaction where an investor puts up collateral, borrows shares from a brokerage, and sells them. Later, they buy back the same number of shares and return them, plus interest and fees. By selling shares they don't actually own, they profit from the "sell high, buy low" spread. As an important financial innovation, short selling helps markets run more efficiently, which is why many mature and emerging markets allow it. In China, a pilot margin trading program started on March 31, 2010 – that's when short selling restrictions officially began to loosen. Existing studies show that short selling doesn't just affect securities markets; it also influences stock prices and, through that, disciplines corporate management and major shareholders. So it acts as an external governance mechanism.

In contrast to developed capital markets where ownership is widely dispersed, China's equity structure appears relatively concentrated, with controlling shareholders common and weak ownership checks and balances. Claessens and his co-authors point out that concentrated ownership produces two opposing effects[1]. On the one hand, it can address the free-rider problem and encourage major shareholders to take an active role in firm management. On the other hand, excessive concentration of control may result in an overconcentration of voting rights and other resources, thereby raising the risk of expropriating minority interests—a practice referred to as "tunneling." Johnson et al. point out that tunneling has become a central agency problem in China's capital market[2].

Modern corporate governance theory emphasizes that curbing tunneling is critical for protecting minority investors, enhancing market efficiency, and fostering healthy capital market development. Particularly in China's concentrated ownership environment, how to effectively restrain tunneling is a key governance issue.

As a major trading mechanism, short selling creates strong external monitoring and constraints on tunneling through its price discovery and information revelation functions. According to Gu

Naikang et al., short selling has a significant ex-ante deterrent effect[3]. When major shareholders engage in tunneling, pessimistic investors dig up and expose negative information about the firm. Short sales cause that information to be quickly priced into stock prices, thereby producing downward pressure that harms all shareholders. This price drop strongly deters major shareholders and curbs their incentives to tunnel.

The external monitoring effect of short selling works through several channels. First, it improves market information transparency, so negative information gets priced faster, increasing the risk that tunneling will be exposed. Second, the price decline directly hurts major shareholders' wallets – a financial deterrent. Third, short selling amplifies monitoring effects by shaping other investors' expectations and behaviors[4,5].

Thus, short selling, as an external market force, plays an important role in curbing tunneling and protecting minority investors in China's concentrated ownership environment.

Focusing on tunneling and using China's short-selling deregulation, this paper examines whether relaxing short-selling restrictions constrains tunneling and whether this effect differs between state-owned enterprises (SOEs) and non-SOEs.

Using a sample of Shanghai and Shenzhen A-share listed companies from 2006 to 2024 and a two-way fixed effects model, we find that deregulating short selling does restrain tunneling, and this effect is stronger in non-SOEs (weaker in SOEs). These results indicate that short selling helps protect minority shareholders and promotes healthy market development.

The potential contributions of this paper are threefold: exploring pathways for minority shareholder protection through the lens of short selling's effect on tunneling; extending the literature on moderating variables in the short selling–tunneling relationship; and broadening the research on short selling's corporate governance implications.

The rest of the paper is structured as follows. Section I is this introduction. Section II reviews the literature. Section III develops hypotheses. Section IV describes the research design. Section V reports empirical results. Section VI concludes.

2. Literature Review

2.1. Research on Short-Selling Mechanisms

When short selling is allowed, if a stock price becomes overvalued relative to its true value, profit-seeking investors borrow shares from securities firms by posting collateral and sell them short. When the overvalued stock price falls, short sellers buy back the same number of shares at a lower price and return them to the lender, pocketing the spread. Existing literature on short selling focuses mainly on two themes: the impact of short selling on capital market pricing efficiency and its role in corporate governance.

On pricing efficiency, many theoretical studies confirm that short-sale constraints hurt asset pricing efficiency. According to Miller, when short sales are constrained, pessimistic investors are forced out, and this will prevent asset prices from reflecting all available negative information[6]. Diamond and Verrecchia further show that short-sale constraints not only cause some informed traders to leave but also significantly reduce pricing efficiency and slow price adjustments to private information[7]. Hong and Stein demonstrate that short-sale constraints slow information absorption, especially negative information – thereby making markets more volatile and even triggering crashes[8]. Empirical cross-country studies support these theoretical findings.

Cross-country studies back this up empirically. Bris et al. use data from 47 countries, find that in markets allowing short selling with fewer restrictions, negative news is incorporated into stock prices more quickly, indicating that relaxing short constraints improves price discovery[9]. Saffi and Sigurdsson, drawing on data from 26 countries over the 2005–2008

period, provide additional evidence that short-sale constraints significantly slow down the speed at which stock prices incorporate negative market- and firm-specific information[10].

Evidence from specific markets supports these conclusions. Chang et al. study of Hong Kong finds that short-sale constraints cause overvaluation, particularly for stocks with greater divergence of investor opinions[11]. In the Chinese market, Li Zhisheng et al., comparing margin-trading eligible stocks with ineligible ones and analyzing pricing efficiency changes around inclusion/exclusion, find a positive correlation between short-selling volume and pricing efficiency[12]. Further research shows that margin trading improves pricing efficiency by enhancing liquidity, reducing information asymmetry, and broadening ownership base.

Research on the corporate governance effects of short selling focuses on earnings quality, financial behavior, and information disclosure.

On earnings quality, short selling shows significant external monitoring. Karpoff and Lou study firms disciplined by the SEC for financial misstatements. They find that short-selling volume starts increasing significantly 19 months before the misstatement is disclosed, and is positively correlated with how severe the misstatement is[4]. This suggests short sellers detect financial misstatements before ordinary investors and help uncover them faster. Massa et al. used firm-level data from 33 countries (2002–2009), find a significant negative relationship between short-selling threat and earnings management[5]. Fang et al. used U.S. data, similarly confirm that short selling effectively monitors and constrains earnings management[13].

In financial behavior, short selling affects multiple dimensions. Regarding financing, Gu Naikang and Zhou Yanli find that the ex-ante deterrent effect of short selling weakens firms' debt financing willingness and reduces leverage[14]. Regarding investment, Jin Qinglu et al. show that relaxing short selling allows firms to reduce investment in a timely manner when lacking good projects, improving investment efficiency[15]. Quan Xiaofeng and Yin Hongying find that short selling enhances innovation efficiency[16], while Chen Shenglan and Ma Hui and demonstrate that short selling leads to better merger and acquisition decisions[17].

In information disclosure quality, Li Chuntao et al. and Li Zhisheng et al. find that short selling significantly improves disclosure quality[12,18]. Zhang Xuan et al. further confirm that short selling curbs financial restatements[19].

Moreover, short selling plays a governance role through stock price informativeness. Meng Qingbin and Huang Qinghua, from the perspective of heterogeneous beliefs, show that short selling reduces overvaluation by reflecting pessimistic views or negative information, with larger short volume associated with greater overvaluation reduction[20]. Hao Xiangchao et al. and Tan Xiaofen and Qian Jiaqi find that relaxing short-selling constraints changes corporate innovation decisions and improves innovation efficiency[21,22].

2.2. Research on Major Shareholder Tunneling

Traditional corporate governance theory, built on the assumption of dispersed ownership, focuses on the first type of agency problem between owners (principals) and managers (agents)[23,24]. However, subsequent studies find that concentrated ownership is more common in European and Asian countries[25], giving rise to research on the second type of agency problem: conflicts between controlling and minority shareholders.

Under concentrated ownership, major shareholders have dual effects. Claessens et al. argue that large shareholdings create an "incentive effect" by solving the free-rider problem, encouraging major shareholders to actively monitor management, thereby alleviating the first agency problem[1]. However, when control rights are excessive, an "entrenchment effect" emerges: major shareholders may exploit their control position for private benefits, harming the firm. Johnson et al. define this expropriation of minority interests as "tunneling." [2]

Research on tunneling methods in China focuses mainly on fund appropriation, related-party transactions, and cash dividends[26].

On fund appropriation, Jiang et al. found that tunneling measured by other receivables is widespread among Chinese listed companies, and the degree of tunneling is significantly negatively correlated with future operating performance[27]. It's worth noting that after the 2003 "Notice on Regulating Fund Flows Between Listed Companies and Related Parties and External Guarantees by Listed Companies," regulatory scrutiny of major shareholders' fund appropriation has been strict.

Regarding related-party transactions, Zheng Guojian provides indirect evidence from an earnings quality perspective: he finds a positive correlation between related-party transactions and earnings management, which supports the view that related-party transactions are used for tunneling rather than for efficient contracting[28].

Regarding cash dividends, domestic and international findings differ. Foreign scholars view cash dividends as a minority protection mechanism resulting from bargaining between minority and major shareholders[2], while domestic studies suggest cash dividends may be used by major shareholders to expropriate minority interests[29].

Research on internal governance factors covers many dimensions. Tang Qingquan et al. use multiple approaches, find that the largest shareholder exhibits significant tunneling, and tunneling increases with ownership share, supporting the entrenchment effect. Liu Shaobo and Ma Chao find that independent manager selection mechanisms help curb tunneling[30]. Johnson et al. note that higher ownership checks and balances can restrain tunneling to some extent. Board size, meeting frequency, and even Confucian culture also influence tunneling[2].

External governance environment also matters. Previous studies have examined multiple external factors and found that government intervention reduces investor protection and exacerbates tunneling, while product market competition effectively enhances protection, especially in government-protected industries. Furthermore, financial market development helps curb tunneling. Bai Yajie points out that capital market opening improves information transparency, reducing agency costs from conflicts between controlling and minority shareholders[31]. Gan Yue confirms that higher audit quality implies fuller disclosure and lower tolerance for tunneling, with auditors more likely to issue modified opinions, forcing major shareholders to reduce tunneling[32]. Hou Qingchuan et al. further find that market governance mechanisms like short selling effectively constrain major shareholder behavior[3]. Existing research has made significant progress in identifying and measuring tunneling methods, but there is relatively little research on external governance mechanisms – especially how market mechanisms like short selling affect major shareholder tunneling. This points to an important direction for future research.

3. Theoretical Analysis and Hypotheses

3.1. Deregulation of Short Selling and Major Shareholder Tunneling

As a key trading mechanism in capital markets, short selling has a profound impact on corporate governance through its unique information discovery and price formation functions. Classic financial theory suggests short sales have dual market effects: on one hand, they provide liquidity [33]and dampen market instability[8,9]; on the other, they significantly enhance pricing efficiency by accelerating the incorporation of negative information into prices[6,9-11].

From a corporate governance perspective, short selling plays a unique external monitoring role. Because short sellers face high additional costs (including high collateral requirements, potential for securities to be recalled, and theoretically unlimited losses), short sellers have

strong incentives to dig deep into corporate information and accurately short stocks of companies with misconduct[4,5,34]. Such research-based short selling not only profits the short sellers but, more importantly, signals to the market that corporate governance problems exist. Short sales and resulting price declines directly harm the economic interests of shareholders and managers. To avoid such losses, corporate decision-makers have incentives to voluntarily constrain their opportunistic behavior. Thus, short selling effectively builds an external governance mechanism that strongly disciplines managerial behavior[5].

In China's specific institutional context, the governance effect of short selling is particularly relevant. First, Chinese listed firms are characterized by "one dominant share" structures, with controlling shareholders holding large stakes, creating conditions for tunneling. Second, China's legal system is still developing; minority shareholders face low success rates in suing major shareholders for tunneling[35,36]. Third, regulatory limitations further impede effective punishment. These institutional features jointly make tunneling a prominent governance problem in China.

Natural experiment evidence from China's deregulation of short selling supports the above theoretical reasoning. Chen Huili and Liu Feng found that after a company becomes eligible for margin trading, both accrual-based and real earnings management decrease significantly, proving that short selling can effectively play an external governance role in China's capital market, restraining corporate opportunistic behaviorp[37].

In terms of theoretical mechanism: in a market where short selling is prohibited, tunneling, being negative news, is not promptly priced, so the costs borne by major shareholders are limited. After deregulation, short sellers' detection and exposure of tunneling cause the firm's stock price to reflect negative information in a timely manner. Given that major shareholders' wealth is closely tied to firm value, a price drop directly hurts their economic interests. When the benefit from tunneling is less than the potential loss from price decline, major shareholders have incentives to restrain tunneling. Based on the above analysis, we propose:

H1: Deregulating short selling effectively curbs major shareholder tunneling.

3.2. The Channel through Which Short Selling Curbs Tunneling: A Mediation Analysis

Since short sellers can detect corporate financial misstatements before the market[4], effectively discipline earnings management[5,13], improve disclosure quality[12], and restrain financial restatements[19], the short-selling mechanism has both ex-ante deterrent and ex-post monitoring effects. Short selling improves information transparency, enhances minority shareholders' ability to detect tunneling, and amplifies their negative expectations. Such negative expectations strengthen minority shareholders' willingness to exit, increasing downward pressure on stock prices and thereby affecting major shareholders' interests. To avoid losses, major shareholders reduce tunneling for private benefits. Based on the above, we propose:

H2: Short selling curbs major shareholder tunneling by strengthening other shareholders' exit threat.

3.3. Boundary Conditions of Short Selling's Governance Effect: A Moderation Analysis

Ownership nature – i.e., the nature of the entity that owns and controls the firm – is an important factor influencing corporate governance. Under China's basic conditions, ownership can be state-owned or non-state-owned. Ownership nature affects the internal governance environment and influences the extent to which short selling affects tunneling. In non-SOEs, the controlling shareholder is typically an individual or family. The market logic focuses on efficiency and profit; the controlling shareholder's wealth and control are tightly linked to the

stock price. Tunneling harms firm value and leads to price declines. When short selling is introduced, negative information is more readily released, and prices respond more sensitively to tunneling. Minority shareholders can more promptly identify tunneling signals and exit by selling shares, creating an exit threat. Facing a stronger exit threat, major shareholders, wanting to avoid price crashes or loss of control, have incentives to reduce tunneling. Thus, in non-SOEs, short selling plays a significant governance role by strengthening minority shareholders' exit threat. In SOEs, the major shareholder is the government or a state-owned asset institution. Their focus is on government directives and public interests; core interests are not directly tied to stock prices. SOE performance evaluation focuses more on policy targets such as size, tax revenue, and employment rather than market value. Consequently, even if short selling leads minority shareholders to detect tunneling and exit, the price decline imposes little actual constraint on SOE major shareholders. Their evaluation is more closely linked to policy goals than to market capitalization, so stock price declines have limited impact on control stability. Moreover, exit threats from minority shareholders have weaker marginal deterrent power under state ownership. Additionally, SOEs are subject to multiple layers of supervision (State-owned Assets Supervision and Administration Commission, audit, discipline inspection), which themselves leave less room for tunneling and make it more concealed, further reducing the marginal deterrent effect of minority shareholders' exit threat. Therefore, short selling has a weaker inhibitory effect on tunneling in SOEs.

H3: Short selling has a stronger tunneling-inhibiting effect in non-state-owned enterprises.

4. Empirical Model and Variable Definitions

4.1. Effect of Deregulating Short Selling on Major Shareholder Tunneling

To examine the impact of deregulating short selling on tunneling, we follow the research design of Bertrand and Mullainathan[38], treating the policy as a staggered quasi-natural experiment. In each year, firms not yet allowed to be sold short serve as the control group. For Hypothesis 1, we specify the following model:

Model (1): Baseline regression

$$Adj - RPT_{i,t} = \alpha + \beta_1 Short_{i,t} + \gamma \sum Controls_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

4.2. Mechanism: Deregulation of Short Selling and Tunneling

To test whether short selling curbs tunneling by strengthening other shareholders' exit threat, we follow the mediation testing procedure of Wen Zhonglin et al.[39]. The measure of exit threat follows Jiang Fuxiu et al. used the institutional exit threat (Exit) brought by the split-share structure reform[40]. We construct the following models:

Model (2): Step 1 (total effect c)

$$Adj - RPT_{i,t} = \alpha + c Short_{i,t} + \gamma \sum Controls_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

Model (3): Step 2 (coefficient a)

$$Exit_{i,t} = \alpha + a Short_{i,t} + \gamma \sum Controls_{i,t} + \mu_{i,t} + \lambda_t + \varepsilon_{i,t}$$

Model (4): Step 3 (coefficients b and c')

$$Adj - RPT_{i,t} = \alpha + c'Short_{i,t} + bExit_{i,t} + \gamma \sum Controls_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

We expect both coefficients a and b to be significantly positive. That is, the introduction of short selling (Short) strengthens the effectiveness of institutional exit threat (Exit), and this strengthened exit threat further curbs tunneling (Adj_RPT). If coefficient c' is significant and its absolute value is smaller than coefficient c in model (3), that indicates partial mediation.

4.3. Moderating Effect of Ownership Nature

To test the moderating effect of ownership nature on the relationship between short selling and tunneling, we introduce an interaction term between short selling and ownership nature based on model (1), specifying the following model (for Hypothesis H3):

$$Adj - RPT_{i,j} = \alpha + \beta_1 Short_{i,t} + \beta_2 Short_{i,t} \times SOE_{i,t} + \beta_3 \times SOE_{i,t} + \gamma \sum Controls_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t}$$

According to H3, we expect short selling to have a stronger tunneling-inhibiting effect in non-SOEs (SOE = 0), so the coefficient β_1 of Short should be significantly negative. For SOEs (SOE = 1), the inhibitory effect should be weaker, so the interaction term coefficient β_2 is expected to be significantly positive, indicating that state ownership weakens the governance effect of short selling.

Variable definitions are shown in Table 1.

Table 1. Variable definitions

Variable Type	Variable Symbol	Definition
Dependent	<i>Adj - RPT</i>	Tunneling: Using the ratio of the total annual related-party transactions to beginning total assets, adjusted by the industry median.
Core independent	<i>Short</i>	Short-selling deregulation: composite indicator based on individual stock short transaction details, list of margin trading eligible stocks, and aggregate market short data
Mediator	<i>Exit</i>	Exit threat: proxy variables based on liquidity and shareholder competition
Moderator	<i>SOE</i>	Ownership nature: 1 for state-owned enterprises, 0 otherwise
Controls	<i>Size</i>	Firm size: natural log of year-end total assets
	<i>Lev</i>	Leverage: total liabilities / total assets
	<i>ROA</i>	Profitability: net income / total assets
	<i>TobinQ</i>	Growth: (market value of equity + book value of liabilities) / total assets
	<i>Age</i>	Listing age: natural log of years since IPO
	<i>IndDir</i>	Independent director ratio: independent directors / total board members
	<i>InstHold</i>	Institutional ownership: institutional investor shares / floating shares
	<i>Top1</i>	Ownership concentration: shareholding ratio of the largest shareholder

5. Empirical Results

5.1. Sample Selection and Data Sources

Data are from the CSMAR database. The sample comprises all A-share companies listed on the Shanghai and Shenzhen Stock Exchanges from 2006 to 2024 (subject to data availability for required variables and the timing of short-selling deregulation). We apply the following

selection criteria: (1) Exclude financial firms due to their unique characteristics; (2) Exclude firms that were ST, *ST, or delisted during the sample period to avoid noise; (3) Exclude observations with missing key variables (dependent variable: related-party transactions; core independent: margin trading eligibility; controls); (4) To satisfy the treatment-control structure for staggered DID, exclude firms never included in the margin trading eligible list during the sample period – a key precondition for the staggered DID design, i.e., the control group must consist of firms that eventually become treated but have not yet been treated; (5) Winsorize all continuous variables at the 1st and 99th percentiles to mitigate outliers. After these screens, we obtain 43,387 firm-year observations.

5.2. Descriptive Statistics

To mitigate outliers, we winsorize all continuous variables at the 1st and 99th percentiles. Descriptive statistics are reported in Table 2.

Table 2. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
adjrpt	43387	1.404	1.104	0	6.853
short	43387	0	.125	-.876	.934
Size	43387	22.19	1.289	19.415	26.452
Lev	43387	.403	.198	.028	.91
ROA	43387	.04	.059	-.556	.222
TobinQ	43376	1.94	1.172	.795	17.676
ListAge	43387	1.931	.932	0	3.555
Indep	43384	.375	.053	.25	.6
Inst	43339	.437	.254	.001	.937
Top1	43387	.343	.149	.075	.758

Table 2 shows the descriptive statistics. The mean of Adj-RPT is 1.404 (sd=1.104), ranging from 0 to 6.853, indicating substantial cross-firm variation in tunneling. Short has a mean near zero (-0.001, sd=0.126), ranging from -0.876 to 0.934, suggesting a relatively balanced and symmetric distribution of short-eligible firms. Firm size (Size) averages 22.184 (sd=1.284), covering firms of various sizes. Leverage (Lev) averages 40.2% (sd=0.198), ranging from 2.8% to 91.0%, indicating significant variation in capital structure. ROA averages 4.0% (sd=0.059), from -55.6% to 22.2%, showing some firms are loss-making. TobinQ averages 1.942 (sd=1.172), with a maximum of 17.676, indicating generally positive growth expectations but some extreme valuations. Listing age (ListAge) mean is 1.931 (roughly 6.8 years), with new firms (0) to about 35 years (3.555). Independent director ratio (Indep) averages 0.375, meeting the regulatory requirement of at least 1/3. Institutional ownership (Inst) averages 43.7% (sd=0.254), from 0.1% to 93.7%, indicating large cross-firm differences in institutionalization. Largest shareholder ownership (Top1) averages 34.3% (sd=0.149), from 7.5% to 75.8%, reflecting generally high ownership concentration with variation across firms.

5.3. Regression Results

Table 3 shows the baseline regression results. Column (1) excludes the core independent variable Short, while Column (2) includes it. Looking at Column (2), after controlling for firm size, leverage, profitability, growth, listing age, independent director ratio, institutional ownership, and largest shareholder ownership, the coefficient on Short is -0.101, significant at the 5% level ($t=-2.696$). This means that after a company becomes a margin trading eligible stock (allowing short selling), the degree of tunneling by its major shareholders through related-party transactions decreases significantly. This result is consistent with our Hypothesis

H1 – relaxing short selling restrictions curbs major shareholders' tunneling. In economic terms, the coefficient of -0.101 corresponds to a drop of about 7.2% relative to the sample mean of 1.404, which is practically meaningful.

Table 3. Deregulation of Short Selling and Tunneling (H1)

Variable	(1) Without Short	(2) With Short
short		-0.101** (-2.696)
Size	-0.091*** (-5.447)	-0.092*** (-5.501)
Lev	0.316*** (4.361)	0.315*** (4.353)
ROA	4.641*** (21.413)	4.635*** (21.404)
TobinQ	0.070*** (10.151)	0.070*** (10.093)
ListAge	0.116*** (7.754)	0.115*** (7.697)
Indep	0.094 (0.536)	0.100 (0.570)
Inst	0.389*** (5.016)	0.433*** (5.262)
Top1	-0.312* (-2.442)	-0.325* (-2.537)
_cons	2.657*** (7.264)	2.661*** (7.282)
Observations	43,326	43,326
R ²	0.066	0.066

*** p<0.01, ** p<0.05, * p<0.1

* p<0.05, ** p<0.01, *** p<0.001

For control variables, Lev, ROA, TobinQ, and ListAge all have positive coefficients significant at 1%. Inst also has a significantly positive coefficient, consistent with Hou Qingchuan et al.[3]– suggesting that institutional investors in China have not yet effectively played a monitoring role. Top1 has a coefficient of -0.325 (p<0.10), possibly because larger shareholders use other means

(rather than related-party transactions) for tunneling. Indep is positive but insignificant, indicating limited monitoring by independent directors.

Table 4. Mediation Effect (H2)

Variable	(1) Total Effect	(2) EXIT Equation	(3) Direct Effect
short	-0.101** (-2.696)	0.008** (2.688)	-0.099** (-2.664)
Size	-0.092*** (-5.501)	-0.002* (-2.183)	-0.092*** (-5.521)
Lev	0.315*** (4.353)	0.003 (0.702)	0.316*** (4.359)
ROA	4.635*** (21.404)	-0.039*** (-3.307)	4.630*** (21.390)
TobinQ	0.070*** (10.093)	-0.001 (-1.196)	0.070*** (10.077)
ListAge	0.115*** (7.697)	0.012*** (10.039)	0.117*** (7.826)
Indep	0.100 (0.570)	0.030* (2.440)	0.105 (0.596)
Inst	0.433*** (5.262)	0.045*** (7.814)	0.440*** (5.340)
Top1	-0.325* (-2.537)	-0.104*** (-12.692)	-0.341** (-2.650)
EXIT			-0.151** (-3.059)
_cons	2.661*** (7.282)	0.024 (1.302)	2.665*** (7.293)
Observations	43,326	43,326	43,326
R ²	0.066	0.018	0.066

*** p<0.01, ** p<0.05, * p<0.1

* p<0.05, ** p<0.01, *** p<0.001

To test whether exit threat mediates the relationship between short selling and tunneling, we follow Wen Zhonglin et al.[39]. Step 1: Column (1) shows the total effect of Short on adjrpt (coefficient -0.101, p<0.05), consistent with the baseline. Step 2: Column (2) regresses Exit (exit

threat) on Short; the coefficient is 0.008, significant at 1% ($p < 0.01$), indicating that short-selling deregulation strengthens the exit threat proxy, as expected. Step 3: Column (3) includes both Short and Exit; Exit has a coefficient of -0.151 ($p < 0.05$), while Short's coefficient is -0.099 ($p < 0.01$), smaller in absolute value than the total effect, suggesting partial mediation. Thus, short selling curbs tunneling by strengthening minority shareholders' exit threat.

Table 5. Heterogeneity Analysis (H3)

Variable	(1) Non-SOEs	(2) SOEs
short	-0.150*** (-3.527)	0.003 (0.034)
Size	-0.051* (-2.215)	-0.106*** (-4.000)
Lev	0.269** (2.956)	0.392** (3.049)
ROA	3.802*** (16.730)	7.649*** (15.552)
TobinQ	0.076*** (9.411)	0.048*** (3.485)
ListAge	0.094*** (5.391)	0.085** (2.618)
Indep	0.539* (2.185)	-0.202 (-0.827)
Inst	0.406*** (4.061)	0.437** (2.837)
Top1	-0.314 (-1.711)	-0.195 (-1.026)
_cons	1.680** (3.247)	2.997*** (5.452)
Observations	28,619	14,707
R ²	0.058	0.096

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5 presents subsample regressions by ownership type. Column (1) for non-SOEs shows a coefficient on Short of -0.150, significant at 1% ($t = -3.527$). Column (2) for SOEs shows a

coefficient of 0.003, insignificant ($t=0.034$). These results indicate that the inhibitory effect of short selling on tunneling exists primarily in non-SOEs and is virtually absent in SOEs. SOEs face more administrative supervision and multiple governance constraints, leaving less scope and incentive for tunneling, so the marginal governance effect of short selling is not significant. Non-SOEs rely more on market mechanisms, and short selling as an external governance tool more effectively constrains major shareholder opportunism. These results support H3.

6. Conclusion and Implications

This paper introduces the deregulation of short selling as an external constraint mechanism into the study of corporate governance. In China, the relatively more concentrated ownership structure leads to controlling shareholders being common and weak checks and balances among shareholders, which gives rise to "major shareholder tunneling" – i.e., large shareholders expropriating minority shareholders' interests. This paper uses the deregulation of short selling as an explanatory variable to investigate how short selling affects tunneling and how this effect differs across different types of ownership. Using A-share listed companies on the Shanghai and Shenzhen stock exchanges from 2006 to 2024 as the research sample, we examine whether, since the introduction of margin trading in March 2010, relaxing short selling constraints has curbed tunneling in China. Through empirical analysis, we find that relaxing short selling does inhibit major shareholder tunneling to some extent. Specifically, short selling affects stock prices through the revelation of negative information, and price changes affect major shareholders' interests – so major shareholders restrain their tunneling behavior to avoid a drop in stock prices. Also, due to the different priorities of state-owned versus non-state-owned enterprises, the impact of relaxing short selling on tunneling varies by ownership type: the inhibiting effect of short selling is stronger in non-SOEs than in SOEs.

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