ISSN: 2688-9323

Can Short Selling Restrain Tunneling by Major Shareholders?

Yaqi Zhang[a]

Guangdong University of Petrochemical Technology, Maoming, Guangdong, China

[a]1085578692@qq.com

Abstract

Taking the tunneling behavior of major shareholders of Chinese listed companies as the research entry point, this paper systematically examines the external governance effect of the short selling system on restraining such tunneling activities. After the introduction of the short selling system, short sellers can identify clues of major shareholders' tunneling by virtue of their superior information mining capabilities. Short selling transactions will trigger stock price declines, which increase the magnitude of major shareholders' wealth losses, control rights risks and regulatory costs arising from tunneling. When the benefits of tunneling fail to offset the above-mentioned losses, the short selling mechanism can effectively curb tunneling behaviors. The empirical results of this study support the above logical inference. Moreover, the restraining effect is more pronounced in enterprises featured with weak industry competition and insufficient media supervision. In terms of mechanism, short selling exerts governance effects by improving the quality of information disclosure and intensifying regulatory inquiries. This research demonstrates that the short selling system serves as a vital external governance tool, which can effectively contain the expropriation of interests by major shareholders and protect the rights and interests of minority shareholders.

Keywords

Short Selling System; Tunneling by Major Shareholders; External Supervision.

1. Introduction

The report to the 20th National Congress of the Communist Party of China clearly puts forward requirements for enterprises to improve corporate governance structures and strengthen internal control. As a critical external governance instrument, the short selling mechanism complements corporate internal control. The effective operation of its restraining function directly improves the overall efficiency of corporate governance. At present, short selling tools in China including margin trading and stock index futures have been continuously optimized with growing market influence. Nevertheless, tunneling behaviors by major shareholders still occur occasionally, which is rooted in the failure of internal governance and inadequate external supervision. The short selling mechanism can force major shareholders to abandon tunneling behaviors through market-oriented price penalties, draw widespread market attention and promote regulatory intervention. Its functional mechanism and practical effects deserve in-depth exploration.

2. Literature Review

2.1. Research on the Short Selling Mechanism

Overseas studies on short selling and corporate governance have evolved from the simple short sale constraint theory to a new stage focusing on information trading and institutional complementarity. Boehmer and Wu (2013) [1]pointed out that short selling transactions not only reduce the deviation of intraday stock prices from a random walk, but also significantly

ISSN: 2688-9323

accelerate the incorporation of public information into stock prices. Their research finds that when negative news emerges regarding a company, timely intervention by short sellers prevents stock prices from being overvalued and pushes prices to quickly return to fundamental values. In addition, Allen et al. (2005) [2]conducted research on China's financial system from a unique institutional perspective. Bertrand and Mullainathan (2003) [3]found in their study on anti-takeover laws that insider control problems are more likely to arise in the absence of effective external governance.

2.2. Research on Tunneling by Major Shareholders

Domestic research on the governance of major shareholders' tunneling has gradually expanded from internal governance mechanisms to the restraining effects of external market forces. Hou et al. (2017) [4]empirically verified that the relaxation of short selling constraints significantly inhibits tunneling by major shareholders, and this restraining effect is more prominent in companies with high shareholding ratios of major shareholders, high risks of equity pledge and a large number of related parties. Li et al. (2008)[5] indicated that controlling shareholders with different property rights have distinct preferences in tunneling approaches, implying that the short selling mechanism may generate differentiated deterrent effects on tunneling behaviors of enterprises with different ownership attributes. Meanwhile, Wu (2022)[6] argued that major shareholders often use debt financing to expand controllable resources to facilitate tunneling, suggesting that a single governance mechanism has limitations and the coordination of internal and external mechanisms is indispensable. Zhang et al. (2021) [7]emphasized that sound internal control can mitigate tunneling risks through risk assessment and management, while Yao (2022) [8]confirmed that external auditors increase the violation costs of tunneling by disclosing key audit matters. The above two studies respectively reflect the effectiveness of internal supervision and traditional external supervision. However, Lu and Ma (2021) [9]found that improperly designed remuneration for independent directors may lead to collusion and aggravate tunneling, revealing the inherent defects of insider supervision.

3. Theoretical Analysis and Research Hypotheses

3.1. Short Selling System and Tunneling by Major Shareholders

In modern corporate governance structures, high ownership concentration typically exacerbates the second type of agency problem. Johnson et al. (2000)[10] first defined tunneling as the behavior that controlling shareholders transfer corporate resources via related transactions, fund occupation and other means by taking advantage of their control rights.

Targeting China's capital market, Jiang et al. (2010)[11] further empirically proved that due to weak legal protection for investors and highly concentrated ownership, tunneling represented by fund occupation of major shareholders is prevalent among Chinese listed companies and has become a major factor undermining long-term corporate value. Boards of directors often fail to maintain independence (Claessens et al., 2000).[12] Meanwhile, external administrative supervision faces practical dilemmas such as delayed information acquisition, high law enforcement costs and insufficient legal enforcement (La Porta et al., 2006).[13]

The short selling mechanism is not merely a tool to suppress stock prices, but generates deterrent effects through short selling threats. Its core logic for restraining major shareholders' tunneling lies in forming a complete chain of information discovery – price pressure – constraint transmission. Based on the information asymmetry theory, tunneling is inherently covert. Nevertheless, short sellers possess prominent advantages in information mining and strong profit-driven incentives (Boehmer et al., 2008)[14]. They actively analyze abnormal capital flows and complex related transaction networks, acting as a large group of professional private supervisors.

ISSN: 2688-9323

According to the external governance substitution hypothesis, fierce competition in the product market squeezes corporate profit margins and forms inherent rigid constraints on major shareholders' tunneling (Hart, 1983)[15]. In this case, the marginal governance effect of short selling will be weakened. By contrast, in industries with low competition and strong monopoly, the restraining effect of market competition fails, leaving ample room for the short selling mechanism to function as a supplementary external supervisor. Based on the above theoretical analysis, this paper puts forward the following research hypotheses:

H1: The short selling system can significantly inhibit tunneling by major shareholders.

H2: The restraining effect of the short selling system on major shareholders' tunneling is more pronounced in enterprises with a lower degree of industry competition.

H3: The restraining effect of the short selling system on major shareholders' tunneling is more pronounced in enterprises with weaker media supervision.

3.2. Short Selling System and Industry Competition

As a critical external institutional environment shaping corporate behaviors, industry competition profoundly affects the effectiveness of corporate governance mechanisms. Hart (1983)[15] pioneered the view that product market competition serves as an effective external governance mechanism. Subsequent empirical studies by Giroud and Mueller (2010)[16] further confirmed that in highly competitive industries, the impact of corporate governance mechanisms on firm performance is greatly diminished, which indicates that market competition largely substitutes the functions of internal governance.

In a fiercely competitive market, enterprises are subject to the rule of survival of the fittest, which constitutes a strong inherent constraint on major shareholders' tunneling. Nickell (1996)[17] pointed out that intense market competition compresses corporate profit margins.According to Jensen's (1986)[18]free cash flow theory, enterprises free from competitive pressure tend to accumulate substantial free cash flow, which motivates management to expand corporate scale or induces major shareholders to embezzle corporate resources. In a market insulated from competition, agency problems are more likely to breed and deteriorate, and major shareholders have stronger incentives and more opportunities to transfer interests. Liu et al. (2012)[19] also verified that internal governance mechanisms tend to fail in highly monopolistic industries.

3.3. Short Selling System and Media Supervision

In the governance system of the capital market, media supervision acts as an information bridge connecting listed companies and general investors and plays the role of the "fourth power". Its governance effect has been widely recognized. Dyck and Zingales (2002)[20] first proposed that the media digs out, discloses and disseminates corporate operational information and negative news, quickly draws widespread market attention, and imposes strong external constraints on management and major shareholders through reputation and price mechanisms. For China's capital market, Li and Shen (2010)[21] empirically proved that media supervision can remarkably improve corporate governance and prompt enterprises to rectify irregular behaviors.

Miller (2006)[22] stated that limited resources drive the media to focus on large blue-chip enterprises or sensational events. For small and medium-sized enterprises or enterprises in unpopular industries with inadequate information disclosure, media supervision is often lagging or even absent.

In line with the complementary effect of supervisory forces, different external governance mechanisms in the capital market are not simply substitutive but mutually complementary. Boehmer et al. (2008)[14] noted that short sellers have superior information mining capabilities and can effectively fill the supervision vacuum where media supervision is absent

ISSN: 2688-9323

or ineffective. Chen et al. (2019)[23] further supported the view that the governance effect of the short selling mechanism is stronger in companies with poor information environments.

4. Research Design

4.1. Benchmark Regression Model

$$Adj-RPT_{i,t} = \alpha_t + \alpha_i + \gamma Short_{it} + \beta_1 PreROA_{it} + \beta_2 Levit + \beta_3 LogMV_{it} + \beta_4 Turover_{it} + \beta_5 Volatility_{it} + \beta_6 TobinQ_{it} + \beta_7 FitstDummy_{it} + \beta_8 Age_{it} + \beta_9 IndDir_{it} + \beta_{10} FundHulding_{it}$$

4.2. Moderating Effect Models

Moderating Effect of Industry Competition.The coefficient β2 is expected to be significantly negative, implying that the restraining effect of the short selling mechanism on tunneling is stronger in industries with low competition (high monopoly).

Model 2 (Testing H2):$Adj\text{-}RPT_{i,t}=\alpha+\beta_1 hort_{it}+\beta_2(Short_{it}\times HHI_{it})+\gamma Controls_{it}+\mu_i+\lambda_t+\varepsilon_{it}$

Moderating Effect of Media Supervision.The coefficient β2 is expected to be significantly negative, indicating that the short selling system exerts a more prominent restraining effect on tunneling when media supervision is weak.

Model3 (Testing H3):$Adj\text{-}RPT_{i,t}=\alpha+\beta_1 Short_{it}+\beta_2(Short_{it}\times Media_{it})+\gamma Controls_{it}+\mu_i+\lambda_t+\varepsilon_{it}$

4.3. Multiple Robustness Tests

This study conducts parallel trend tests to verify whether the treatment group and the control group share consistent trends before policy implementation. Benchmark regression is adopted to examine the significance and sign of the coefficient of Short. Moderating effect tests are carried out by introducing interaction terms. In addition, PSM-DID and variable substitution methods are applied to ensure the robustness of empirical results.

4.4. Variable Definitions

Table 1. Variable Definitions

Variable Category	Variable Name	Symbol	Definition and Calculation Method
Dependent Variable	Tunneling by Major Shareholders	Adj-RPT1	Total annual related transactions divided by total assets at the beginning of the year, adjusted by the industry median
		Adj-RPT2	Total annual related transactions excluding five categories (cooperation projects, license agreements, R&D achievements, remuneration for key management personnel and other items) divided by total assets at the beginning of the year, adjusted by the industry median
		Adj-RPT3	Sum of annual commodity transactions and service-related related transactions divided by total assets at the beginning of the year, adjusted by the industry median
	Year Fixed Effect	αt	Dummy variable for year fixed effect
	Firm Fixed Effect	αi	Dummy variable for firm fixed effect
Core Explanatory Variable	Short Selling Mechanism	Short	Dummy variable for margin trading: assigned 1 if the sample firm is included in the margin trading list in year t, otherwise 0

ISSN: 2688-9323

Variable Category	Variable Name	Symbol	Definition and Calculation Method
Moderating Variables	Degree of Industry Competition	HHI	Herfindahl-Hirschman Index: calculated as the sum of squares of the proportion of total assets of each enterprise in the industry (based on two-digit industry classification of the CSRC). A higher value represents stronger industry monopoly and weaker competition
	Media Supervision Intensity	Media	Natural logarithm of the total number of reports on the firm released by mainstream financial media in year t
Control Variables	Total Asset Return	PreROA	Net profit of the previous year divided by total assets at the end of the year
	Corporate Leverage	Lev	Total liabilities divided by total assets at the end of the year
	Natural Logarithm of Circulating Market Value	LogMV	Natural logarithm of corporate circulating market value
	Turnover Rate	Turnover	Annual average of daily turnover rate
	Stock Volatility	Volatility	Standard deviation of residual terms obtained from regressing daily stock returns on daily market returns
	Tobin's Q	TobinQ	(Market value of equity + Book value of liabilities) / Total assets at the end of the year
	Ownership Concentration	FirstDummy	Dummy variable for the shareholding ratio of the largest shareholder: assigned 1 if the ratio is higher than the annual median, otherwise 0
	Firm Listing Age	Age	Number of years since the firm's listing
	Proportion of Independent Directors	IndDir	Proportion of independent directors on the board of directors
	Fund Shareholding Ratio	FundHolding	Shareholding ratio of funds
Fixed Effects	Firm Fixed Effect	μi	Controls time-invariant individual characteristics of firms
	Year Fixed Effect	λt	Controls macroeconomic factors and common time trends varying with years

5. Empirical Results and Analysis

5.1. Sample and Descriptive Statistics of Variables

The baseline regression employs an unbalanced panel dataset spanning 2015 to 2024, consisting of 37,125 firm-year observations across 5,217 listed firms. The sample for the moderating effect test of industry competition remains identical to the baseline sample. Due to missing values of media-related variables, the sample for the media supervision moderating effect test is reduced to 36,504 observations covering 5,092 firms. For mediation analyses, the sample for information disclosure quality includes 37,056 observations, while the sample for regulatory inquiry mediation comprises 8,315 observations from 3,035 firms.

ISSN: 2688-9323

Table 2 presents the descriptive statistics of core variables. The mean values of the three tunneling proxies, adj_rpt1, adj_rpt2 and adj_rpt3, are 0.0860, 0.0847 and 0.0287 respectively, all exhibiting a distinct right-skewed distribution. This evidence suggests that abnormal related-party transactions are maintained at a relatively low level for most sampled firms, though a small fraction of observations report extremely high values. The mean of short_did is 0.4755, indicating that nearly half of the firm-year observations are subject to the constraints of the short selling regime.

In terms of moderating variables, the mean value of the Herfindahl-Hirschman Index (HHI) is 0.1012, the logarithmic value of media coverage averages 4.8916, the mean of the KV index stands at 0.5303, and the logarithmic value of regulatory inquiry intensity is 0.9459. The overall distribution of control variables is consistent with stylized facts documented in mainstream corporate finance literature.

Table 2. Descriptive Statistics of Main Variables

Variable	Observations	Mean	Std. Dev.	Median	Min	Max
adj_rpt1	37,627	0.0860	1.2315	-0.0174	-1.6771	24.6439
adj_rpt2	37,627	0.0847	1.1811	-0.0171	-1.6747	23.4195
adj_rpt3	37,627	0.0287	0.1632	-0.0003	-0.4249	2.4778
short_did	40,307	0.4755	0.4994	0.0000	0.0000	1.0000
hhi	40,260	0.1012	0.1251	0.0605	0.0106	1.0000
media_ln	39,078	4.8916	1.4073	4.9345	0.0000	11.8338
kv_index	39,456	0.5303	0.2152	0.5019	0.0000	2.5000
inq_count	8,650	1.7969	1.4164	1.0000	1.0000	20.0000
inquiry_ln	8,650	0.9459	0.3708	0.6931	0.6931	3.0445
pre_roa	37,627	0.0242	0.3971	0.0352	-48.3159	8.4414
lev	40,260	0.4339	0.9463	0.4089	0.0084	178.3455
logmv	39,368	22.9015	1.2186	22.6854	20.2593	30.4505
turnover	39,866	2.4392	2.7375	1.7273	0.0035	80.8554
volatility	39.702	2.8840	4.3705	2.4541	0.0000	383.8364
tobinq	39.368	2.5712	4.5859	2.0320	0.7054	730.1380
firstdummy	40,260	0.5012	0.5000	1.0000	0.0000	1.0000
age	40,307	11.6484	8.5539	9.0000	0.0000	35.0000
inddir	39,839	0.3799	0.0560	0.3636	0.1000	0.8182
fundhold	39,802	41.7637	24.7307	42.3095	0.0000	107.3178

Table 3 reports the Pearson correlation coefficients between the main variables. The variable short_did exhibits a statistically significant negative correlation with all three tunneling indicators, which preliminarily supports the research expectation that the short selling regime restrains tunneling behaviors. The Herfindahl-Hirschman Index (hhi) is also significantly negatively correlated with the tunneling indicators, indicating a systematic association

ISSN: 2688-9323

between industry structure and the extent of tunneling in the current sample. Meanwhile, media_ln shows a significant positive correlation with the tunneling indicators. Additionally, the KV index and regulatory inquiry variables display statistically significant correlations with the explained variables, albeit with varying directional signs.

Table 3. Correlation Coefficient Matrix of Main Variables

Variable	adj_rpt1	adj_rpt2	adj_rpt3	short_did	hhi
adj_rpt2	0.9803***	1.0000			
adj_rpt3	0.3108***	0.3196***	1.0000		
short_did	-0.1264***	-0.1286***	-0.0171***	1.0000	
hhi	-0.1236***	-0.1263***	-0.0665***	-0.0292***	1.0000
media_ln	0.0958***	0.0992***	0.0692***	0.1883***	0.0384***

*Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. The variable indices correspond to: 1=adj_rpt1, 2=adj_rpt2, 3=adj_rpt3, 4=short_did, 5=hhi, 6=media_ln, 7=kv_index, 8=inquiry_ln, 9=pre_roa, 10=lev, 11=logmv, 12=turnover, 13=volatility, 14=tobinq, 15=firstdummy, 16=age, 17=inddir, 18=fundholding.

5.2. Baseline Regression Results

Table 4. Baseline DID Regression Results

Variable	(1) adj_rpt1	(2) adj_rpt2	(3) adj_rpt3
short_did	-0.3452*** (-10.93)	-0.3359*** (-10.96)	-0.0258*** (-8.05)
pre_roa	-0.4874*** (-4.28)	-0.4628*** (-4.26)	0.0058 (1.00)
lev	0.0078 (0.43)	0.0136 (0.77)	-0.0037*** (-2.81)
logmv	0.1000*** (3.85)	0.0953*** (3.75)	0.0027 (0.95)
turnover	0.0138*** (2.78)	0.0141*** (2.90)	0.0002 (0.18)
volatility	0.0243*** (3.38)	0.0239*** (3.40)	0.0033 (1.42)
tobinq	0.0026 (0.91)	0.0019 (0.63)	0.0025*** (3.83)
firstdummy	0.0047 (0.15)	0.0059 (0.19)	-0.0059 (-1.47)
age	-0.0127*** (-3.34)	-0.0126*** (-3.38)	0.0007 (1.62)
inddir	-0.5703** (-2.41)	-0.5205** (-2.26)	-0.0259 (-1.13)
fundholding	0.0049*** (3.32)	0.0050*** (3.48)	0.0006*** (3.72)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	37,125	37,125	37,125
Firms	5,217	5,217	5,217
Within R^2	0.0358	0.0362	0.0217

*Note: Robust t-statistics clustered at the firm level are reported in parentheses. ***, *, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

ISSN: 2688-9323

Table 4 reports the estimation results of the baseline difference-in-differences (DID) model. Regardless of whether adj_rpt1, adj_rpt2, or adj_rpt3 is used as the dependent variable, the regression coefficients of short_did are all significantly negative. This indicates that after firms are included in the short selling mechanism, the level of abnormal related-party transactions and the degree of tunneling by major shareholders decrease significantly. Thus, Hypothesis H1 is consistently supported.

5.3. Moderating Effect Analysis

To further examine the boundary heterogeneity of the short selling mechanism in curbing tunneling by major shareholders, this paper incorporates moderating variables from two dimensions-industry competition intensity and media supervision strength-and constructs interaction term models to conduct moderating effect tests. The unified regression results are presented in the table below.

Table 5. Combined Regression Results of Moderating Effects: Industry Competition and Media Supervision

Variable	(1) adj_rpt1	(2) adj_rpt2	(3) adj_rpt3
short_did	-0.0300 (-0.89)	-0.0223 (-0.68)	-0.0015 (-0.42)
hhi	-0.1375 (-0.53)	-0.1057 (-0.41)	-0.0177 (-0.95)
short_did×hhi	-3.1542*** (-13.90)	-3.1374*** (-14.10)	-0.2435*** (-11.34)
media_weak	-0.0330*** (-3.73)	-0.0348*** (-4.06)	-0.0004 (-0.48)
short_did×media_weak	-0.2403*** (-15.87)	-0.2362*** (-16.06)	-0.0194*** (-14.68)
Control Variables	Controlled	Controlled	Controlled
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	36,504	36,504	36,504
Firms	5,092	5,092	5,092
Within R^2	0.0613	0.0634	0.0377

*Notes:A higher HHI value indicates weaker industry competition. media_weak is obtained by taking the negative of the number of media reports; a higher value indicates weaker media supervision intensity.Control variables are included in the regression but are omitted here for brevity. Throughout the paper, firm and year fixed effects are uniformly controlled.***, *, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

5.4. Parallel Trend Test and Robustness Test

To verify the validity of the identification strategy of the Difference-in-Differences (DID) model, this paper first conducts a parallel trend test based on the event study approach. Taking the year prior to policy implementation (t=−1) as the benchmark period, we construct relative time dummy variables covering multiple periods before and after the treatment. As presented in Figure 1 and Table 6, the p-values of the joint significance test for the coefficients evt_m4, evt_m3 and evt_m2 in the pre-treatment period across the three models are 0.6480, 0.6752 and 0.5501 respectively, all of which fail to reach the conventional significance level. This indicates that there is no statistically significant systematic difference in trends between the treatment group and the control group before the treatment, which validates the parallel trend assumption.

ISSN: 2688-9323

Meanwhile, the coefficients for the current period of treatment and subsequent periods are significantly negative, with their absolute values showing an overall upward trend. The results demonstrate that the short selling mechanism exerts a sustained and cumulative inhibitory effect on the tunneling behavior of major shareholders.

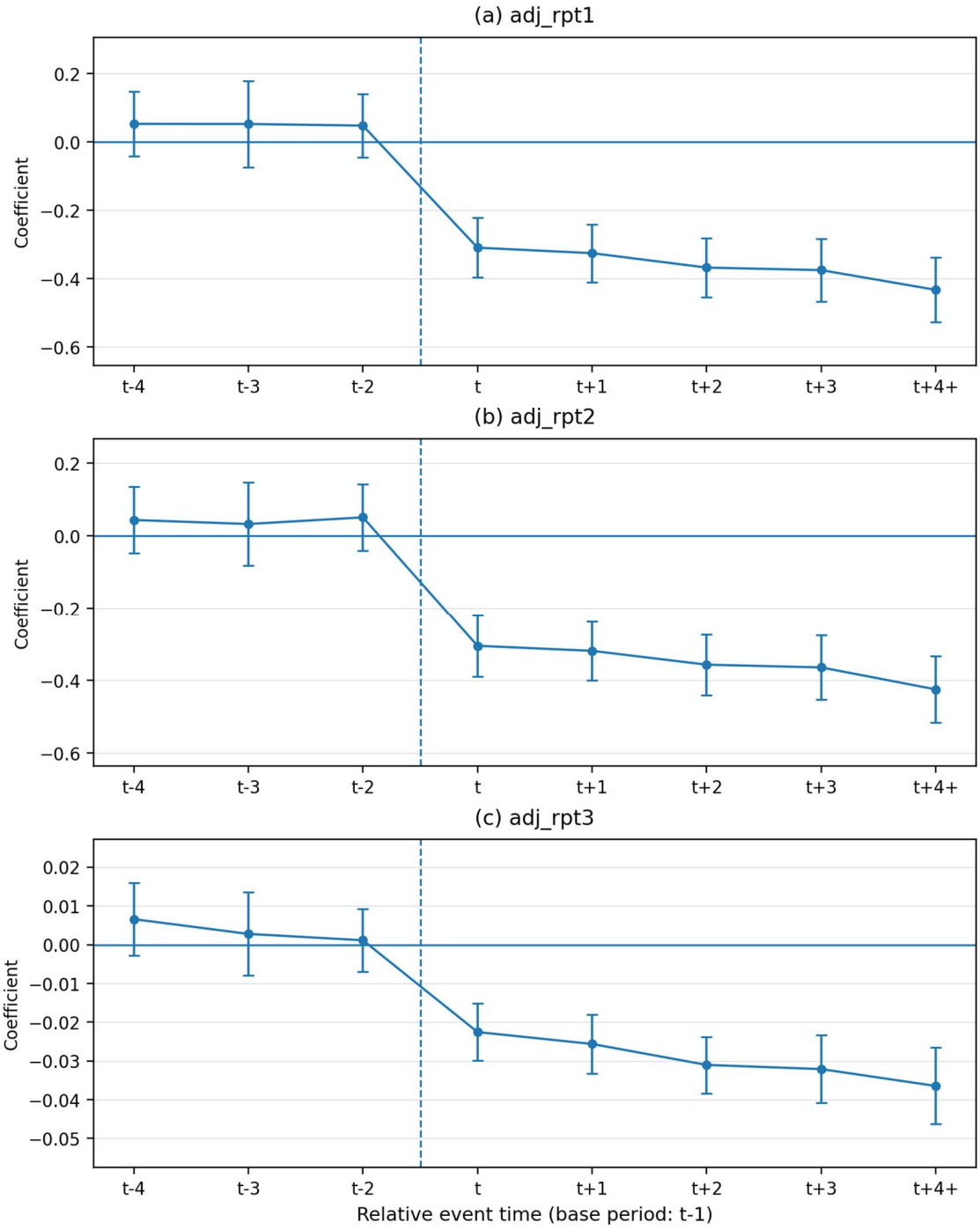


Figure 1. Parallel Trend Test and Dynamic Effect Graph

Notes: The dots represent the estimated coefficients at each event time, and the error bars denote the 95% confidence intervals. The benchmark period (omitted) is the year prior to the treatment (t=−1).

ISSN: 2688-9323

Table 6. PSM-DID Robustness Test

Variable	(1) adj_rpt1	(2) adj_rpt2	(3) adj_rpt3
short_did	-0.3677*** (-9.12)	-0.3566*** (-9.10)	-0.0268*** (-6.41)
pre_roa	-0.4919*** (-4.26)	-0.4667*** (-4.23)	0.0054 (0.90)
lev	0.0044 (0.25)	0.0103 (0.62)	-0.0040*** (-3.06)
logmv	0.0694* (1.93)	0.0632* (1.81)	-0.0008 (-0.22)
turnover	0.0208** (2.39)	0.0219** (2.58)	-0.0000 (-0.02)
volatility	0.0317** (2.27)	0.0312** (2.28)	0.0060 (1.40)
tobinq	0.0034 (1.38)	0.0026 (1.02)	0.0026*** (4.17)
firstdummy	-0.0067 (-0.17)	-0.0047 (-0.12)	-0.0076 (-1.45)
age	-0.0104** (-2.48)	-0.0105** (-2.56)	0.0006 (1.39)
inddir	-0.4864* (-1.73)	-0.4503 (-1.64)	-0.0320 (-1.09)
fundholding	0.0063*** (3.27)	0.0066*** (3.46)	0.0008*** (3.79)
Year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	23,170	23,170	23,170
Number of firms	2,404	2,404	2,404
Within R^2	0.0477	0.0486	0.0282

Note: The matching is performed using 1:1 nearest neighbor matching (without replacement, common support) on the 2015 cross-sectional sample, followed by DID estimation on the panel sample.

5.5. Mediating Effect Test

1) Information Disclosure Quality Mechanism: Evidence Based on the KV Index

Table 7 presents the results of the mediating mechanism test using the KV index as the mediating effect test. First, in Model (1), the coefficient of short_did on kv_index is significantly positive, indicating that the short-selling mechanism can significantly improve corporate information disclosure quality. Second, in Models (2) and (3), the coefficient of kv_index is significantly negative, suggesting that higher information disclosure quality is associated with lower levels of tunneling. However, in Model (4), the effect of kv_index on adj_rpt3 is not

ISSN: 2688-9323

statistically significant. These results imply that information disclosure quality plays a partial mediating role in the relationship between the short-selling mechanism (short_did) and adj_rpt1 / adj_rpt2, while the mediating effect is not fully established for the governance dimension represented by adj_rpt3.

Table 7. Mediation Effect Test: The KV Index Mechanism

Variable	(1) kv_index	(2) adj_rpt1	(3) adj_rpt2	(4) adj_rpt3
short_did	0.0201*** (4.97)	-0.3449*** (-10.89)	-0.3356*** (-10.92)	-0.0258*** (-8.06)
kv_index		-0.0817** (-2.10)	-0.0819** (-2.18)	0.0014 (0.37)
pre_roa	0.0052 (1.10)	-0.4880*** (-4.29)	-0.4634*** (-4.27)	0.0057 (0.98)
lev	-0.0015 (-0.92)	0.0074 (0.41)	0.0132 (0.76)	-0.0037*** (-2.83)
logmv	0.1153*** (28.86)	0.1089*** (4.03)	0.1042*** (3.94)	0.0026 (0.90)
turnover	0.0031*** (4.17)	0.0131*** (2.64)	0.0133*** (2.76)	0.0000 (0.03)
volatility	-0.0021** (-2.20)	0.0285*** (4.42)	0.0281*** (4.47)	0.0038 (1.52)
tobinq	-0.0001 (-0.57)	0.0026 (0.94)	0.0019 (0.65)	0.0025*** (3.84)
firstdummy	-0.0146*** (-3.15)	0.0053 (0.17)	0.0064 (0.21)	-0.0059 (-1.47)
age	-0.0021*** (-3.53)	-0.0122*** (-3.19)	-0.0122*** (-3.23)	0.0007* (1.72)
inddir	0.0891*** (3.07)	-0.5722** (-2.42)	-0.5222** (-2.27)	-0.0257 (-1.12)
fundholding	0.0011*** (7.37)	0.0049*** (3.32)	0.0051*** (3.48)	0.0006*** (3.63)
Year FE	是	是	是	是
Firm FE	是	是	是	是
Observations	37,056	37,056	37,056	37,056
Firms	5,217	5,217	5,217	5,217
Within R^2	0.1136	0.0360	0.0365	0.0220

Notes: Model (1) presents the regression for the mediating effect test. Models (2)–(4) report the results equations after including the mediating effect test.

2) External Supervision Mechanism: Evidence Based on Regulatory Inquiries

ISSN: 2688-9323

Table 8 reports the results using the intensity of regulatory inquiries as the mediating effect test. Model (1) shows that short_did significantly increases inquiry_ln, indicating that short-selling mechanisms attract greater regulatory attention. Models (2)–(4) further demonstrate that inquiry_ln has a significantly negative impact on all three tunneling indicators.

Table 8. Mediation Effect Test: The Regulatory Inquiry Mechanism

Variable	**(1) inquiry_ln**	**(2) adj_rpt1**	**(3) adj_rpt2**	**(4) adj_rpt3**
short_did	0.1262*** (7.16)	-0.4012*** (-5.39)	-0.3967*** (-5.47)	-0.0240*** (-3.70)
inquiry_ln		-0.1625*** (-2.90)	-0.1603*** (-2.94)	-0.0152*** (-3.04)
pre_roa	-0.0711** (-2.06)	-0.6482*** (-3.59)	-0.6169*** (-3.58)	-0.0047 (-0.87)
lev	-0.0109*** (-2.97)	-0.0174 (-0.65)	-0.0110 (-0.43)	-0.0057*** (-5.64)
logmv	-0.0501*** (-3.57)	0.2313*** (2.69)	0.2310*** (2.72)	0.0160** (2.54)
turnover	0.0158*** (4.56)	0.0059 (0.51)	0.0056 (0.50)	-0.0048** (-2.57)
volatility	0.0091** (2.37)	0.0468*** (3.72)	0.0461*** (3.87)	0.0097** (2.00)
tobinq	0.0000 (0.29)	0.0035 (1.51)	0.0030 (1.35)	0.0030*** (9.22)
firstdummy	-0.0172 (-0.98)	-0.0060 (-0.08)	-0.0055 (-0.08)	-0.0077 (-1.10)
age	0.0018 (0.67)	-0.0197 (-1.47)	-0.0199 (-1.50)	0.0017** (1.98)
inddir	0.2482* (1.94)	-1.4311** (-2.28)	-1.3967** (-2.27)	-0.0552* (-1.69)
fundholding	-0.0004 (-0.61)	0.0092** (2.19)	0.0089** (2.17)	0.0007** (2.23)
Year FE	是	是	是	是
Firm FE	是	是	是	是
Observations	8,315	8,315	8,315	8,315
Firms	3,035	3,035	3,035	3,035
Within R^2	0.0947	0.0823	0.0817	0.1028

Note: Although the sample size for the regulatory inquiry mechanism is relatively small, the directions and significance of the core coefficients remain stable.

ISSN: 2688-9323

6. Conclusion

Taken together, the empirical results of this chapter draw the following unified conclusions. The short-selling mechanism can significantly constrain the tunneling behavior of controlling shareholders, which provides solid empirical support for Hypothesis H1. Heterogeneity analysis further shows that the inhibitory governance effect of short selling becomes more prominent for firms operating in less competitive industries and those facing weaker media supervision, verifying Hypotheses H2 and H3 simultaneously. In terms of the reliability of benchmark regression results, event study tests confirm that there exist no significant pre-trend differences before the short selling policy shock, and PSM-DID re-estimation further strengthens the robustness of our core conclusions. As for the internal transmission channels, short selling restrains tunneling through two paths: it improves the quality of corporate information disclosure and intensifies regulatory inquiries to generate effective external constraints, and the channel of strengthened regulatory supervision presents more complete mediating evidence in our analysis.

References

[1] Boehmer, E., & Wu, J. (2013). Short selling and the price discovery process. The Review of Financial Studies, 26(2), 287–322.

[2] Allen, F., Qian, J., & Qian, M. (2005). Law, finance, and economic growth in China. Journal of Financial Economics, 77(1), 57–116.

[3] Bertrand, M., & Mullainathan, S. (2003). Enjoying the quiet life? Corporate governance and managerial preferences. Journal of Political Economy, 111(5), 1043–1075.

[4] Hou, Q. C., Jin, Q. L., & Su, L., et al. (2017). Relaxing short-selling regulations and major shareholders' "extraction". Economics (Quarterly), 16(03), 1143–1172.

[5] Li, W. L., Lü, H. L., & Chen, L. Y. (2008). A study on different control shareholders' methods of "exhausting" control. Journal of Shanxi University of Finance and Economics, (11), 53–58.

[6] Wu, G. D. (2022). Debt financing under major shareholder control: does it curb or facilitate shareholder hollowing-out? Journal of Central University of Finance and Economics, (09), 104–117.

[7] Zhang, X. M., Ge, C., & Yang, D. G. (2021). Can internal control mitigate the shareholder hollowing-out risk caused by tax avoidance? Journal of Nanjing Audit University, 18(06), 61–69.

[8] Yao, Y. F. (2022). Can the disclosure of key audit matters curb major shareholders' expropriation practices? - Evidence from expropriation-related key matters. Shanghai University of Finance and Economics Journal, 24(05), 92–107.

[9] Lu, T. P., & Ma, T. F. (2021). Compensation of independent directors and shareholder drainage by major owners: Incentive or collusion. Financial and Trade Research, 32(12), 94–105.

[10] Johnson, S., La Porta, R., Lopez-de-Silanes, F., et al. (2000). Tunneling. American Economic Review, 90(2), 22–27.

[11] Jiang, G., Lee, C. M. C., & Yue, H. (2010). Tunneling through intercorporate loans: The China experience. Journal of Financial Economics, 98(1), 1–20.

[12] Claessens, S., Djankov, S., & Lang, L. H. P. (2000). The separation of ownership and control in East Asian corporations. Journal of Financial Economics, 58(1-2), 81–112.

[13] La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2006). What works in securities laws? The Journal of Finance, 61(1), 1–32.

[14] Boehmer, E., Jones, C. M., & Zhang, X. (2008). Which shorts are informed? The Journal of Finance, 63(2), 491–527.

[15] Hart, O. D. (1983). The market mechanism as an incentive scheme. The Bell Journal of Economics, 366–382.

ISSN: 2688-9323

[16] Giroud, X., & Mueller, H. M. (2010). Does corporate governance matter in competitive industries? Journal of Financial Economics, 95(3), 312–331.

[17] Nickell, S. J. (1996). Competition and corporate performance. Journal of Political Economy, 104(4), 724–746.

[18] Jensen, M. C. (1986). Agency costs of free cash flow, corporate finance, and takeovers. The American Economic Review, 76(2), 323–329.

[19] Liu, C., Uchida, K., & Yang, Y. (2012). Corporate governance and firm value during the global financial crisis: Evidence from China. International Review of Financial Analysis, 21, 70–80.

[20] Dyck, A., & Zingales, L. (2002). The corporate governance role of the media. Working paper.

[21] Li, P., & Shen, Y. (2010). The role of media in corporate governance: Empirical evidence from China. Economic Research Journal, 4, 14–27.

[22] Miller, G. S. (2006). The press as a watchdog for accounting fraud. Journal of Accounting Research, 44(5), 1001–1033.

[23] Chen, H., Zhu, Y., & Chang, L. (2019). Short-selling constraints and corporate payout policy. Accounting & Finance, 59(4), 2273–2305.