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How do Capital Market Pressures Affect Pay Structures? Evidence Based on Short Selling and Firms' Internal Pay Gaps

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Abstract. This paper examines the relationship between short selling and internal pay gaps of listed companies, and explores how short selling affects the company's pay structure. To this end, this paper utilizes the data of Chinese A-share listed companies from 2008 to 2022, and adopts the staggered-DID method, and finds that short selling significantly increases the internal pay gaps of firms subject to the short selling mechanism, but gaps are instead narrowed in SOEs and technology-intensive firms. The mechanism analysis suggests that short selling widens pay gaps by increasing the demand for highly educated managers and their compensation for job risk. The result of this paper provides a new perspective for understanding the socio-economic effects of capital market policies, as well as a rationale for formulating fair and reasonable pay policies.

Keywords: short selling; pay gap; capital market.

1. Introduction

China's capital market reform is deepening against the backdrop of promoting the high quality development of the capital market, while institutional arrangements and policy adjustments in the capital market play a crucial role in promoting economic growth optimizing resource allocation and enhancing market efficiency. Short selling, which allows investors to borrow securities and then sell them, is a common trading mechanism in modern financial markets, used as a market discipline mechanism to increase the liquidity and efficiency of the stock market. China has started the pilot of short selling since 2010, and it has been gradually extended to stocks of more listed companies. The existing data indicates that as the pilot policy on short selling expands and market participation increases, the volume of short selling transactions shows an overall upward trend. This not only reflects the broad acceptance of this mechanism by the capital market but also demonstrates its significant role in enhancing market functionality.

In addition, research on internal pay gap has become a hot topic in the academic field. With the gradual public disclosure of individual executive pay data, the issue of pay gap has attracted widespread attention from all sectors of society. For example, studies have shown that promotion expectations may lead executives to choose lower pay in order to narrow the pay gap with ordinary employees, which to a certain extent reflects the adjustment of internal pay policy and its potential social impact (Bu et al., 2016). Meanwhile, different types of promotion expectations also have a significant impact on executives' compensation decisions. Executives with higher political promotion expectations may voluntarily lower their pay because of the pursuit of greater political benefits, a phenomenon that is particularly common in Chinese SOEs (Yang et al., 2013). However, these studies also suggest some potential risks that may arise from internal compensation policies, such as affecting the efficiency of corporate governance and employee morale, which require sufficient attention from corporate managers and policy makers.

The existing literature on the economic consequences of short selling mechanism focuses on their positive impact on market efficiency and corporate governance. For example, some studies have shown that short selling mechanism contributes to the overall operational efficiency of the market by increasing the information transparency of the market (Massa et al., 2015). In addition, some studies have also pointed out the positive impact of short selling mechanism on promoting the improvement

of corporate governance structure, optimizing the capital structure of firms and reducing the cost of capital (Li et al., 2017). However, these studies also suggest some potential risks that may be caused by short selling mechanism, such as the increase in market volatility and the negative impact on the financial stability of firms, which need to be paid enough attention by policy makers and market participants. In the existing literature, the studies related to short selling mechanism and internal pay gap have touched upon various dimensions of market efficiency, corporate governance, and executive compensation structure. However, these studies tend to suffer from a number of shortcomings, especially in understanding how short selling transactions affects the internal pay gap. First, most of the studies focus on the impact of short selling mechanism on market efficiency and corporate governance. For instance, Massa et al. (2015) discuss that short selling mechanism can increase information transparency in the market, while Li et al. (2017) examine its role in improving the quality of corporate disclosure. Although these studies indirectly suggest that short selling mechanism may change the internal pay structure by affecting corporate governance, they do not provide a deep enough analysis of the direct link and impact on the pay gap. Secondly, studies on short selling mechanism and internal pay gaps often ignore the differences between different types of firms. Although some studies, such as Liu & Kong (2021), attempt to explore the effects of different corporate strategies on pay gaps, there is still a lack of research on the differences between firms with different ownership structures and industry types in the context of the securities financing policy. These differences may have a significant impact on the effectiveness of the policy, but the current literature often fails to provide sufficient data or theory to support these differences. Finally, despite studies such as Huang et al. (2018) suggesting that short selling mechanism can improve the accuracy of analysts' forecasts, which may affect the compensation structure, there is still less discussion on how short selling mechanism can specifically affect a firm's internal compensation policy through market reactions. In summary, while the existing literature provides a basic framework for understanding the impact of short selling, it is still deficient in explaining the mechanism of how it specifically affects the internal pay gap and in analyzing the differences across firm types.

This paper conducts a detailed empirical analysis to explore the impact of the short selling mechanism on firms' internal pay gap by utilizing data from Chinese A-share listed firms over the period from 2008 to 2022. The analysis shows that firms subject to the short selling mechanism exhibit a larger pay gap compared to firms not subject to the mechanism. Then, through robustness tests, the paper enhances the reliability of the above findings. Further mechanism tests find that this is mainly due to the fact that short selling increases the demand for highly educated executives and their risk compensation, and these executives usually receive higher pay due to their scarcity and critical role in the execution of the firm's strategy. In addition, the instability of executive positions and the fierce competition in the market force firms to offer higher risk compensation in order to stabilize the top management team, further widening the internal pay gap. Conversely, the heterogeneity analysis shows that among SOEs and technology-intensive firms, short selling instead narrows the pay gap.

The main contribution of this paper is to reveal the positive correlation between the short selling mechanism and the firms' internal pay gap, and to explore two possible mechanisms of influence through empirical analysis. Although existing studies, such as Massa et al. (2015) and Li et al. (2017), have extensively explored the positive impact of short selling on market efficiency and corporate governance structures, suggesting that short selling enhances corporate governance and optimizes capital structure by increasing market information transparency, there is a lack of specific mechanisms and empirical research on how short selling affects firms' internal gaps. This paper reveals a significant positive correlation between short selling and internal pay gaps, and explores the specific economic mechanisms. To a certain extent, this research enriches the existing literature at in this area and provides a new perspective for understanding the impact of capital market policies.

This paper also has some reference value for corporate governance and policy regulation practices. Against the backdrop of fluctuations in compensation structures that may be triggered by short selling mechanism, company management should strengthen governance to ensure that compensation policies are open and transparent, consistent with the company's long-term development strategy, and

avoid frequent adjustments to compensation policies due to short-term market fluctuations. Companies should also consider redesigning its remuneration structure, setting reasonable remuneration ceilings and introducing more performance-oriented remuneration components to incentivize efficient management and focus on the satisfaction and fairness of ordinary employees. These measures will help the companies effectively respond to the challenges posed by the short selling mechanism and promote long-term stability and sustainable development. Plus, government regulators should take measures to ensure market fairness and transparency in the face of potential pay volatility arising from short selling, such as requiring detailed pay reports and stepping up the fight against market manipulation to ensure that the market is not affected by the speculators.

2. Theoretical analysis and research hypotheses

2.1. Impact of the short selling on the firms' internal pay gap

Short selling is beneficial for corporate governance and market efficiency. First, short selling plays an important role in improving the transparency and quality of corporate governance. Massa et al. (2015) showed that short selling induces insiders to disclose negative information earlier to avoid potential competition with short-sellers and enhances the market's oversight of insider trading. Meanwhile, Massa et al. (2015) also found that short selling increases the speed at which insiders sell their shares to prevent competition for information from short-sellers, thus strengthening firms' information transparency. In domestic studies, Li et al. (2017) found that the short selling mechanism significantly improves the disclosure quality of the subject firm. In addition, Gu & Zhou (2017) pointed out through their study that firms that allow short selling have a significant reduction in their new external equity and debt financing, which shows that the short selling mechanism reduces the reliance on external financing by improving the corporate governance structure.

In addition, empirical studies have shown that short selling enhances the governance structure of the firm and reduces the opportunistic behavior of management by increasing the pressure on their performance. For example, exogenous events of short selling deregulation suggest that this mechanism can increase the value of firm cash, and the effect is particularly significant in private firms (Hou et al., 2016). In addition, short selling is also seen as an effective preventive measure against firms' non-compliance behavior, discouraging such behavior by increasing the cost of non-compliance (Meng et al., 2019). The short selling mechanism also improves the accuracy of analysts' surplus forecasts by improving information transparency and the market's information reaction speed (Huang et al., 2018).

The impact of the short selling mechanism on the pay gap is manifested in its adjustment of executive pay structure. For example, the short selling mechanism enhances executives' performance incentives by increasing the performance sensitivity of compensation (Ma et al., 2019). This suggests that the short selling mechanism not only directly affects corporate governance, but may also indirectly affect the pay gap by adjusting the executive incentive structure.

Research has shown that short selling mechanisms can significantly increase the performance sensitivity of executive pay, which may indirectly affect the formation of pay gaps. For example, when the short selling mechanism strengthens the link between executives and company performance, it may lead to further increases in executive pay and exacerbate the pay gap. In addition, by influencing the corporate governance structure, short selling mechanism may also indirectly influence the formulation of compensation policies, further affecting the pay gap. For example, Hope et al. (2017) found that the threat of short selling causes auditors to increase their audit fees, indirectly suggesting that short selling pressures increase the cost of running the firm, which may influence the adjustment strategy of the firm's compensation structure.

Based on the above theoretical analysis, this paper presents the hypothesis:

H1: The short selling widens firms’ internal pay gaps.

2.2. Mechanism testing

2.2.1. High educational background

The introduction of short selling have ushered in stricter external supervision of the capital market. Such supervision not only improves market transparency, but also forces listed companies to face greater operational and management pressure. According to Karpoff & Lou (2010), short selling activities force companies to improve their governance structure to avoid potential market attacks by exposing their financial weaknesses and management gaps. In order to effectively respond to these pressures and protect the firm from the negative impact of market speculators, firms often need to improve the quality and decision-making capabilities of their management teams. Highly educated executives are preferred by companies because they usually have better strategic vision and crisis management skills.

In this environment, companies often seek to recruit executives who have a higher educational background or extensive experience in their industry. These executives not only bring advanced management knowledge and skills, but also improve the company's market competitiveness and investor confidence through their expertise. According to Zhang et al. (2018), highly-educated executives show greater efficiency in strategic planning and execution, which is crucial for firms to preserve stability in unstable market environments. However, these executives are typically paid well above industry averages, largely due to their scarcity and high added value they bring to the company. This significant increase in compensation directly widens the pay gap between top executives and ordinary employees.

With the relaxation of short selling restrictions, listed companies will be more inclined to hire highly educated and capable executives in response to enhanced market regulation and potential short sales pressure. Li et al. (2017) also showed that the short selling indirectly increases the demand for top executives by affecting the quality of corporate disclosure. Huang & Kisgen (2013) pointed out that the greater the uncertainty and pressure in the market, the more firms tend to maintain the stability of their executive teams by offering high salaries. And this above trend will lead to further polarization of the compensation structure within the company, and the pay difference between top and average employees, i.e. the internal pay gap, will continue to widen.

This leads to another hypothesis in this paper:

H2: Short selling widens the internal pay gap by increasing the demand for highly educated executives in public companies.

2.2.2. Executive position risk

Moreover, short selling not only intensifies market surveillance of listed companies, but also significantly increases the position risk of executives. This risk mainly stems from the market's ability to react quickly to negative information about a company. If a company performs poorly, the stock price may fall rapidly, thus threatening the job stability of executives. Boone & Raman (2010) pointed out that short selling simultaneously increases the risk of executives' replacement by increasing the transparency of the company, and thus executives may demand higher compensation to counteract this career instability. As the risk of the position increases, executives often demand higher compensation to offset potential career losses.

Executives, in response to this increased job risk, tend to demand higher risk compensation in salary negotiations. Perry & Zenner (2001) show that performance bonuses and other forms of incentives are particularly attractive to executives in higher risk environments. Such incentives not only protect the financial interests of executives, but also indirectly push up their overall compensation levels. According to Huang & Kisgen (2013), firms under short selling pressure are more inclined to pay higher compensation to keep their executive teams stable against potential market volatility and short selling attacks. This is corroborated by the study of Chen et al. (2019), which showed that executives of listed firms receive significantly higher compensation in environments facing short selling

pressures, reflecting their financial compensation to cope with the instability of their positions. In addition, Ma & Tong (2019) also found that the increase in short sales activities led to an increase in the level of executives' compensation to cope with the potential job instability brought about by high risk. In addition, this risk compensation may also motivate executives to adopt short-term strategies to maintain or enhance their job security, for example, by manipulating short-term performance or acting in ways that may not be entirely beneficial to shareholders' interests.

Such increases in executive compensation based on the risk of management positions not only exacerbate the pay gap, but may also lead to other problems within the company, such as declining employee morale and a lack of trust between management and employees. As the impact of short selling, it is foreseeable that pay gaps and related internal problems will be evident in more companies that are subject to market pressures, especially those that are active in highly competitive industries.

Based on this, this paper presents this hypothesis:

H3: Short selling exacerbates firms' internal pay gaps by increasing risk compensation arising from the risk of executive positions.

3. Study design and modeling

3.1. Data sources and their processing

In this paper, China's A-share listed companies from 2008 to 2022 are taken as the research sample, and all the data are from CSMAR database, and the data are processed as follows in this paper: (1) the samples with missing variables are excluded; (2) this paper shrinks the tails of all the continuous variables at the 1 percent and 99 percent levels to exclude the interference of extreme values. After the above screening and processing, 38,132 valid firm-year observations are finally obtained.

3.2. Variable description

3.2.1. Explained variable: internal pay gap

Referring to existing literature such as Bu et al. (2017) and Liu et al. (2018), this paper measures the internal pay gap by the ratio of the average salary of management to the average salary of employees, i.e.,

$$Gap = \frac{Average\ management\ salary}{Average\ staff\ salary} \quad (1)$$

Where the average management salary is defined as "total management salary / (number of directors, supervisors, and executives - number of independent directors - number of directors, supervisors, and executives not receiving a salary)", and the average staff salary is defined as "(cash paid to and for employees - total management compensation) / (number of employees - number of management)".

3.2.2. Explanatory variables: pilot policy on short selling

Referring to the existing literature such as Tong et al. (2019) and Liu (2021), this paper uses the policy of whether a firm is included in the pilot scope of short selling as a measure. Since 2010, the China Securities Regulatory Commission (CSRC) has been gradually expanding the pilot scope of short selling. This policy can be regarded as an event independent of firms and thus can be considered a quasi-natural experiment, which contains multiple policy shocks, with the timing of these shocks being staggered. Drawing on the existing literature, this paper uses a DID model and defines the policy as a dummy variable, *Short*, as follows: *Short* takes 1 if a listed company is targeted for the short selling pilot policy in a given year, otherwise, *Short* takes 0.

3.2.3. Control variables

Drawing on previous literature such as Liu et al. (2011) and Wei et al. (2022), this paper selects the following variables as control variables: firm size, ROA, shareholding ratio of the largest shareholder,

shareholding ratio of the management, size of the board of directors, debt ratio, proportion of independent directors, cash from operating activities. The specific notations and definitions of the variables are shown in Table 1.

Table 1. Notations and definitions of variables

Variables	Notations	Definitions
Internal pay gap	*Gap*	Ratio of average management salary to average staff salary
Short Selling	*Short*	It takes 1 when a company's stock can be sold short in a given year and 0 otherwise
Return on assets	*ROA*	Ratio of net profit for the year to total assets at the end of the year
Shareholding ratio of the largest shareholder	*Top1*	Number of shares held by the largest shareholder as a percentage of the total number of shares
Shareholding ratio of the management	*Sr*	Number of shares held by management as a percentage of total shares
Size of the board	*Sd*	Natural logarithm of the number of board members
Company size	*Size*	Natural logarithm of total assets at the end of the period
Debt ratio	*Leverage*	Ratio of total liabilities to total assets at the end of the period
Proportion of independent directors	*Idr*	Ratio of the number of independent directors to the total number of board members
Cash from operating activities	*Ocir*	Net cash flow from operating activities to operating income for the year
Nature of state ownership	*SOE*	1 if state-controlled, 0 if non-state-controlled
Number of executives with a master's degree	*Master_num*	Number of executives with a master's degree or higher
Percentage of executives with a master's degree	*Master_prop*	Number of executives with a master's degree or higher as a percentage of the total number of executives
Whether or not the CEO leaves the company	*Turnover*	1 if a CEO leaves during the year, 0 otherwise
CEO position risk	*TurnoverRisk*	Risk of executive position calculated with reference to Wu et al. (2019)
Technology-intensive industries	*Tech*	Referring to the classification of technology-intensive industries calculated by Lutong et al. (2014), it is a technology-intensive industry take 1, otherwise take 0

3.2.4. Modeling

The pilot policy on short selling in China since 2010 is equivalent to a quasi-natural experiment. To test the impact of the pilot policy on firms' pay gaps, referring to the methods of Liu (2021), Meng & Huang (2018), and Dong et al. (2022), this paper employs a DID (difference-in-difference) model.

The specific model is as follows:

$$Gap_{i,t} = \beta_0 + \beta_1 Short_{i,t} + \beta_2 Controls + \mu_t + \varphi_i + \varepsilon_{i,t} \quad (2)$$

Where $Gap_{i,t}$ denotes the internal pay gaps; the dummy variable $Short_{i,t}$ denotes whether the firm becomes the subject of the pilot policy; when the firm becomes the subject, the $Short_{i,t}$ is taken as 1, otherwise, it is taken as 0; Controls are control variables, which is defined in Table 1, and μ_t and φ_i denote year fixed effects and firm fixed effects, respectively; $\varepsilon_{i,t}$ is the random error term.

4. Empirical results and analysis

4.1. Descriptive statistics for key variables

Table 2 shows the descriptive statistics of the main variables, in which the sample size, mean, standard deviation, minimum and maximum values of the main variables are listed in turn. Gap has a mean of 5.431 and a standard deviation of 4.001, which suggests that the firms in the sample selected for this paper generally have some pay gap, but this varies from firm to firm. Short has a mean of 0.283, which suggests that about 28.3% of the firms in the sample selected for this paper were included in the pilot policy on short selling. The rest of variables have been presented in the table below and therefore will not be repeated.

Table 2. Descriptive statistics of the main variables

Variables	N	Means	Std	Min	Max
Gap	38132	5.431	4.001	0.662	24.819
Short	38132	0.283	0.451	0.000	1.000
Top1	38132	34.665	14.685	9.050	73.873
Sr	38132	0.077	0.143	0.000	0.600
Sd	38132	2.126	0.199	1.609	2.708
Idr	38132	0.375	0.054	0.286	0.571
Leverage	38132	0.416	0.206	0.052	0.998
Size	38132	22.115	1.324	19.303	27.077
ROA	38132	0.039	0.066	-0.361	0.209
Ocir	38132	0.091	0.214	-1.395	1.069

4.2. Baseline regression analysis

Table 3 demonstrates the results of the regressions on the intra-firm pay gap for the pilot policy on short selling.

Table 3. Benchmark regression results

	(1) *Gap*	(2) *Gap*
Short	0.469***	0.213***
	(10.349)	(4.694)
Top1		-0.002
		(-0.948)
ROA		5.095***
		(19.883)
Sr		0.228
		(1.176)
Sd		0.601***
		(4.274)
Idr		2.450***
		(5.680)
Ocir		-0.033
		(-0.470)
Size		0.839***
		(26.597)
Leverage		-0.231*
		(-1.768)
_cons	5.295***	-15.437***
	(289.337)	(-20.156)
Year FE	Yes	Yes
Firm FE	Yes	Yes
N	38132	38132
F-value	107.110	161.43
Adj R-squared	0.646	0.659

Note: The values in parentheses are standard errors. ∗, ∗∗ and ∗∗∗ denote significance at the 10%, 5%, and 1% levels, respectively, and the same applies below.

Model (1) only controls for year fixed effects and firm fixed effects, and the regression coefficient of *Short* is 0.465, and is significant at the 1% level; while in model (2), control variables are added, and the regression coefficient of *Short* decreases to 0.213, but is also significant at the 1% level. This may be due to the fact that some of the factors affecting the internal pay gap are absorbed after the addition of the control variables. This implies that the pilot policy on short selling significantly enhances the firms ' internal pay gap, i.e., there is a significant positive correlation between the two. Thus, H1 is supported by empirical evidence.

4.3. Robustness tests

4.3.1. Parallel trend test

In the DID model, there may be the endogeneity problem, such as companies with larger internal pay gaps possibly lobbying the regulator to get themselves included in the list of the pilot policy, leading to reverse causality. Based on this, this paper conducts a parallel trend test, defining *pre1*, *pre2*, *pre3*, *pre4*, and *pre5* as time dummy variables for the 1-5 years before the implementation of the pilot policy, *current* as time dummy variables for the year of the implementation of the pilot policy, and *post1*, *post2*, and *post3* as time dummy variables for the 1-3 years after the implementation of the pilot policy, respectively. For the sake of preventing collinearity, this paper removes the dummy variable *pre1* for the last period before the implementation of the pilot policy.

The following results show that: *pre2*, *pre3*, *pre4*, and *pre5* are not significant, which indicates that the listed companies entering the list of the pilot policy do not have a higher pay gap than those that do not enter even before they enter. This suggests that whether a company is included in the list of the pilot policy is not significantly related to the internal pay gap before their inclusion. On the other hand, *post1*, *post2*, and *post3* are significant, indicating that the internal pay gap starts to widen only after the companies enter the list of the pilot policy.

Table 4. Parallel trend test

	(1) *Gap*
pre5	-0.093
	(-1.288)
pre4	-0.060
	(-0.873)
pre3	-0.014
	(-0.221)
pre2	-0.074
	(-1.211)
current	0.226***
	(3.934)
post1	0.152**
	(2.361)
post2	0.154**
	(2.311)
post3	0.135*
	(1.928)
Control	Yes
cons	-15.538***
	(-20.395)
Year FE	Yes
Firm FE	Yes
N	38132
F-value	91.420
Adj R-squared	0.659

4.3.2. Replacement of explanatory variables

In this paper, the explanatory variables were replaced with the average management salary (*Manasalary*), the average employee salary (*Staffsalary*), the difference between the average management salary and the average employee salary (*Diff*), and the total salary of the three highest paid members of management (*Top3salary*), respectively, and a robustness test was conducted.

This paper finds that the regression coefficient of *Manasalary* on Short is 64929.265 and is significant at the 1% level, i.e., the pilot policy on short selling significantly increases the average management salary; the regression coefficient of *Staffsalary* on Short is 69.07 and is insignificant, i.e., the pilot policy does not significantly increase the average salary of employees; the regression coefficient of Diff on Short is 64,860.196 and is significant at the 1% level, i.e., the pilot policy increases the gap between the average management salary and the average employee salary; the regression coefficient of the *Top3salary* on Short is about 286,000 and is significant at the 1% level, i.e., the pilot policy significantly increases the total salary of the three highest paid members of management.

Table 5. Robustness test: replacement of explanatory variables

	(1)	(2)	(3)	(4)
	Manasalary	*Staffsalary*	*Diff*	*Top3salary*
Short	64929.265***	69.070	64860.196***	2.86e+05***
	(13.490)	(0.075)	(13.447)	(8.508)
Control	Yes	Yes	Yes	Yes
_cons	-3.03e+06***	-1.33e+05***	-2.90e+06***	-1.73e+07***
	(-37.392)	(-8.609)	(-35.677)	(-30.480)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
N	38132	38132	38132	38132
F-value	402.050	49.950	360.680	232.160
Adj R-squared	0.735	0.677	0.707	0.627

4.4. Mechanism test

The above study provides empirical evidence that the pilot policy on short selling can widen firm's internal pay gaps. However, the above only discusses this effect, but does not examine the mechanism through which the pilot policy on short selling widens firms' internal pay gap. Next, this paper analyzes the mechanisms by which the pilot policy on short selling affects the pay gap within firms.

For one thing, short selling, as a form of external surveillance in the capital market, puts pressure on listed companies. In the face of this pressure, listed companies are likely to need to hire more capable executives for market capitalization management, which may make companies tend to hire executives with higher academic qualifications, and thus, accordingly, pay executives higher salaries and widen internal pay gaps.

To study the impact of executives' education on firms' pay gaps, this paper selects the number of executives with master's degrees in the firms to be donated as *Master_num*, and the proportion of executives with master's degrees in the firms to the total number of executives to be donated as *Master_prop*. This study finds that the regression coefficient of *Master_num* on Short is 0.070, which passes the 10% statistical significance test, while the regression coefficient of *Master_prop* on Short is 0.016, which passes the 1% statistical significance test. These facts suggest that the pressure of external monitoring brought about by the implementation of the pilot policy on short selling does prompt listed companies to tend to employ master executives with higher academic qualifications and to increase the number and proportion of master executives in the expectation of increasing the quality of the executives and their ability to manage the market capitalization of the company. As higher academic qualifications usually imply relatively higher salaries, the increase in executive compensation further widens internal pay gaps of firms.

Table 6. Mechanism analysis based on capital market pressure and executive master's degree

	(1)	(2)
	Master_num	*Master_prop*
Short	0.070*	0.016***
	(1.839)	(3.960)
Control	Yes	Yes
_cons	-8.549***	0.299***
	(-12.937)	(4.283)
Year FE	Yes	Yes
Firm FE	Yes	Yes
N	38132	38132
F-value	77.14	8.210
Adj R-squared	0.778	0.608

For another, executives' position risk rises under the external capital market pressure of short selling. If executives expect to take higher position risk, they will either demand higher compensation or engage in opportunistic behavior against shareholders' interests to compensate for the position risk based on risk aversion considerations. This paper measures the position risk of corporate executives with reference to the method of the two-stage model of Hu (2017). First, this paper defines the dummy variable *Turnover*, which takes 1 when a firm has an CEO leaving a firm in a given year; otherwise, it takes 0. In addition, the probability of a CEO leaving a firm increases when his or her previous year's operations are poor, causing the previous year's ROA to decline. Based on this, this paper refers to Wu et al. (2019), which defines the executive's job risk, donated as *TurnoverRisk*, as the portion of the CEO's probability of leaving the job that cannot be explained by ROA of the previous year. As a result, the following probit model is developed:

$$Turnover_{i,t} = a_0 + a_1 ROA_{i,t-1} + v_{i,t} \quad (3)$$

$$TuroverRisk_{i,t} = Turnover_{i,t} - (\widehat{a_0} + \widehat{a_1} ROA_{i,t-1}) \quad (4)$$

This paper finds that the regression coefficient of TurnoverRisk on Short is 0.019, and it is statistically significant at the 1% level. This fact suggests that the pressure of external monitoring brought about by the implementation of the pilot policy on short selling does increase the position risk of CEOs of listed firms, which in turn is likely to increase their own pay due to opportunistic demands and thus widen internal pay gaps in listed firms.

Table 7. Analysis of mechanisms based on risk in executive positions

	(1)
	TurnoverRisk
Short	0.019***
	(7.086)
Control	Yes
_cons	1.520***
	(34.348)
Year FE	Yes
Firm FE	Yes
N	38132
F-value	634.430
Adj R-squared	0.560

4.5. Heterogeneity test

4.5.1. Differences in the nature of property rights

Liu (2011), and Chen et al. (2021) found that SOEs had relatively low internal pay gaps, which may be influenced by the traditional pay structure of SOEs. This paper investigates whether internal pay gaps in SOEs expand or narrow under the pilot policy on short selling and how they differ from those

in non-state-controlled enterprises. In order to achieve the purpose, this paper takes the sample according to the nature of property rights, based on whether it is a SOEs or not. This paper makes the following definition: when the enterprise is state-controlled, SOE takes 1, otherwise it takes 0.

This paper finds that SOEs have a significant negative effect on internal pay gaps at the 5% level. Additionally, there is a significant negative interaction between *SOE* and *Short* at the 1% level. These findings indicate that the implementation of the pilot policy on short selling not only fails to widen internal pay gaps of firms but also narrows them within SOEs.

Table 8. Heterogeneity Analysis Based on Nature of Property Rights

	(1)
	Gap
Short	0.406***
	(7.495)
SOE	-0.204**
	(-2.452)
Short×SOE	-0.479***
	(-6.505)
Control	Yes
_cons	-15.116***
	(-19.723)
Year FE	Yes
Firm FE	Yes
N	38132
F-value	137.990
Adj R-squared	0.660

4.5.2. Differences in the nature of industries

Lu & Dang (2014) found that in technology-intensive industries, the salary gap between ordinary employees and executives was less likely to widen because ordinary employees possessed higher levels of technical skills. This paper investigates whether internal salary gaps in technology-intensive industries under the pilot policy on short selling expands or contracts and how they differ from non-technology-intensive industries. To achieve the aforementioned objectives, this paper defines the variable Tech by referring to the classification of technology-intensive industries calculated by Lu & Dang (2014). If a company belongs to a technology-intensive industry, *Tech* is assigned a value of 1; otherwise, it is assigned a value of 0.

Table 9. Heterogeneity Analysis Based on Nature of Industries

	(1)
	Gap
Short	0.231***
	(4.999)
Tech	0.292
	(1.120)
Short×Tech	-0.404**
	(-2.212)
Control	Yes
_cons	-15.387***
	(-20.083)
Year FE	Yes
Firm FE	Yes
N	38132
F-value	132.570
Adj R-squared	0.659

This paper finds that the intersection term between *Tech* and *Short* is significantly negative at the 5% level. The above suggests that the implementation of the pilot policy on short selling not only does not widen internal pay gaps of firms in technology-intensive industries, but rather narrows their internal pay gaps.

5. Conclusion

By analyzing the data of Chinese A-share listed companies during the period from 2008 to 2022, this paper explores the relationship between the pilot policy on short selling and internal pay gaps of listed companies by applying the staggered-DID method. First, the analysis in this paper reveals that there is a significant positive correlation between the pilot policy on short selling and internal pay gaps. This finding complements the existing literature in exploring the impact of short selling on market efficiency and corporate governance while understanding their socio-economic effects. The study finds that the pilot policy on short selling typically leads to a widening of internal pay gaps in listed firms. Second, Further results of the mechanism analysis in this paper reveal how short selling affects the pay structure. In most of the firms, the pilot policy on short selling exacerbates pay gaps by increasing the demand for highly educated executives and their compensation. In addition, with increased risk in executive positions, firms tend to offer higher risk compensation to attract and retain key top talent. Third, this study also observes that in SOEs and technology-intensive firms, pay gaps are relatively instead reduced by the constraints of the short-selling mechanism. That is, due to the unique corporate governance structure and industry characteristics, the effect of short selling is different from that of other types of firms in terms of pay gaps, which may be related to the strict control of top-level pay increases in these firms as well as the general demand for skilled personnel.

In conclusion, findings of this paper provide new insights into understanding the complex socioeconomic effects of capital market policies such as the pilot policy on short selling, as well as informing the formulation of related policies. First, the positive correlation between the pilot policy on short selling and internal pay gaps suggests that we should take into account the pay inequality that may be exacerbated by the market mechanism when formulating relevant policies. Therefore, it is suggested that policymakers should introduce complementary measures at the same time when promoting the pilot policy on short selling, such as enhancing the transparency and regulation of executive compensation, as well as encouraging firms to adopt a fairer compensation structure to mitigate the widening of pay gaps. Second, given that the pilot policy on short selling exacerbates pay gaps between executives and ordinary employees by increasing the demand for highly educated executives and their remuneration, regulators may consider introducing more detailed human resources policies, such as training and upgrading skills of ordinary employees to enhance their career development potential and room for salary advancement, so as to reduce the imbalance within the pay structure. Finally, Considering the phenomenon that pay gaps have narrowed along with the short selling in state-owned and technology-intensive enterprises, it is recommended that attempts be made to learn from their effective corporate governance and human resource management practices in a wider range of enterprises. Specifically, similar policies of strict pay control and emphasis on skilled personnel could be implemented in other types of enterprises to promote pay equity and rationalization of pay structures within enterprises. To summarize, policy recommendations should be customized to the specific characteristics of different enterprises and industries. More refined and targeted measures should be formulated to accommodate potential changes in pay structures resulting from short selling. These measures are crucial to ensuring fairness and effectiveness in corporate governance while safeguarding the rights and interests of ordinary employees.

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