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The Impact of Short Selling on Stock Price Crash Risk: A Study of Market Conditions

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Abstract: As China's capital market continues to evolve, businesses have increasingly acknowledged the significance of the short selling mechanism within its framework. To gain a deeper understanding of its influence, this analysis explores the interplay between the short selling mechanism and the risk of stock price crashes, examining both the market environment and investor behavior. By focusing on Shanghai and Shenzhen A-share listed companies between 2010 and 2021, this study sheds light on the empirical relationship between short selling policies and extreme stock price volatility. Our findings indicate that the implementation of short selling mechanisms contributes to mitigating such volatility. However, it is crucial to note that the efficacy of these mechanisms in reducing the risk of stock price crashes is notably influenced by the market environment. The results highlight the importance of considering market dynamics and investor responses when assessing the role of short selling in the Chinese capital market.

Keywords: Short selling mechanism; Stock price crash risk; Stock liquidity; Quality of information disclosure.

1. Introduction

Since the introduction of margin trading and short selling in China's securities market in 2010, the short selling mechanism has gained prominence. Its effect on stock price crash risk remains contentious. Some experts contend that short sellers uncovering negative news push companies to enhance disclosure quality, thereby reducing information asymmetry and controlling stock price crash risks [1].

According to governance theory, high stock liquidity fosters informed trading and enhances shareholder oversight, potentially decreasing the risk of stock price crashes. Conversely, significant reductions or withdrawals by major shareholders may elevate this risk. Alternatively, the short-term behavior theory posits that high liquidity attracts short-term investors, heightening pressure on management to meet immediate performance targets and thereby increasing the chance of a stock price crash [2]. For firms with low stock liquidity, the short selling mechanism can be more effective in mitigating crash risks. However, in highly liquid companies, short selling may intensify performance pressures on managers, leading them to conceal negative news and potentially triggering a stock price crash [3]. Thus, the impact of stock liquidity on the effectiveness of the short selling mechanism appears nuanced and context-dependent.

The quality of information disclosure impacts the effectiveness of the short selling mechanism. Poor disclosure quality leads to information asymmetry, but short selling can pressure companies to improve disclosure and reduce crash risks. Conversely, high-quality disclosure makes short selling less influential.

Using 2010-2021 Shanghai and Shenzhen A-share data, this article examines the impact of the short selling mechanism on stock price crash risk via a differences-in-differences model. It systematically explores this mechanism's path by incorporating the moderating influence of the market environment.

The innovations of this article include, offering empirical support for differentiated regulatory policies, showcasing practical innovation value, conducting heterogeneity analysis to reveal the operational path of the short selling mechanism, addressing the current "mechanism black box" issue, and verifying that short selling can mitigate the risk of stock price crashes, thereby resolving contradictory literature findings on its impact.

2. Literature Review and Research Hypotheses

2.1. Short Selling Mechanism and Stock Price Crash Risk

Xu Fei suggests that relaxing short-selling regulations mitigates the impact of analysts' optimistic ratings on stock price crash risks, preventing crashes driven by concealed negative information [4]. Meng Qingbin argues that the short selling mechanism enhances price discovery, strengthens external supervision, improves stock price information efficiency, and reduces risks [5]. Previous studies [1] highlight short sellers' crucial role in revealing hidden negative information.

Chu Jian and Fang Junxiong found that margin trading and short selling increase stock price crash risks [6]. Allen and Gale argued unrestricted short selling deteriorates the market environment and boosts crash risks [7]. However, post-2010 short selling deregulation has empowered short sellers to uncover negative news, reducing information asymmetry, aiding investors in using diverse information, improving pricing efficiency, and lowering crash risks.

Based on this, the following assumptions are proposed:

H1: Short selling mechanisms are associated with a lower likelihood of stock price crashes.

2.2. Short Selling Mechanism, Stock Liquidity and Stock Price Crash Risk

Existing literature on short selling focuses on stock price informativeness and price stability [8, 9].

Tang Song, Wu Qiujun, and Wendell et al found that margin

trading and short selling target stocks quickly absorb negative information post-designation, significantly reducing stock price crash risks and enhancing pricing efficiency compared to non-target stocks [10].

Li Zhisheng, Du Shuang, and Lin Bingxuan found that introducing a short selling mechanism effectively reduces price volatility and stock price jump risks of underlying stocks, thus controlling stock price surges and crashes [11].

From this, it can be seen that the short selling mechanism can increase the information content of stock prices and price stability, thereby reducing the risk of stock price crashes. In enterprises with high stock liquidity, the information content of their own stock prices is already relatively high, and capital allocation efficiency, capital cost, etc. are relatively better than those of enterprises with poor stock liquidity.

Based on this, the following hypotheses are proposed:

H2: The short selling system is more effective in mitigating the risk of stock price crashes for companies with low stock liquidity compared to companies with high stock liquidity.

2.3. Short Selling Mechanism, Quality of Information Disclosure and Risk of Stock Price Crash

The short selling mechanism enhances stock price informativeness and stability, reducing crash risks. In highly liquid stocks, information content is already high, contributing to better capital allocation and lower costs. Based on information asymmetry theory, poor information transparency in companies increases stock price crash risks [12]. High-quality disclosure enables investors to fully understand a company, reducing valuation bias and crash risks [13]. Conversely, low disclosure quality leads to negative information accumulation, sending negative signals and increasing crash risks [14].

Short sellers seek profits by uncovering negative company information, pressuring management to boost transparency. In markets permitting short selling, firms are induced to minimize earnings management, enhancing the market's perception of their financial information quality [15]. Additionally, the short selling mechanism acts as an external overseer, prompting companies to disclose more information. Most studies indicate that short selling enhances market information efficiency, corrects disclosure biases, and improves transparency [16].

In summary, companies with high-quality information disclosure experience low information asymmetry, fewer negative news, and reduced stock price crash risks, making the short selling mechanism less significant. Conversely, firms with low disclosure quality often conceal negative news, increasing crash risks. Introducing short selling in such cases can motivate management to decrease earnings management, disclose negative information, correct disclosure biases, and effectively mitigate crash risks.

Based on this, the following assumptions are proposed:

H3, The short selling mechanism is more effective at reducing stock price crash risks in companies with low disclosure quality compared to those with high disclosure quality.

3. Data Sources and Variable Design

3.1. Data Sources and Exclusion

3.1.1. Sources of data

The research data in this paper spans the 2010-2021 period, encompassing publicly disclosed information of Shanghai and Shenzhen A-share listed companies. Short selling mechanism data originates from the Rui Si database, internal control quality from the Dibo Internal Control Index, and other necessary information from the CSMAR database.

3.1.2. Data exclusion

According to the research requirements, Excel and Stata18.0 software were used to screen and eliminate the original data as follows:

(1) Remove ST/PT listed companies.

(2) Financial companies are excluded.

(3) Exclude samples with missing main data.

(4) Exclude samples with a debt-to-asset ratio exceeding 100%.

(5) Exclude the 2015 data sample (to avoid data anomalies that a stock market crash might cause).

Before regression, continuous variables are truncated at the 5th and 95th percentiles to mitigate the influence of outliers and extreme values on the results.

3.2. Variable Measurement and Definition

3.2.1. Explained variable: Risk of stock price crash

The calculation method of the stock price crash risk indicator uses the negative return skew coefficient (NCSKEW) and the upward and downward volatility of returns (DUVOL) to measure the stock price crash risk.

3.2.2. Explanatory variables

(1) Short selling mechanism

Select the Treat × Post of the short selling mechanism as the explanatory variable for this paper. Treat is a dummy variable for enterprises that indicate whether an enterprise is included in the margin trading target. It takes 1 if the enterprise is included in the margin trading target and 0 if not. Post is a policy status dummy variable indicating whether the policy was implemented at that point in time, taking 1 if the policy was implemented in that year, or 0 if not. The resulting Treat × Post= 1 indicates that the enterprise is in a short-sellable state in that year.

Moderating variables

(2) Stock liquidity

Measure it using the individual stock Amuid indicator, or ILLIQ. Stocks in the period of I in y ILLIQ calculation formula is: $ILLIQiy = 108 * 1/Diy\sum|Riyd|/VOLDivydDiyt = 1$

(3) Quality of Financial Information Disclosure

The Shenzhen and Shanghai Stock Exchanges evaluate listed companies' information disclosure, categorizing them as excellent, good, qualified, and unqualified, with corresponding values of 4,3,2, and 1. Companies with higher ratings produce better financial information. This assessment ensures transparency and reliability in the market, guiding investors towards companies with high-quality disclosure practices. By analyzing these evaluations, investors can make informed decisions based on reliable financial information.

3.2.3. Control variables

Referring to the existing text, the following control variables are added in this paper:

Capital intensity CI; Debt-to-asset ratio (Lev); Return on total assets (ROA); Stock price synchronicity (GJTBX); Internal control quality (LnNK); Annual stock turnover rate (tover), logarithmic processing; Annual individual stock return rate (Yretwd); Board size.

3.2.4. Model design

This paper mainly uses the difference-in-differences DID model, along with bidirectional fixed effects, fixed individuals and years.

$$\text{NCSKEW}_{i,t}\left(DUVOL_{i,t}\right) = \alpha_i + \delta_t + \beta_3 \cdot (\text{Treat}_i \times \text{Post}_t) + \gamma \cdot \text{Control}_{i,t} + \epsilon_{i,t}$$

4. Empirical Research

4.1. Descriptive Statistics

Over a span of 12 years from 2010 to 2021, a comprehensive dataset including 17,832 firm-year observations from Shanghai and Shenzhen A-shares was analyzed. Key metrics such as NCSKEW and DUVOL were found to have mean values of -0.300,0.635 and -0.192,0.437 respectively, aligning closely with existing research, ensuring the reliability of the data. An interesting finding was the treatpost metric, related to short selling mechanisms, with a mean of 0.631 and a standard deviation of 0.483, indicating that approximately 63% of the sample fell into the post-short selling mechanism treatment group. This distribution reflects the gradual policy promotion characteristic, shedding light on the evolving nature of the market dynamics over time.

Table 1. Descriptive statistics

Variable	N	Mean	SD	p25	p50	p75	Min	Max
NCSKEW	17,832.000	-0.300	0.635	-0.702	-0.252	0.139	-1.629	0.820
DUVOL	17,832.000	-0.192	0.437	-0.505	-0.189	0.129	-0.997	0.600
treatpost	17,832.000	0.631	0.483	0.000	1.000	1.000	0.000	1.000
ILLIQ_Y	17,832.000	0.044	0.034	0.017	0.034	0.062	0.005	0.128
quality	17,832.000	3.107	0.573	3.000	3.000	3.000	2.000	4.000
Yretwd	17,832.000	0.089	0.389	-0.204	0.018	0.297	-0.442	1.015
tover	17,832.000	-3.469	0.893	-4.080	-3.380	-2.781	-5.294	-2.058
ROA	17,832.000	0.042	0.043	0.015	0.038	0.068	-0.049	0.131
CI	17,832.000	2.261	1.340	1.312	1.879	2.763	0.714	5.859
LnNK	17,832.000	6.486	0.089	6.434	6.501	6.551	6.278	6.621
GJTBX	17,832.000	0.401	0.194	0.248	0.400	0.552	0.073	0.741

4.2. Principal Hypothesis Regression

Table 2. Robust t-statistics in parentheses

	(1)	(2)
VARIABLES	NCSKEW	DUVOL
treatpost	0.1207 * *	0.0930 * *
	(-1.9613)	(-2.1848)
Yretwd	0.3257 * * *	0.2585 * * *
	(-19.7520)	(-22.4469)
tover	0.0550 * * *	0.0181 * *
	(-4.8262)	(-2.2251)
ROA	0.9671 * * *	0.6232 * * *
	(5.1367)	(4.7524)
CI	0.0059	0.0086
	(0.7091)	(1.4829)
LnNK	0.2225 * * *	0.1433 * * *
	(-3.1708)	(-3.0100)
GJTBX	0.4661 * * *	0.2380 * * *
	(12.4078)	(9.3937)
Constant	0.8169 *	0.6156 * *
	(1.8114)	(2.0040)
Observations	17,696	17,696
R-squared	0.270	0.267
yearfix	YES	YES
idfix	YES	YES
** p<0.01, ** p<0.05, * p<0.1		

The analysis from Table 4 reveals key insights into the impact of various factors on the risk of stock price crashes. The coefficients of NCSKEW and DUVOL in the main regression hypothesis stand out significantly with negative values of -0.7, both statistically significant at the 5% level. This points to the crucial role of the short selling mechanism in reducing the likelihood of stock price collapses, showcasing the effectiveness of intervention policies in mitigating market risks. Moreover, the variables Yretwd, tover, LNnk show significant negative trends, indicating that factors such as annual individual stock turnover rate, return on total assets, and stock price synchronization have a positive impact on diminishing the risk of stock price crashes. By utilizing a directional fixed effect that accounts for both year and individual effects, the analysis successfully addresses potential biases from omitted variables. With a robust sample size of 17,696 observations, the study's results are deemed reliable and offer valuable insights for investors and policymakers alike.

4.3. Heterogeneity Analysis

4.3.1. Short selling, stock liquidity, stock price crash risk

Table3 analyzes the impact of various factors on the risk of stock crashes (measured by NCSKEW and DUVOL) by categorizing the sample into low stock liquidity (Group1) and high stock liquidity (Group 2). The findings illuminate the relationship between these variables and stock crash risk based on liquidity levels.

In the low liquidity group, the coefficient was significantly negative, indicating that policy intervention significantly reduces crash risk in a less liquid environment.

In the high liquidity group, the coefficient was still negative, but the absolute value was smaller, indicating that the policy effect weakened in a market with good liquidity.

The effectiveness of policy intervention in reducing crash risk is more pronounced in low-liquidity markets. In such markets, external intervention plays a crucial role in stabilizing expectations, thereby mitigating the potential for crashes. This highlights the importance of proactive policy measures in managing market volatility.

Table 3. Heterogeneity Analysis: Stock Liquidity

Low stock liquidity	(1)	(1)	High stock liquidity	(2)	(2)
	NCSKEW	DUVOL		NCSKEW	DUVOL
treatpost	0.069 * * *	0.056 * * *	treatpost	0.039 * * *	0.032 * * *
	(-4.351)	(-5.196)		(-2.685)	(-3.084)
ILLIQ_Y	4.235 * *	2.313 *	ILLIQ_Y	7.316 * * *	5.746 * * *
	(-2.103)	(-1.707)		(4.070)	(4.570)
Yretwd	0.370 * * *	0.264 * * *	Yretwd	0.250 * * *	0.201 * * *
	(-15.750)	(-16.705)		(-15.753)	(-18.089)
tover	0.311 *	0.177	tover	0.132 * * *	0.089 * * *
	(1.906)	(1.612)		(-4.148)	(-4.018)
ROA	1.197 * * *	0.758 * * *	ROA	1.473 * * *	0.949 * * *
	(5.486)	(5.162)		(9.864)	(9.087)
CI	0.017 * * *	0.009 * *	CI	0.004	0.005
	(-2.849)	(-2.343)		(0.786)	(1.576)
LnNK	0.005	0.009	LnNK	0.177 * *	0.092 *
	(0.053)	(0.138)		(-2.447)	(-1.829)
GJTBX	0.264 * * *	0.084 * * *	GJTBX	0.091 * * *	-0.011
	(5.767)	(2.731)		(2.875)	(-0.489)
_cons	0.744	0.402	_cons	0.108	-0.087
	(0.861)	(0.692)		(0.225)	(-0.259)
N	6987	6987	N	10845	10845
R2	0.060	0.056	R2	0.036	0.040

4.3.2. Short selling, quality of information disclosure, Risk of stock price crash

The study revealed that in the low-quality group, the treatpost coefficient had a higher significance compared to the high-quality group. This indicates that the real space mechanism was more stable and effective in mitigating risks in low-quality enterprises. Specifically, the treatpost coefficients were -0.054 and -0.043 in the low-quality group, both achieving three-star significance. In contrast, the high-quality group had coefficients of -0.056 and -0.053, with only two-star significance.

The study compared two groups based on disclosure quality in companies to analyze the impact on the risk of stock price crashes. The group with low-quality disclosure had a larger sample size (N=13851 vs.3981) and a slightly higher model R^2 (0.047 vs.0.042), indicating stronger statistical support for the conclusions drawn from this group. The data suggested that in companies with low disclosure quality, the null mechanism had a more significant mitigating effect on the risk of stock price crashes. This was supported by the higher significance of the treatpost and the statistical robustness of the larger sample size, supporting the null hypothesis.

Table 4. Heterogeneity Analysis: quality of information disclosure

The quality of information disclosure is high	(1)	(1)	Low quality of information disclosure	(2)	(2)
	NCSKEW	DUVOL		NCSKEW	DUVOL
treatpost	0.056 * *	0.053 * * *	treatpost	0.054 * * *	0.043 * * *
	(-2.226)	(-3.009)		(-4.516)	(-5.289)
Yretwd	0.209 * * *	0.175 * * *	Yretwd	0.315 * * *	0.236 * * *
	(-8.064)	(-9.496)		(-20.571)	(-22.526)
tover	-0.007	0.006	tover	0.014 * *	0.006
	(-0.634)	(0.829)		(-1.972)	(1.170)
ROA	2.021 * * *	1.346 * * *	ROA	1.230 * * *	0.755 * * *
	(7.609)	(7.139)		(8.564)	(7.711)
CI	0.014 *	-0.007	CI	-0.002	0.001
	(-1.867)	(-1.323)		(-0.537)	(0.347)
LnNK	0.079	0.064	LnNK	0.137 * *	-0.074
	(0.583)	(0.665)		(-2.070)	(-1.636)
GJTBX	0.249 * * *	0.071 *	GJTBX	0.133 * * *	0.014
	(4.729)	(1.889)		(4.420)	(0.663)
_cons	-0.949	-0.608	_cons	0.496	0.310
	(-1.083)	(-0.977)		(1.161)	(1.065)
N	3981	3981	N	13851	13851
R2	0.042	0.042	R2	0.044	0.047

4.4. Robustness Tests

4.4.1. Extended variables

The short selling mechanism has a significant impact on reducing the negative return skew coefficient, ultimately lowering the risk of stock price crash. The coefficient of -0.120 (t=-1.956, p<0.05) supports this finding, highlighting the effectiveness of short selling in minimizing financial volatility.

DUVOL: The coefficient is -0.093 (t=-2.178, p<0.01), which also shows that the short selling mechanism significantly reduces the volatility of returns up and down, further verifying its inhibitory effect on the risk of crash.

Conclusion: After adding additional control variables, the negative impact of the short selling mechanism on stock price crash risk remains robust, supporting Hypothesis H1. The larger sample size (N=17,696) enhances the reliability of the results. R^2 was 0.270-0.267, indicating that the model explained about 27% of the variations, with room for improvement. The robustness test validates the suppression effect of the short selling mechanism on the risk of stock price crashes (H1 holds), and the addition of control variables does not change the core conclusion, indicating that the results are robust.

Table 5. Robustness tests: Extended variables

	(1)	(1)
	NCSKEW	DUVOL
treatpost	0.120 *	0.093 * *
	(-1.956)	(-2.178)
Yretwd	0.325 * * *	0.258 * * *
	(-19.679)	(-22.357)
tover	0.055 * * *	0.019 * *
	(-4.834)	(-2.268)
ROA	0.922 * * *	0.578 * * *
	(4.684)	(4.174)
CI	0.005	0.008
	(0.604)	(1.335)
LnNK	0.220 * * *	0.141 * * *
	(-3.139)	(-2.952)
GJTBX	0.466 * * *	0.238 * * *
	(12.398)	(9.380)
Lev	-0.046	-0.046
	(-0.721)	(-1.049)
Boardsize	0.005	0.003
	(0.719)	(0.641)
_cons	0.781 *	0.594 *
	(1.717)	(1.915)
N	17696	17696
R2	0.270	0.267

4.4.2. Alternative variables

CRT1 and 2 are the return rates of stock price volatility under two calculation methods, which are used to replace the two variables originally used for the risk of stock price crash.

In the CRT1 and CRT2 models, the treatpost coefficients are -0.050 and -0.056, respectively (significant at the 1% level), and the sign and significance are consistent with the original model. The R^2 of the CRT1 and CRT2 models was 0.664 and 0.580, respectively, indicating that the alternative dependent variable (CRT indicator) was sensitive to the explanatory variable, or that the model setting was in line with the volatility characteristics. With a sample size of 17,696 observations, the sample size is sufficient and the results are reliable.

This shows that the negative effects of the core variable treatpost are consistent across different dependent variables, verifying the robustness of the original study.

Table 6. Robustness tests: Alternative variables

	(1)	(2)
	CRT1	CRT2
treatpost	0.050 * * *	0.056 * * *
	(-3.694)	(-3.125)
Yretwd	0.211 * * *	0.277 * * *
	(41.947)	(38.862)
tover	0.126 * * *	0.132 * * *
	(-30.708)	(-24.543)
ROA	0.612 * * *	0.825 * * *
	(-10.036)	(-10.328)
CI	0.000	0.003
	(0.005)	(0.894)
LnNK	0.156 * * *	0.182 * * *
	(7.303)	(6.659)
GJTBX	0.163 * * *	0.235 * * *
	(-13.708)	(-14.460)
_cons	4.981 * * *	4.392 * * *
	(-35.475)	(-24.453)
N	17696	17696
R2	0.664	0.580

5. Research Conclusions and Policy Recommendations

This paper uses data from Shanghai and Shenzhen listed A-shares from 2010 to 2021. By building a difference model within differences, Focus on the impact of short selling mechanisms on the risk of stock price collapse. By introducing the moderating effects of market environment (stock liquidity, quality of information disclosure) and investor behavior, it systematically explores the path of action of short selling mechanism and concludes: 1. The analysis corroborates that short selling acts as a stabilizing force, curbing the likelihood of severe price collapses. 2. There are significant differences in the effectiveness of short selling mechanisms: companies with low stock liquidity have a more prominent effect in mitigating the risk of stock price crashes; Companies with lower quality of information disclosure benefited more significantly from the short selling mechanism, The risk of stock price collapse has been significantly reduced.

This paper advocates for several recommendations in light of the current state of China's capital market development. Firstly, regulators should recognize the stabilizing effect of short selling in preventing severe price collapses. Secondly, listed companies should focus on enhancing their information disclosure systems and implementing external supervision mechanisms. Thirdly, there is a need to improve the quality of information disclosure and increase the content of stock price information. Lastly, investors should prioritize gaining market expertise, approach short selling judiciously, and utilize it effectively. By addressing these recommendations from the perspectives of regulators, listed companies, and investors, China's capital market can advance towards a more

stable and efficient future.

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