A study of the impact of short selling mechanism on the stock price collapse risk

Junwei Song

School of Beijing Technology and Business University, Beijing, China
Email: aabbcc200204230012@163.com

Abstract:

Drawing from an extensive review of existing literature, this study investigates the influence of the short selling mechanism (SSM) on x through both theoretical and empirical lenses. It further assesses whether this mechanism can effectively mitigate stock price collapse risk (SPCR). The findings reveal that the SSM has a significant moderating effect on stock price declines, with stability tests for alternative factors affirming the robustness of these results. The study then narrows its focus to listed companies in China, examining the role of the SSM in this specific context. Results indicate that the SSM enhances the information content of stocks, thereby reducing the risk of stock market crashes. Using regression analysis and a mediating role model, the paper empirically explores the relationship between the SSM and SPCR. The conclusions suggest that the SSM can partially reduce the risk of stock market crashes by increasing the information content of stock prices.

Keywords: short selling mechanism, accounting disclosure quality, information content, SPCR

1. Introduction

Stock price crashes have emerged as a significant threat to the stability of financial markets, leading to substantial losses for investors and raising concerns about market resilience. SPCR refers to the potential for a sudden and severe decline in stock prices, which can undermine investor confidence and disrupt market stability. Given the growing importance of understanding and mitigating this risk, it is crucial to investigate the role of the SSM in addressing SPCR. With the ongoing evolution and innovation in international financial markets, SSMs have become increasingly widespread. Many countries and regions are exploring strategies to effectively introduce and enhance SSMs, with the goal of maintaining securities market stability and improving liquidity and market efficiency. As a result, it is imperative to examine how these mechanisms operate and their impact on market dynamics.

The relationship between the short selling system in China's securities market and the risk of stock market crashes is investigated, with a focus on the specific characteristics and conditions of China's financial environment. By leveraging data from the Shenzhen stock market for the period 2013 to 2022, the study will conduct a comprehensive multiple regression analysis to assess the influence of financing activities and securities financing on stock price collapse risk. Furthermore, the paper will employ a mediation effect model to explore how information content and the quality of accounting disclosures mediate the connection between the short selling system and SSM. To achieve this, the study will utilize precise mediating variables: the asynchrony of stock prices as a measure of information content and the officially published disclosure evaluation index to assess the quality of accounting disclosures. This approach will provide a nuanced understanding of how SSMs impact stock price stability and contribute to enhancing market resilience.

2. Literature review

The SSM plays a crucial and development-promoting role in the capital market. Foreign scholars generally view the impact of short selling on capital markets positively. Miller (1977) posited that under conditions of restricted short selling, negative information about a company is not swiftly reflected in stock prices. However, a more relaxed short selling system allows such adverse information to be integrated into stock prices more effectively, facilitating more accurate price adjustments. Further research by Karpoff and Lou (2010) and Saffi and Sigurdsson (2011) supports this view. They found that restrictive short selling regulations can significantly slow the rate at which stock prices incorporate negative news. In contrast, a well-developed short selling regime enables stock prices to more quickly and efficiently adjust to unfavorable information

about firms. This, in turn, enhances market efficiency and reduces instances of stock price inflation.

The SPCR is theorized in this study from both market and firm perspectives. On the market side, Campb ell and Hentschel (1992) show that stock market volatility increases when good information is transmitted into the stock market, which in turn leads to higher stock prices. After negative information is communicated into the stock market, the stock market plummets, and the change in volatility in turn leads to a higher risk premium, which pushes the stock market to continue to decline, and finally triggers a stock market crash. Gennotte and Leland (1990); Caplin and Leahy (1994) suggest that insiders have relevant private information, while outside investors only have public information.

The price of a stock is a mixture of truths that are beneficial to the stock price and negative news that cannot be known. Over time, when the unknown information is released, outside investors will start selling their shares causing the price to plummet. At the firm level, Jin and Myers (2006) studied information asymmetry among firms from the perspective of agency theory and information asymmetry. There is a tendency to conceal unfavourable insider information about the company in the course of its ongoing operations. With the accumulation of unfavourable news, the company's share price is gradually overvalued. Once the accumulation of negative news reaches a critical point, the negative news will be leaked and the stock price will plummet. based on agency theory and information asymmetry theory, Chen et al. (2001) and Jin et al. (2006) suggest that corporate executives have strong information dominance and can control the release and disclosure of corporate information. From their respective perspectives, managers and company boards of directors tend to amplify good news and cover up bad news when disclosing information, thus misleading the outside world and making external investors over-optimistic in their stock price forecasts, which results in a misjudgment of the stock price. At the same time, the stock price cannot truly reflect the actual value of the enterprise, resulting in a stock market bubble. Once the negative benefits are exposed, the stock market bubble will burst.

3. Theoretical analysis and hypothesis formulation

3.1 SSMs and SPCR

Relaxing restrictions on short selling is crucial for the advancement of stock markets. Diamond and Verrecchia (1987) developed a mathematical model of rational expectations, demonstrating that the trading behavior of short-selling investors enhances pricing efficiency and contributes to market stability. Similarly, researchers argued that the implementation of SSMs can improve equity pricing efficiency in China's stock market, reduce the frequency of extreme events, and thus mitigate the SPCR. Empirical research on securities lending and short selling revealed that these mechanisms significantly stabilize stock price volatility and reduce the amplitude of price fluctuations. Their findings suggest that the short selling system curbs excessive market swings and minimizes the risk of abrupt price jumps. Additionally, the availability of short selling information helps investors better assess firm-specific risks, thereby enhancing overall market effectiveness. Based on the above theoretical analyses, the following hypotheses are proposed in this study:

H1: SSMs in stock markets can effectively reduce the SPCR

3.2 SSM and quality of accounting disclosure

From the aspect of short sellers, short sellers have the role of information intermediaries. Researchers argued that short sellers have rich professional skills and relevant abilities, are willing to spend a lot of effort to collect and analyse the financial data of listed companies, and through the quality of their disclosure to select the target companies to carry out the short selling behaviour, and are capable of identifying the problems such as financial fraud and surplus management of the companies. This is echoed by Karpoff (2010) who suggests that short sellers can get bad news about companies earlier and short companies with fraud.

At the same time, short selling behaviour will also have an impact on the disclosure quality of listed companies at the firm level. Researchers analyse the connotations of risk in detail, pointing out that the emergence of a short selling regime and short sellers not only results in the collapse of share prices and lower managerial compensation, but also may result in the laying off of executives. In the face of multiple pressures, managers will take the initiative to improve the quality of accounting disclosure. Researchers also argues that the short selling regime in listed companies can motivate investors to actively collect negative news about the target company, which makes it more likely that malpractices, such as financial fraud, are exposed by the listed company, and thus motivates management to make more timely and accurate accounting disclosures.

In summary, the following assumptions are made:

H2: SSMs in capital markets can induce firms to improve the quality of their accounting disclosures, thereby reducing the risk of share price crashes

3.3 SSM and stock price information content

In the stock market, the short selling system can increase

the information content of stock prices. Miller (1997) argues that informed investors are able to better utilise the acquired private information to increase the information content of stock prices by means of financing and financing, prompting stock prices to converge to their intrinsic value. Based on the information hypothesis theory, Researchers argued that since the SSM gives investors who want to engage in arbitrage trading through information advantage a more convenient trading mechanism, which motivates traders to actively seek information, and as arbitrageurs continue to trade, their price changes reflect more company-related information. Researchers study firms with high default risk in the securities market are difficult to detect through stock price changes. This, in turn, demonstrates that the short selling regime has a significant effect on enhancing the information content of stock prices.

In summary, the following hypotheses can be made:

H3: SSMs in capital markets can reduce the SPCR.

4. Research design

4.1 Data sources and sample selection

This study selects the data of relevant listed companies published by Shenzhen Stock Exchange from 2013 to 2022. The initial sample is also screened according to the following criteria: (1) removing companies with missing data; (2) removing companies such as ST, *ST and PT; (3)

$$R_{i,t} = \beta_0 + \beta_1 R_{m,t-2} + \beta_2 Rm, Rm\ t\text{-}1 + \beta_3 Rm,t + \beta_4 Rm,t+1 + \beta_5\ Rm,t+2 + \varepsilon i,t$$

Ri,t denotes the stock return of listed companies in week t of year i considering cash dividends, and Rm,t is the weighted average market return of the stock market in week t considering reinvestment of cash dividends. The market returns for the two weeks before and after week t are also added to the model as variables to reduce the effect of different trading methods. $\varepsilon i,t$ is the model regression residual term, which measures the portion of the return volatility of an individual stock that is unsystematic and cannot be captured by the market, and the greater

$$NCSKEW_{i,t} = -[n(n-1)\ \frac{3}{2}\ \varSigma W3_{\ i,t}]\ /[(n-1)(n-2)(\varSigma W2\ i,t)\ ]\ 3/2$$

In the model, n represents the number of trading weeks of a stock in fiscal year t. The larger the value of NCSKEW, i.e., the larger the coefficient, the greater the risk of a stock price collapse.

Mediating variable: accounting information disclosure quality (Report). The information content of stock price, the stock return is expressed as the common rate of return from the market level, the common rate of return from the industry level and the unique rate of return from the company level and then the synchronicity of the stock price is calculated by the following model:

removing financial listed companies; and (4) removing insolvent companies. The final data of 16,111 sample companies were obtained from the Cathay Pacific database (CSMAR). In order to avoid the effect of extreme values when performing regression analysis, this study has performed the shrinking of the upper and lower 1% for all continuous variables.

4.2 Variable setting

4.2.1 Dependent Variable - SSM (Short)

In order to observe the role of SSM on stock price risk, this study draws on the study to classify the listed companies, construct a double difference (DID) model, and define the dummy variable

Short: if the company becomes a firm that is the subject of financing and financing, i.e., if its stock can be sold short in year t, and the time for which it is available for short selling is greater than three months, the value of Short is taken to be 1, otherwise Otherwise, the value of Short is 0. Dependent variable - SSM, in order to better observe the change of SSM, this study draws on Chen et al. (2001) to construct the Negative Coefficient of Returns Bias (NCSKEW) to measure the SPCR in the establishment of risk. The larger the index, the greater the SPCR. The detailed calculation process is as follows: firstly, the market-adjusted return is calculated by constructing the model

the absolute value of $\varepsilon i,t$, the greater the deviation of the weekly return of an individual stock from the market the greater the deviation from the market average. Using the regression residuals, the market-adjusted return of stock i, Wi,t, can be obtained as:

$$Wi,t = \ln (1 + \varepsilon i,t)$$

Based on the calculated returns, the indicator negative return skewness coefficient, which measures the SPCR, can be further constructed:

$$ri,t\ = \alpha 0 + \alpha\ r1m,t + \alpha\ r2n,t + \varepsilon$$

where ri,t is the weekly individual stock return in period t considering reinvestment of cash dividends; rm,t is the market capitalization-weighted average weekly market return in period t; and rn,t is the market capitalization-weighted average weekly industry return in period t. The goodness-of-fit value of R2 is derived from the regression of the above model, after which R2 is logarithmised by the following model:

$$SYN = Ln[R2\ i,t\ /(\ 1\text{-}R2\ i,t)]$$

The SYN obtained in the model is a measure of the syn-

chronisation of the stock prices.A larger SYN means a higher synchronisation of the stock prices.
Control Variables: Firm Size (Size), Market-to-Book Ratio (MB), Profitability (Profit), Shareholding Concentration (Shrcr), Board Size (Board), Independent Director Ratio (Indep), Gearing Ratio (Lev), and Return on Total Assets (ROA).

A description of the control variables is listed in Table 1.

Table 1 Definition of relevant control variables

Indicator name	Indicator symbols	elaborate definition
Company size	Size	Natural logarithm of total assets
market capitalization	MB	Share price per share/net assets per share
profitability	Profit	EBIT/total assets
Shareholding concentration	Shrcr	Shareholding ratio of the largest shareholder
Board size	Board	Number of Board of Directors
Ratio of independent directors to	Indep	Number of independent directors/number of board of directors
gearing	Lev	Ratio of liabilities to total assets
return on total assets	ROA	Net profit/total assets
Equity liquidity	Liquidity	Annual stock turnover rate
growth	Growth	Growth rate of operating income
Industry dummy variables	Industry	Sectoral classification bySFC 2012
Annual dummy variables	Year	Classification by year

4.2.2 Modelling

(1) SSM and the SPCR

$$NCSKEW_{i,t+1} = \alpha 0 + \alpha 1\ Short_{i,t} + \gamma Control\_varibles_{i,t} + \varepsilon_{i,t}$$

$NCSKEW_{i,t+1}$ is a significant measure of the risk of a stock price crash, $Short_{i,t}$ is a dummy variable indicator of whether the SSM is implemented or not, and Control_variblesi,t is a set of control variables. If H1 holds, a negative value of $\alpha 1$ indicates that the risk of a stock price

$$Report_{i,t} = \beta 1\ Short_{i,t} + \beta 2\ Control\_varibles_{i,t} + \Sigma Year + \Sigma Industry + \varepsilon_i,$$

$$NCSKEW_{i,t+1} = \alpha 1\ Short_{i,t} + \alpha 2\ Report_{i,t} + \alpha 3\ Control\_varibles_{i,t} + \Sigma Year + \Sigma Industry + \varepsilon_i,$$

$$SYN_{i,t} = \beta 1\ Short_{i,t} + \beta 2\ Control\_varibles_{i,t} + \Sigma Year + \Sigma Industry + \varepsilon_i,$$

$$NCSKEW_{i,t+1} = \alpha 1\ Short_{i,t} + \alpha 2\ SYN_{i,t} + \alpha 3\ Control\_varibles_{i,t} + \Sigma Year + \Sigma Industry + \varepsilon_i,$$

5. Empirical analyses

5.1 Descriptive statistics

Table 2 presents the results of the descriptive statistical analysis for the main variables. The mean and median values of NCSKEW for sample companies where Short

The following model is set up to test the effect of the capital market SSM on the SPCR in Hypothesis H1:

crash decreases with the implementation of short selling.

(2) Short-selling mechanism and factors affecting the SPCR

Mediating effects of accounting disclosure quality

The mediating effect of stock price information content

equals 1 are lower compared to those for companies where Short equals 0, aligning with the theoretical predictions of Hypothesis 1. Additionally, the mean and median values for the quality of accounting disclosures (Report) and information content (SYN) for companies with Short equal to 1 are not lower than those for companies with Short equal to 0. This observation is consistent with the theoretical expectations outlined in Hypotheses H2 and H3.

Table 2 Results of descriptive statistical analyses of the main variables

variant	Full sample (N=16111)			Short=1 (N=9774)			Short=0 (N=6337)		
	average value	median	(statistics) standard deviation	average value	median	(statistics) standard deviation	average value	median	(statistics) standard deviation
NCSKEW	-0.289	-0.240	0.751	-0.306	-0.260	0.732	-0.264	-0.220	0.778
Report	3.082	3.000	0.601	3.144	3.000	0.617	2.986	3.000	0.563
SYN	0.375	0.363	0.200	0.394	0.385	0.200	0.346	0.330	0.197
Size	22.049	21.900	1.151	22.455	22.340	1.167	21.423	21.390	0.787
MB	3.660	2.870	2.788	3.619	2.830	2.810	3.722	2.940	2.752
Profit	0.046	0.050	0.091	0.054	0.050	0.086	0.033	0.040	0.097
Shrcr	31.461	29.510	13.968	31.902	29.660	14.613	30.780	29.280	12.881
Board	8.268	9.000	1.553	8.404	9.000	1.577	8.058	9.000	1.489
Indep	0.378	0.360	0.058	0.376	0.360	0.058	0.380	0.380	0.057
Lev	0.395	0.380	0.198	0.409	0.400	0.199	0.373	0.350	0.196
ROA	0.033	0.040	0.089	0.040	0.040	0.083	0.021	0.030	0.095
Growth	0.352	0.140	1.053	0.349	0.130	1.056	0.358	0.140	1.050

5.2 Regression analysis

5.2.1 Impact of SSM on the SPCR

It can be seen in Table 3 the coefficients for the gearing ratio (LEV) and return on total assets (ROA) are significantly negative in terms of control variables. This suggests that firms with higher earnings, as indicated by a higher ROA, tend to experience a lower SPCR, while higher leverage (LEV) also contributes to reducing crash risk. The analysis further confirms Hypothesis H1, which posits that the implementation of a SSM in the capital market plays a crucial role in mitigating the SPCR. The findings indicate that the SSM contributes to enhanced market stability by lowering the probability of significant declines in stock prices.

Table 3 Table of results of regression analysis for hypothesis H1

variant	(1)	(2)
	NCSKEW	NCSKEW
Short	-0.052***	-0.031**
	(-4.54)	(-2.27)
Lev		-0.17***
		(-4.35)
ROA		-1.338***
		(-2.81)
Growth		-0.004
		(-0.80)
Size		-0.03***
		(-4.31)
Profit		-1.176***
		(2.58)
Constant	-0.249***	0.559***

	(-27.94)	(3.79)
Industry	containment	containment
Year	containment	containment
N	16111	16111
R-squared	0.001	0.013
Note: (1) *, **, *** denote significance levels of 10%, 5% and 1% respectively (2): values in parentheses are t-values		

5.2.2 A test of the mechanism by which SSM affects the SPCR

Table 4 show how the quality of accounting information mediates the impact of the SSM on stock price collapse risk. Although the coefficient for the short selling dummy variable (Short) remains significantly negative at the 1% level after including the accounting disclosure quality variable (Report) in the model, the coefficient for Short in column (1) is not significant. Additionally, the confidence intervals for the indirect effect in the Bootstrap analysis encompass both positive and negative values, indicating that there is no significant mediating effect of accounting disclosure quality on the relationship between the SSM and stock price collapse risk. This suggests that changes in accounting disclosure quality do not influence the risk of future stock price crashes. A possible explanation is that poor accounting disclosure quality does not necessarily prevent firms from hiding unfavorable information, leading to inflated stock prices that do not accurately reflect the true financial condition.

Table 4 Table of results of regression analysis for hypothesis H2 cause-effect step-by-step approach

variant		(1)		(2)
		Report		NCSKEW
Short		-0.012		-0.039***
		(-1.18)		(-2.80)
Report				-0.023**
				(-2.08)
Size		0.143***		0.011
		(26.31)		-1.41
MB		0.013***		0.003
		(7.51)		-1.26
Profit		-2.482***		1.417***
		(-7.41)		-3.06
Shrcr		0.004***		-0.001
		(13.23)		(-1.27)
Board		0.018***		-0.005
		(5.14)		(-1.12)
Indep		0.111		0.029
		(1.19)		-0.22
Lev		-0.456***		-0.235***
		(-15.78)		(-5.85)
ROA 4.328***				-1.577***
		(12.40)		(-3.26)

Growth		-0.001	-0.005**
		(-0.35)	(-0.92)
Constant		-0.288**	-0.313*
		(-2.41)	(-1.90)
Industry		containment	containment
Year		containment	containment
N		16111	16111
R-squared		0.183	0.004

Note: (1) *, **, *** denote significance levels of 10%, 5% and 1% respectively (2): values in parentheses are t-values

Bootstrap method			
	Effect	Error (SE)	Lower limit (LLCI)	Upper limit (ULCI)
direct effect	-0.027	0.0137	-0.0538	-0.008
Indirect benefits	-0.0004	0.0003	-0.0011	0.0001

Table 5 gives how stock price information content mediates the impact of the SSM on stock price collapse risk. The analysis reveals that both the stock price information content indicator (SYN) and the short selling dummy variable (Short) in column (1) are significantly positive at the 5% level, with a coefficient of 0.009 for SYN. When these variables are incorporated into the model, the coefficients for stock price information content and the SSM remain significantly positive at the 1% level, with coefficients of -0.041 and 0.333, respectively, in the second column. Furthermore, the Bootstrap method shows that the confidence intervals for both direct and indirect effects include both positive and negative values. This indicates that stock price information content plays a mediating role in the effect of short selling on mitigating stock price collapse risk, as measured by the negatively skewed coefficient of SPCR.

Table 5 Table of results of regression analysis for hypothesis H3 cause-effect step-by-step approach

variant		(1)		(2)
		SYN		NCSKEW
Short		0.009**		-0.041***
		(2.415)		(-2.997)
SYN				0.333***
				(11.015)
Size		0.041***		-0.006
		(21.066)		(-0.803)
MB		0.000		0.003
		(-0.4)		(1.174)
Profit		0.112		1.436***
		(0.931)		(3.12)
Shrcr		0.000		-0.001
		(0.04)		(-1.507)
Board		0.006***		-0.008*
		(5.063)		(-1.651)

Indep		0.062**		0.006
		(1.867)		(0.043)
Lev		-0.11***		-0.188***
		(-10.604)		(-4.718)
ROA		-0.203		'-1.607***
		(-1.619)		(-3.353)
Growth		0.004***		-0.007
		(2.871)		(-1.163)
Constant		-0.57***		-0.117
		(-13.282)		(-0.707)
Industry		containment		containment
Year		containment		containment
N		16111		16111
R-squared		0.052		0.011

Note: (1) *, **, *** denote significance levels of 10%, 5% and 1% respectively (2): values in parentheses are t-values

Bootstrap method				
	Effect	Error (SE)	Lower limit (LLCI)	Upper limit (ULCI)
direct effect	-0.0324	0.0136	-0.0591	-0.0057
Indirect benefits	0.0051	0.0013	0.0026	0.0077

6. Robust type tests

In order to further mitigate possible endogeneity issues and to make the findings more robust, this study will test this by substituting the dependent variable. The ratio of upward and downward fluctuations in returns (DUVOL) is another indicator commonly used in academic research to measure the SPCR, which is characterized by capturing asymmetric fluctuations in stock returns. $DUVOL_{i,t} = Log \{[(nu - 1) \times \Sigma \text{down} W2_{i,t}]/[(nd - 1) \times \Sigma W2_{i,t}]\}$.

Table 6 Table of results of regression analysis for hypothesis H1

variant	(1)	(2)
	DUVOL	DUVOL
Short	-0.056***	-0.027***
	(-7.22)	(-3.11)
Lev		-0.055**
		(-2.16)
ROA		-0.367
		(-1.18)
Growth		0.000
		(0.10)
Size		-0.033***
		(-7.15)
Profit		0.278
		(0.93)

Constant	-0.146***	0.644***
	(-24.03)	(6.54)
Industry	containment	containment
Year	containment	containment
N	16111	16111
R-squared	0.003	0.008
Note: (1) *, **, *** denote significance levels of 10%, 5% and 1% respectively (2): values in parentheses are t-values		

After replacing the variables, the results still show that firms running SSMs are still effective in reducing the SPCR. Column (2) adds the relevant control variables. The significance of the DUVOL coefficient also confirms that hypothesis H1 still holds, i.e., SSM in the capital market can effectively reduce the SPCR.

6. Conclusions of the study

In this study, the relevant stock market information disclosed by the Shenzhen Stock Exchange from 2013-2022 is selected as the research object, and regression analysis, causal step analysis and other research tools are used to explore the role of short selling in the SPCR and its regulating mechanism. It is found that the likelihood of stock price crash is greatly reduced in the stock market due to the introduction of the short selling system, and the above conclusions remain true through robust-type tests of variable substitution and extended capacity samples; in the examination of the influencing factors, it is found that in the stock market, the short selling system is able to improve the information content of stock price, thus reducing the risk of stock market crash.

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