Stock price crash risk and cost of equity capital

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Abstract. This paper studied the impact of stock price crash risk on the cost of equity capital by taking a-share listed companies in Shanghai and Shenzhen stock exchanges from 2013 to 2017 as samples. The empirical test results show that the increase of the risk of stock price crash will lead to the increase of the cost of equity capital. Further empirical test is made on the impact of major shareholders’ shareholding on the relationship between stock price crash risk and equity capital cost. The empirical results show that major shareholders’ shareholding will inhibit managers’ selective disclosure of information and alleviate information asymmetry, thus weakening the relationship between stock price crash risk and equity capital cost.

1. Introduction
Because of its significant impact on economic development, the risk of stock price crash has long been one of the hot issues studied by many scholars. Existing researches mostly focused on the influence factors of stock price crash risk, scholars from the gender of the executives, the equity incentive policy, the difference of enterprise strategy, the investor sentiment, the auditor quality, accounting conservatism and heterogeneous aspects respectively to study how the factors affect stock price crash risk. However, there is little literature research the economic consequences that stock price crash risk brought. There is no doubt that the collapse of stock prices will have a huge impact on the development of the capital market itself and its participants. Therefore, the study of the consequences of stock price crash risk has theoretical and practical significance.

This paper enriches the research results of the negative effects of stock price crash risk. At the same time, it also enriches the research on the factors affecting the cost of equity capital. This paper studies the moderating effect of top shareholders' ownership on the stock price crash risk and the cost of equity capital, providing incremental empirical evidence for the study of the mechanism of major shareholders' ownership.

2. Literature review and theoretical hypotheses
2.1. Stock price crash risk
The risk of stock price crash results from that enterprises hide negative information for their own interests, which accumulates to a certain extent and is suddenly released (Romer, 1993)[1]. The governance model of modern enterprise management and ownership separation brings about the problem of information asymmetry. Xiao Shisheng et al. (2017)[2] found that high-quality information disclosure can significantly reduce the risk of stock price crash. Ding Hui et al. (2018)[3] pointed out that in the context of various social media, the improvement of investors' information ability can significantly reduce the risk of stock price crash. Zhou Song et al. (2019)[4] pointed out that the stronger the
management level is, the lower the risk of stock price crash in the future, and this effect is long-term and lasting.

2.2. Cost of equity capital
Lu Wenbin et al. (2014)\(^5\) pointed out that the information communication function and supervision function of media can help enhance the information symmetry between investors and enterprises, and the decline of this information asymmetry will reduce the cost of equity capital of enterprises. Feng Laiqiang et al. (2017)\(^6\) pointed out that executive liability insurance reduces the cost of shareholder lawsuits, reduces the quality of financial information and increases the financing cost of the company. Li Xiaolin et al. (2018)\(^7\) pointed out that managers' financial experience helps to reduce the cost of a company's equity capital, and this effect is more obvious in companies with low governance level.

2.3. Research hypothesis
When the stock price fluctuates greatly, due to the information asymmetry, investors can not timely understand the business situation of the enterprise, it is difficult to effectively supervise the managers, investors face increased uncertainty, so they will require higher yield as risk compensation. In addition, frequent fluctuations of stock prices will also cause investors to question the management ability of enterprise management, and increase the expectation judgment of the degree of risk they face, which further increases the risk compensation demanded by investors.

H1: All else being equal, the increased risk of a stock price crash will result in a significant increase in the company's cost of equity capital.

Empirical studies have verified that high-quality information disclosure will enable investors to make a higher evaluation of the company's stock and play a positive role in investors' decision-making. Top shareholders who have more shares of surplus are more motivated to supervise and intervene in the behaviors of managers, so as to curb the opportunistic behavior of managers in selective disclosure of information, which is conducive to improving the quality of information disclosure of the company and alleviating the problem of information asymmetry. Combined with the above analysis, the risk of stock price crash is closely related to information asymmetry, so this paper believes that the major shareholders' shareholding can reduce the impact of stock price crash risk on the cost of equity capital. Therefore, hypothesis 2 is proposed in this paper:

H2: Major shareholder ownership will weaken the impact of stock price crash risk on the cost of equity capital.

3. Empirical research

3.1. Sample selection and data source
This paper takes the data of a-share listed companies in Shanghai and Shenzhen exchanges from 2013 to 2017 as the research sample. The data comes mainly from the Wind database. In this paper, the original data were processed as follows: (1) ST enterprises were excluded; (2) excluding financial enterprises; (3) excluding enterprises listed for less than one year; (4) eliminate samples with missing data; (5) eliminated the data if \(\text{eps}_t < \text{eps}_{t+1}\). 1% Winsorize reduction is adopted for the main variables. Data processing in this paper was performed with Excel 2010 and Stata11.0.

3.2. Variable selection

3.2.1. Risk of stock price crash (CRASHRISK). Based on the research of Kim et al. (2011), this paper adopts the following two variables, namely negative coefficient of skewness (NCSKEW) and down-to-up volatility (DUVOL), to measure the risk of stock price crash. The variable construction process is as follows:

Firstly, the regression model is constructed:

\[
 r_{it} = \alpha_i + \beta_1 r_{it-2} + \beta_2 r_{it-1} + \beta_3 r_{it-1} + \beta_4 r_{it+1} + \beta_5 r_{it+2} + \epsilon_{it} 
\]

(1)
\( r_{i,t} \) is the yield of stock \( i \) in week \( t \), \( r_{m,t} \) is weighted average weekly return on market value of a-share in week \( t \). We use the residual item in formula (1) to calculate the specific market-adjusted return rate of stock \( i \) in week \( t \): \( W_{i,t} \).

\[
W_{i,t} = \ln (1 + e_{i,t})
\]

We use \( W_{i,t} \) to construct two indicators to measure the risk of stock price crash:

1. Negative coefficient of Skewness (NCSKEW)

\[
NCSKEW = \left[ n(n-1)^{3/2} \sum W_{i,t}^3 \right] / \left[ (n-1)(n-2)(\sum W_{i,t}^2)^{3/2} \right]
\]

\( n \) is the number of weeks in which stock \( i \) trades in year \( t \).

2. Down-to-up volatility (DUVOL)

\[
DUVOL = \log \left[ \left( n_{up} - 1 \right) \sum W_{i,t}^2 \right] / \left( n_{down} - 1 \right) \sum W_{i,t}^2 \right]
\]

\( n_{up} (n_{down}) \) is the number of weeks that \( W_{i,t} \) is above (below) the average return of the year. The greater the value of DUVOL and NCSKEW, the greater the risk of stock price crash.

3.2.2. Top shareholder’s ownership (TopHold). Referring to relevant studies on shareholder ownership, this paper uses the shareholding ratio of the top shareholder to represent the shareholding situation of the major shareholder.

3.2.3. Control variables. The control variable definitions are shown in table 1.

| Nature          | Name            | Code  | Definition                                      |
|-----------------|-----------------|-------|------------------------------------------------|
| Dependent       | Cost of equity capital | COC   | Calculated according to equation (5)           |
| variable        | Negative Coefficient of Skewness | NCSKEW | Calculated according to equation (3)           |
| Independent     | Down-to-Up Volatility | DUVOL | Calculated according to equation (4)           |
| variables       | Top shareholder’s ownership | TopHold | The shareholding ratio of TOP shareholders     |
|                 | company size    | Size  | Take the natural log of the total assets of the company |
|                 | Leverage ratio  | Lev   | Total liabilities/total assets                 |
|                 | Beta coefficient | Beta  | The correlation between corporate stock returns and the overall market returns |
|                 | Total stock turnover per year | Turnover | Take the natural logarithm of the turnover rate over the total number of shares |
|                 | Return on total assets | Roa   | Net profit/total assets                        |
|                 | Company growth  | Growth | Growth rate of operating income                |
|                 | industry        | Ind   | Control industry                               |
|                 | year            | YR    | Control year                                   |

3.3. Empirical model
To test hypothesis 1, the following model is constructed in this paper:

\[
COC_{i,t} = \alpha_0 + \alpha_1 CRASHRISK_{i,t-1} + \alpha_2 ControlVariable_{i,t-1} + \epsilon_{i,t}
\]  \( 5 \)

CRASHRISK is the risk of stock price crash and represents NCSKEW and DUVOL. If \( \alpha_i \) is positive, hypothesis 1 is true.

To test hypothesis 2, the following model is constructed in this paper:

\[
COC_{i,t} = \beta_0 + \beta_1 CRASHRISK_{i,t-1} + \beta_2 TopHold_{i,t-1} + \beta_3 CRASHRISK_{i,t-1} + \beta_4 ControlVariable_{i,t-1} + \epsilon_{i,t}
\]  \( 6 \)
If β2 is significantly negative, then hypothesis 2 holds.

4. **Empirical results analysis**

4.1. **Descriptive statistics**

| Variable | N     | Mean  | Sd   | Min   | p25   | Median | p75   | Max   |
|----------|-------|-------|------|-------|-------|--------|-------|-------|
| COC      | 3268  | 0.0179| 0.0257| 0.0001| 0.0059| 0.0112 | 0.0201| 0.5294|
| NCSKEW   | 3268  | -0.2412| 0.7531| -2.9242| -0.7142| -0.2152| 0.2947| 1.7231|
| DUVOL    | 3268  | -0.2779| 0.6742| -2.0481| -0.6899| -0.2565| 0.1453| 1.6486|
| TopHold  | 3268  | 0.3791| 0.161 | 0.0893| 0.1427| 0.3591| 0.5163| 0.7610|
| Size     | 3268  | 22.0681| 1.3151| 18.326 | 21.5389| 21.9917| 22.5314| 26.0445|
| Lev      | 3268  | 0.4729| 0.1953| 0.0267| 0.3822| 0.4516| 0.672 | 2.1059|
| Beta     | 3268  | 0.9613| 0.1901| 0.4016| 0.8459| 0.9925| 1.1002| 1.5109|
| Turnover | 3268  | 4.7129| 2.8736| 0.0516| 2.1472| 3.7562| 6.1665| 18.0355|
| Roa      | 3268  | 0.149 | 0.7925| -0.9151| -0.0152| 0.1315| 0.2691| 34.4591|
| Growth   | 3268  | 0.0438| 0.0715| -1.1279| 0.0159| 0.0431| 0.0769| 1.2439|

According to table 2, the mean value of COC is 0.0179, the minimum value is 0.0001, and the maximum value is 0.5294, indicating that there is a large gap in the cost of equity capital among listed companies in China. The mean value of NCSKEW and DUVOL is less than the median, which conforms to the definition that these two variables tend to skew to the left. The minimum of TopHold is 0.0893, and the maximum is 0.7610, indicating that the shareholding ratio of the largest shareholder in China’s listed enterprises varies greatly.

4.2. **Correlation analysis**

| Variables | COC   | NCSKEW | DUVOL | TopHold |
|-----------|-------|--------|-------|---------|
| COC       | 1     |        |       |         |
| NCSKEW    | 0.0349*** | 1     |       |         |
| DUVOL     | 0.0891*** | 0.7018*** | 1     |         |
| TopHold   | -0.1328*** | -0.0141 | -0.0251* | 1   |

***,**,*represent significance at 1%,5%,10%

In order to preliminarily analyse the correlation between variables in the model and test multicollinearity, Pearson correlation analysis was carried out for main variables in this paper. The correlation coefficient between NCSKEW and DUVOL is 0.7018, which is significant on the 1% level, indicating that these two variables have a strong consistency. The correlation coefficient between NCSKEW and COC is 0.0349, which is significant on the 1% level. The correlation coefficient between DUVOL and COC was 0.0891, which was significant at the level of 1%, preliminarily proving the rationality of hypothesis 1.

4.3. **Regression result analysis**

4.3.1. **Relationship between risk of stock price crash and cost of equity capital.** Table 4 shows the regression results of model (6). We can see that when DUVOL’s correlation coefficient with COC is 0.0021, which is significant at the level of 1%. NCSKEW’s correlation coefficient with COC is 0.0039, which is significant on the 1% level, indicating that the increase in the risk of stock price crash will increase the cost of equity capital. This result verifies hypothesis 1. F value is significant at the level of 1%, indicating that the model has a good fitting degree.

| Variables | COC   | NCSKEW | DUVOL | TopHold |
|-----------|-------|--------|-------|---------|
| COC       | 1     |        |       |         |
| NCSKEW    | 0.0349*** | 1     |       |         |
| DUVOL     | 0.0891*** | 0.7018*** | 1     |         |
| TopHold   | -0.1328*** | -0.0141 | -0.0251* | 1   |

Table 4 Regression results of stock price crash risk and cost of equity capital

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4.3.2. The TopHold’s impact on the relationship between CRASHRISK and COC. Table 5 shows the regression results of model (7). We can see that the coefficient of DUVOL and COC is 0.0051, which is significant at the level of 10% after considering the TopHold. The coefficient on NCSKEW and COC is 0.0097, which is significant on the 1% level, indicating that hypothesis 1 still holds. The coefficient of DUVOL*TopHold is -0.0019, which is significant at 1%. The coefficient on NCSKEW*TopHold is -0.0002, which is also significant on the 1% level, indicating that major shareholders' shareholding has a negative moderating effect on the relationship between CRASHRISK and COC. That is to say, hypothesis 2 is true.

Table 5 The regression results of stock price crash risk, top shareholders' shareholding and cost of equity capital

| Variables | Coefficients | t  | Coefficients | t  |
|-----------|--------------|----|--------------|----|
| C         | -0.0342***   | -3.4801 | -0.0379***   | -4.7987 |
| NCSKEW    | -0.0097***   | 0.0015 | 1.6749       | —   |
| DUVOL     | -0.0003*     | -1.9251 | 0.0026***   | 3.9571 |
| TopHold   | -0.0019***   | -8.7149 | —           | —   |
| YR        | Controlled   | Controlled | Controlled | Controlled |
| Ind       | Controlled   | Controlled | Controlled | Controlled |
| N         | 3268         | 3268     | —           | —   |
| A-R2      | 0.1391       | 0.1473   | —           | —   |
| F         | 24.4151***   | 26.9331*** | —           | —   |

***,**,*represent significance at 1%,5%,10%

5. Conclusion and revelation

The results show that the increase of the risk of stock price crash will lead to the increase of the cost of equity capital. As one of the risks faced by investors, the risk of stock price crash should be positively
correlated with the investment returns demanded by investors. In addition, the validity of this view is verified by empirical test. Existing research shows that the share price collapse is the result of the outbreak of negative information managers. Big shareholders, as the owner of most surplus value, in order to maintain their own interests, they will actively supervise managers, restrain opportunism behaviors of the selective disclosure of information, which to a certain extent can supervise the managers to make decisions beneficial to investors, and the empirical results support this idea. In order to reduce the cost of equity capital of listed companies and improve the financing efficiency of China’s capital market, regulatory authorities should perfect and strengthen the formulation of relevant laws and regulations on enterprise information disclosure. Enterprises should strengthen the construction of internal control, and make joint efforts to create a good information disclosure environment and prevent the risk of stock price crash.

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