Research on the Impact of Stock Price Crash Risk on the Cost of Equity Capital

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Abstract. The global financial crisis in 2008 and the sharp fluctuation of China's stock market in 2015 made the risk of stock price collapse widely concerned by regulators and investors, and also became a hot topic of academic discussion. In recent years, based on the capital market, the academia has studied the formation mechanism of stock price crash risk from the perspectives of behavioral finance and incomplete information. But existing studies have focused on the causes of stock price crash risk, while ignoring the direct examination of its economic consequences. In this context, this paper will study the impact of stock price crash risk on the cost of equity capital.

Introduction

The financial crisis in 2008 and the boom and slump in China's stock market in 2015 brought the risk of stock price collapse to the public's eyes, attracting people's attention and making it a hot topic in academic circles. In recent years, academic circles have studied the formation mechanism of stock price crash risk from behavioral finance and incomplete information based on capital market. Recent results have also found that the personal characteristics of the management, accounting robustness, financial reporting quality and other aspects of the company's internal factors have a significant impact on the risk of stock price crash. The external environment of the company, such as the shareholding ratio of major shareholders, institutional investors, analysts, media reports and other aspects of the impact on the stock price crash risk, should not be underestimated.

The existing discussions mainly focus on the formation mechanism and influencing factors of stock price crash risk, but ignore the possible economic consequences. Equity capital cost is the minimum rate of return on investment required by investors, and it is an important benchmark that listed companies pay close attention to. In this context, this paper studies the impact of stock price crash risk on the cost of equity capital, hoping to contribute to the economic consequences of stock price crash risk.

Literature Review

J. Kim et al.(2015) study found that the manager of the blind confidence led to a negative NPV project continues, thereby increasing the risk of a share price collapse [1]. J.B. Kim et al. (2011) from the perspective of equity incentive, the option incentive makes the management personnel start to care too much about the stock price and do not want the company's stock price to fall. In order to achieve this goal, the management personnel are more reluctant to disclose the negative news of the company, thus increasing the risk of stock price crash [2].

Y. Kim et al. (2014) found that companies that take the initiative to assume social responsibility tend to hide less negative news, have higher transparency, and have less risk of stock price collapse. [3]. J.L. Callen et al.(2013) explored the correlation between the shareholding ratio of institutional investors and the stock price crash risk faced by the company. The results showed that there was a significant positive correlation between the two. [4].

H.C. Wang et al.(2014) study areas such as level of investor protection and a share price collapse risk of significant negative relationship, good investor protection can encourage management to strengthen information disclosure, thereby reducing the company's stock price crash risk[5]. H.C.

Wang et al. (2015) found that the shareholding ratio of major shareholders was significantly negatively correlated with the future stock price crash risk of the company, that is, the larger the shareholding ratio of major shareholders, the smaller the stock price crash risk[6].

Research Hypothesis

The risk of stock price collapse is a kind of systematic risk. At present, China's stock market is not mature yet. Under this background, when the systematic risk keeps increasing, the stock return rate investors want will also increase. If the stock price of an enterprise has the risk of collapse, it indicates that the stock price will drop sharply. When the bad news is released, the investment risk will increase. In this case, the enterprise needs to put forward the promise of relatively higher return on investment to obtain the investment from investors, and the cost of equity capital will rise relatively. Therefore, hypothesis 1 is proposed: Other things being equal, there is a significant positive correlation between the risk of stock price collapse and the cost of equity capital.

In China, there are a lot of state-owned listed companies, and the government is the ultimate controller of state-owned enterprises, usually the government will give some support to state-owned enterprises. Brandt and Li proposed the concept of ownership "financial discrimination", and found that financial institutions were more inclined to invest and lend to state-owned enterprises under the same conditions .Compared with non-state-owned enterprises, state-owned enterprises have higher risk tolerance, which makes it easier for state-owned listed companies to conduct financing activities in case of crash risk compared with non-state-owned listed companies. Compared with private enterprises, state-owned enterprises have more channels to raise their own costs, face less financing constraints, and have the support of state capital, even if state-owned enterprises face the risk of stock price collapse, investors will not worry too much. Based on this, this paper holds that the relationship between the two is different in enterprises with different ownership nature, and proposes hypothesis 2: when other conditions remain unchanged, the significance level of the relationship between stock price crash risk and equity capital cost of non-state-owned listed companies is higher than that of state-owned listed companies.

Perspective theory in behavioral finance: investors' attitude to risk is asymmetric. They tend to be aggressive when they suffer losses and relatively conservative when they face gains. Therefore, when the market goes up, investors are more cautious about risks, and the property of "crash risk aversion" is more obvious, so they will demand a higher crash risk premium. On the contrary, when the market falls, the strong risk tolerance makes investors less sensitive to risks, and the required risk return compensation for crash is relatively low. Based on this, this paper holds that the relationship between the two is different in different market conditions, and proposes hypothesis 3: when other conditions remain unchanged, the relationship between the risk of stock price collapse and the cost of equity capital is different in different market conditions (i.e., bull market and bear market), and the significance level of the relationship between the two in bull market is higher than that in bear market.

Data Source and Metrics Construction

Data Source. In this paper, Chinese a-share listed companies in Shanghai from 2012 to 2016 are selected as research objects. The data are mainly from RESSET database and CSMAR database. In this paper, the initial data are screened and processed.

Metrics Construction. Referring to the research of J. Chen et al. (2001) [7] and A.P. Hutton et al. (2009) [8], the following two indicators will be used to measure the risk of stock price crash of enterprises. The calculation method is as follows: First, the weekly return rate and the weighted average weekly return rate of market value in circulation are used to calculate the unaccounted part of the stock price of stock i after market adjustment in week t, and the following regression model is constructed:

$$\gamma_{i,t} = \alpha_i + \beta_1 \gamma_{m,t-2} + \beta_2 \gamma_{m,t-1} + \beta_3 \gamma_{m,t} + \beta_4 \gamma_{m,t+1} + \beta_5 \gamma_{m,t+2} + \varepsilon_{i,t} \tag{1}$$

$\gamma_{i,t}$ is the weekly return rate of stock i in week t, and $\gamma_{m,t}$ is the weighted average weekly return rate of market capitalization in week t. In order to reduce the influence brought by non-synchronous transactions, the lag and lead terms of weighted average weekly return of market capitalization are added into the model. Where $\varepsilon_{i,t}$ is the residual term in model Eq.1, which is the part of stock price that cannot be explained by the market. In order to make the residual term $\varepsilon_{i,t}$ obey the standard normal distribution, this paper takes 1 plus the natural logarithm of regression residual $\varepsilon_{i,t}$ in model Eq.1 as the company-specific weekly return rate:

$$W_{i,t} = \ln(1 + \varepsilon_{i,t}) \tag{2}$$

$W_{i,t}$ is used to calculate the following two indexes: the first one is the NCSKEW coefficient of negative returns. The calculation method is as follows:

$$NCSKEW_{i,t} = \frac{\left[n(n-1)^{\frac{3}{2}} \sum W_{i,t}^3 \right]}{\left[(n-1)(n-2)(\sum W_{i,t}^2)^{\frac{3}{2}} \right]} \tag{3}$$

n is the number of weeks that stock I trades in the year t. In order to ensure the statistical comparability of company-specific weekly returns with different time spans, the ratio of the third-order origin moment of company-specific weekly returns and its variance to the 3/2 power is used to indicate the deviation degree of return rate, and according to previous research results, a negative sign is added before the obtained ratio, finally forming the NCSKEW index. NCSKEW is a positive indicator, and the larger the calculated value is, the more serious the negative skew degree of return rate of stocks in the Tth year is.

The second indicator, DUVOL, is the up-down ratio of earnings, which indicates the degree of asymmetric volatility in stock returns. The calculation method is as follows:

$$DUVOL = \ln \left\{ \frac{[(n_{up}-1) \sum_{down} W_{i,t}^2]}{(n_{down}-1) \sum_{up} W_{i,t}^2} \right\} \tag{4}$$

$n_{up}(n_{down})$ is the number of weeks in which the weekly specific return rate of stock I is higher (lower) than the average weekly specific return rate. DUVOL measures the difference in volatility between periods of rising and falling share prices. The larger the value of DUVOL, the more inclined the yield distribution is to the decline period, which means the yield distribution is more skewed to the left.

In this paper, PEG model is selected to estimate the cost of equity capital based on the consideration of operability and feasibility, and existing studies have pointed out that PEG model has the highest efficiency in estimating the cost of equity capital, and has the advantages of simple and easy to understand, with few restrictions (X.S. Mao et al.,2012) [9].The model is as follows:

$$COC = \sqrt{\frac{eps_{t+2} - eps_{t+1}}{P_t}} \tag{5}$$

eps_{t+2} and eps_{t+1} are the average earnings per share in the period t+2 and t+1 predicted by analysts respectively, and P_t is the price per share at the end of the period t (i.e., closing price).

With reference to existing studies on the cost of equity capital, the following indicators are selected as control variables in this paper: Beta, Turnover, BM, Size, Lev, ROA and Growth.

Model construction. In this paper, multiple linear regression method is adopted to build a model to study the relationship between them. The model is as follows:

$$COC_{i,t} = \alpha_0 + \alpha_1 Crashrisk_{i,t-1} + \alpha_2 Beta_{i,t-1} + \alpha_3 Turnover_{i,t-1} + \alpha_4 BM_{i,t-1} +$$
$$\alpha_5 Size_{i,t-1} + \alpha_6 Lev_{i,t-1} + \alpha_7 ROA_{i,t-1} + \alpha_8 Growth_{i,t-1} + \varepsilon_{i,t-1} \tag{6}$$

$Crashrisk_{i,t}$ is the proxy variable of stock price crashrisk, which is measured by negative return skewness coefficient and fluctuation ratio of return. If coefficient α_1 is positive and significant, it means that there is a positive correlation between the two.

Empirical Results

As can be seen in the table 1, when regression is conducted with NCSKEW as an independent variable, the coefficient of COC of the dependent variable equity capital cost is 0.008(T value is 8.434, P value is less than 0.01), so it is significantly positive at the level of 1%.When taking DUVOL as the independent variable for regression, the COC coefficient is 0.011(T value is 8.036, P value is less than 0.01), which is significantly positive at the level of 1%. Based on this hypothesis, the risk of stock price collapse is significantly positively correlated with the cost of equity capital.
  (Space is limited and control variables are omitted.)

Table 1   Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.062	.009		6.336	.000
	NCSKEW	.008	.001	.377	8.434	.000

Table 2   Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.068	.001		6.910	.000
	DUVOL	.011	.001	.324	8.036	.000

In the samples of non-state-owned enterprises, when NCSKEW is an independent variable for regression, the coefficient of the dependent variable COC is 0.008(T value is 5.892), and it is significantly positive at the level of 1%.Similarly, when taking DUVOL as the independent variable for regression, the coefficient of the dependent variable COC is 0.009(the T value is 4.375), which is significantly positive at the level of 1%. This indicates that in non-state-owned enterprises, there is a significant positive correlation between them.

In the samples of state-owned enterprises, when NCSKEW is an independent variable for regression, the coefficient of the dependent variable COC is 0.003(T value is 1.285). Although the coefficient is positive, it does not pass the significance test. Similarly, when taking DUVOL as the independent variable for regression, the coefficient of the dependent variable COC is 0.006(the T value is 1.183). Although the coefficient is positive, it fails the significance test. This indicates that in state-owned enterprises, the positive correlation between them is not significant.

According to hypothesis 2, the significance level of their relationship in non-state-owned enterprises is higher than that in state-owned enterprises.

Table 3   Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.067	.016		4.035	.000
	NCSKEW	.008	.001	.178	5.892	.000

Table 4   Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.105	.020		5.342	.000
	NCSKEW	.009	.002	.133	4.375	.000

Table 5　Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.031	.015		2.137	.000
	NCSKEW	.003	.002	.158	1.285	.174

Table 6　Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.033	.011		2.910	.008
	DUVOL	.006	.003	.124	1.183	.214

In the bull market, when NCSKEW is returned as an independent variable, the coefficient of the dependent variable COC is 0.009(T value is 5.763), and it is significantly positive at the level of 1%.Similarly, when taking DUVOL as the independent variable for regression, the coefficient of the dependent variable COC is 0.011(the T value is 4.845), which is significantly positive at the level of 1%. In the bull market, the two are significantly positive correlation.

Table 7 Coefficientsa

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.043	.010		4.314	.000
	NCSKEW	.009	.001	.167	5.763	.000

Table 8　Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.067	.012		5.713	.000
	DUVOL	.011	.002	.154	4.845	.000

Table 9　Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.017	.003		5.846	.000
	NCSKEW	.004	.005	.134	0.973	.106

Table 10　Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.023	.004		5.846	.000
	DUVOL	.005	.004	.151	1.097	.082

In the bear market, when NCSKEW is an independent variable for regression, the coefficient of the dependent variable COC is 0.004(T value is 0.973), although the coefficient is positive, it fails the significance test. Similarly, when taking DUVOL as the independent variable for regression, the

coefficient of the dependent variable COC is 0.005(the T value is 1.097). Although the coefficient is positive, it fails the significance test. This shows that in the bear market, the positive correlation between the two is not significant.

According to hypothesis 3, the relationship between bull and bear market is different in different market conditions, and the significance level of the relationship between bull market and bear market is higher than that of bear market.

Conclusions

The empirical results show that the risk of stock price collapse is significantly positively correlated with the cost of equity capital. After distinguishing the nature of ownership, further research finds that the relationship between non-state-owned listed companies and state-owned listed companies is more significant. Under different market conditions, the relationship between the two is different. In the bull market, the relationship between the two is more significant, while in the bear market, the relationship between the two is not very significant.

There are still some limitations in this study. Firstly, PEG model is adopted to measure the cost of equity capital in this paper. This model is simple to calculate and can properly consider various risk factors, but the error variance of time series is relatively large. Secondly, in addition to the control variables taken into account in this paper's model, there are many factors that affect the cost of equity capital, such as media reports and stock liquidity, which have not been controlled in this paper and may have some influence on the research conclusions.

Acknowledgements

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