

# *The Impact of Financial Leverage Ratio on the Stock Price Crash Risk*

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**Abstract:** Against the backdrop of an economic downturn, whether the amount of cash flow is sufficient for a company to operate and does this amount could support a company to survive under severe economic background are the question emphasis by companies and investors. Yet, how much leverage does a company take is an important index for investors and firms to look at. This paper examines the influence of financial leverage ratio that works on the stock price crash risk by considering the listed companies' financial data in China from 2003-2022. In this paper, using the method of multilinear regression and the correlation test. The financial leverage ratio shows a negative relationship with the stock price crash risk in both results. This article bridges the gap in the area of the relationships between company financial leverage ratio and stock price crash risk. Furthermore, it can be instructive for regulators to target their policies.

**Keywords:** financial leverage ratio, stock price crash risk, stock market, financial reporting

## **1. Introduction**

In a stage of recession, people beginning to emphasis the importance of cash flow, and the financial leverage ratio is always an important financial reporting indicator of measuring a corporate debt financing condition. In the article from Habib, Hasan, and Jiang, they identify four key indicators that contribute to stock price crashes: financial reporting, managerial incentives, capital market transactions, corporate governance mechanisms, and informal institutional mechanisms [1]. Although current papers have analyzed many determinants, including ETFs, Stock Liquidity and the impact of CEO overconfidence, it is an area that lack of exploration on the interdependence between the financial leverage and the stock price crash [2][3].

As Zhang, Bouchaud, Matacz and Potters explains, enterprises operating in debt will inevitably produce a financial leverage effect. Into the financial leverage effect, uncertainty may produce positive and negative impacts on the enterprise [4][5]. Besides, the model developed by Ozdagli shows that in the cross-sectional patterns of a stock return, financial leverage is the primary source of the value premium [6]. These papers can explain that financial leverage indeed affects the stock price. In order to maintain a healthy environment in the stock market, this article aims to study more profoundly how the financial reporting factor mentioned can influence the stock price crash risk. In the research, which is hold by Chang, Cheng, Kwok and Wong, they found that the firm with a higher

operating leverage would have a lower stock price crash risk [7]. To go a step further, this article mainly contributes to how the financial leverage ratio of a company affects the stock price crash risk.

Part 2 introduces the data source and what adjustments are made to the data for maintaining the accuracy of the study.

Part 3 presents the methodology and variables which is been used in this article. In addition, the hypothesis and the multilinear model are raised in part 3 as well.

In Part 4, results of descriptive statistics analysis, correlation test and regression analysis are shown.

Last but not least, through the result in part 4, a conclusion of the whole article would be made, and the limitation of this paper would be cited. After this, the following study object would be raised in the conclusion.

## 2. Data Source

This paper utilizes data from Wind and CSMAR. The time lag is from 2003 to 2022. Gathering the data is from Chinese A-shares. The companies with "ST" and "ST\*" have been removed to remove the impact from exceptional and extreme cases. The financial leverage is limited to -100 to 100 in order to remove the impression of financial data from some unscrupulous companies. This paper will not discuss this unique industry since the financial industry is a particular case relative to other industries. The data has been deleted from company related to the financial industry, including insurance companies.

## 3. Methodology

### 3.1. Control Variables

This article reference by Ye, Liu and Li, here adding the control variables [8]:

- (1) Ret: Average of yearly returns of listed companies.
- (2) Sigma: The standard deviation of one stock's weekly rate of return.
- (3) Return of asset: An indicator used to measure how much net profit is generated per unit of assets over a period.
- (4) Satisfaction Index: The satisfaction index measures a company's customer satisfaction and is used to assess the degree of customer satisfaction with a product or service.
- (5) Price to Book ratio: Measuring how many times the price of a company's stock is compared with its book price.

### 3.2. Dependent and Independent Variables

Using financial leverage ratio as the independent variables. Due to the accessibility of the data, the formula for this ratio is defined as financial leverage ratio = Asset / Equity.

The response variables used in this paper are NCSKEW and DUVOL. NCSKEW measures how much a stock is negatively skewed, and DUVOL measures the upper and lower volatility of one stock.

This article reference by the method Chen, J., Hong, H., Stein, J., and An, H., Zhang, T., here used NCSKEW and DUVOL to evaluate the probability of a stock price to crash [9][10]. These are both positive indicators. Thus, when these indicators are more prominent, the stock price crash risk is also more significant.

To eliminate the part that is influenced by market, using the formula (1) to do the regression and get the residuals  $\varepsilon_{i,t}$ . Then, calculate the specific return rate of a stock, adding 1 to the residuals and take the logarithm of the result, which is  $W_{i,t} = \ln(1 + \varepsilon_{i,t})$ .

$$r_{i,t} = \beta_0 + \beta_1 r_{mkt,w-2} + \beta_2 r_{mkt,w-1} + \beta_3 r_{mkt,w} + \beta_4 r_{mkt,w+1} + \beta_5 r_{mkt,w+2} \quad (1)$$

In the formula (1),  $r_{i,t}$  measures a stock  $i$ 's return rate in a week. The term  $r_{mkt,w-2}$ ,  $r_{mkt,w-1}$ ,  $r_{mkt,w}$ ,  $r_{mkt,w+1}$ ,  $r_{mkt,w+2}$ , are the weighted average weekly return rate of two periods later, one period later, current period, one period prior, two periods prior, respectively. After that, use formula (2) and formula (3), NCSKEW and DUVOL can be calculated.

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

Formula (2) shows that a larger NCSKEW value indicates a negative skewness coefficient, increasing the risk of a crash.

$$DUVOL_{i,t} = \log \{ [n_u - 1] \sum_{down} W_{i,t}^2 / [(n_d - 1) \sum_{up} W_{i,t}^2] \} \quad (3)$$

In formula (3),  $n_u$  and  $n_d$  measures how many weeks of a weekly return of a stock is higher or lower than the corresponding average weekly return for the year. when the DUVOL is larger, the greater the tendency of the stock return distribution to be skew to the left and the more significant the risk of stock price to collapse. Thus, the larger DUVOL is, the greater of possibility that the risk of a stock price collapse.

### 3.3. Hypothesis

To maintain a healthy environment in the financial market, whether a company has sizeable financial leverage would influence the cash flow condition in a company. Furthermore, whether a more significant financial leverage ratio would incur a higher probability of a stock price crash, makes people concerned. If a corporate has a sizeable financial leverage ratio, it means that this company has a large debt financing structure. Furthermore, this could cause the financial leverage effect. The financial leverage effect is when a company uses debt financing, resulting in a higher rate of change in earnings per share than EBITDA. To discover how the financial leverage ratio would influence the stock price crash risk, here constructed three hypotheses:

H1: A higher financial leverage ratio would incur a higher chance of a stock price crash.

H2: A higher financial leverage ratio would lower down the possibility of a stock price crash.

H3: Financial leverage ratio would not influence the probability of a stock price to collapse.

### 3.4. Model Building

By applying variables to a multilinear regression model, model (4) was constructed.

$$Y_{i,t} = \alpha + \beta_1 financial\ leverage_{i,t} + Control\ Variables_{i,t} + \varepsilon_{i,t} \quad (4)$$

## 4. Result Analysis

### 4.1. Descriptive statistics analysis

First, look at the indicators of NCSKEW and DUVOL in Table 1. These two indicators' maximum and minimum values are from 6.1527 to -5.1701 and from 3.4188 to -2.5615, respectively. This means that stocks' volatility is significant. The probability of a stock price crash is various in different companies. Second, the standard deviation of financial leverage is 7.225015. Compared with other standard deviation values, companies could have a significant variance in financial leverage. Third, the mean and the median do not have a significant difference. This demonstrates that companies

mainly have a similar financial leverage. A way to understand it is that some companies in some industries, like housing, may have a relatively more considerable financial leverage than others. Next, standard deviations in Table 1 shows that the ROA, sigma return, and Ret value do not deviate a lot. Yet, as a business is more profitable, the high a stock price crash is likely to happen.

Table 1: Descriptive statistics

	NCSKEW	DUVOL	PB ratio	Financial leverage	ROA	Sigma return	Ret
Minimum value	- 5.1707	-2.5615	0.0004	-67.230	-8.7534	0.004386	- 0.058441
Maximum Value	6.1527	3.4188	2788.7040	90.571	0.78587	4.629598	1.018869
Mean	- 0.2673	-0.1777	3.8605	2.322	0.02969	0.064750	0.003443
Median	- 0.2333	-0.1783	2.4667	1.860	0.03268	0.059159	0.001621
Standard deviation	0.55175	0.2400779	NA	7.225015	0.000169	0.0015711	0.010520

## 4.2. Correlation Test

Table 2: Correlation test

	Financial leverage &NCSKEW	Financial leverage & DUVOL
Pearson correlation	-0.006266028	-0.008897413
P value	2.514e-07	2.439e-13

Table 2 raises the result of the correlation test for financial leverage with NCSKEW and DUVOL, respectively. In Table 2, both p-values are smaller than 0.05. Results of the test proves that these two linear correlations are statistically significant. The Pearson correlation reveals a negative linear relation of financial leverage ratio with NCSKEW and DUVOL. This suggests that companies with greater financial leverage are less likely to experience stock price collapse.

## 4.3. Regression Analysis

Table 3: Regression analysis

variables	NCSKEW	DUVOL
PB ratio	4.323e-04*	0.0003071*
Financial leverage	-2.025e-0*	-0.0020878*
ROA	5.326e-02*	0.0196816*
Sigma return	3.519e-01*	0.6615956*
Ret	-1.066e+01*	-8.4506289*
SA index	-1.264e-02*	-0.0115519 *
Intercept	-2.996e-01*	-0.2317376*
Adjusted $R^2$	0.031	0.0385
Sample Size	675395	675395

\*Under 95% confidence interval

By looking at Table 3, the index before the financial leverage is negative. This indicates that the financial leverage ratio could impact negatively on both NCSKEW and DUVOL indexes. The result reveals that hypothesis 2 is correct. This implies that a firm with a larger financial leverage ratio can reduce the likelihood of a stock price collapse to happen, rejecting hypothesis 1 and hypothesis 3. After that, the Ret and Satisfaction index have a negative relation with collapse risk, while price-to-book ratio, return on asset, and Sigma return have positive relationships. This suggests that a larger Ret and Satisfaction index reduces a stock price to collapse. Besides, this result indicates that a financial leverage can be a significant factor in reducing risk. When a company has a larger price to book ratio, return on asset and Sigma return, the stock price crash risk will also be more considerable. A step further, this verifies that as a company becomes more profitable, the risk of a crash increases.

## 5. Conclusion

In general, this article analyzed companies' financial data from 2003-2022 in China to look into the relationships of financial leverage ratio with the probability of a stock price crash to happen. Considering the financial leverage effect, this article focuses on what kind of relation would be between the corporate debt financing structure and the chance of a stock price collapse. The study demonstrates that a company with a higher financial leverage ratio has a higher stock price crash risk, with the financial leverage effect working on the positive side of a stock price. Furthermore, it illustrates that a positive financial leverage effect works on the stock price. This article bridges the research gap on the relationships between financial reporting indicators, specifically financial leverage, and stock price collapse risk. Furthermore, this is instructive for regulators to target their policies.

There exist some limitations as well:

(1) This paper only gathered the data in Chinese stock market, the relationship may perform different due to policy and cultural difference in different stock markets.

(2) This paper does not consider the effect of the economic cycle on the share price's volatility is a key factor to consider. This could affect the accuracy of using the volatility indicator DUVOL to measure the probability of a stock price crash to happen.

(3) This paper does not discuss different industries in granular classification. The financial leverage ratio of a company can be varied significantly across different industries.

In order to minimize these limitations, the follow-up research plan to focus on average leverage ratio in different industries, as well as going further to understand whether there are differences in leverage from industry to industry, and if so, why is that. Besides, taking a step further on looking at how the economic cycle could influence on the volatility of a share price.

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