

# Stock Price Crash Risk and Financing Constraints: An Explanation Based on the Moderate Effect of Corporate Performance-- Empirical Evidence from Shanghai and Shenzhen A-share Listed Companies

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**Abstract.** The stock price crash risk and financing constraints are the focus of current social concerns, and the moderating effect of corporate performance on them has also been focused. This paper uses the data of China's A-share listed companies in 2018 to study the interaction mechanism and relationship among corporate performance, the stock price crash risk and financing constraints. The results show that the stock price crash risk significantly increases the degree of financing constraints, and good corporation performance reduces the increasing effect of stock price crash risk on financing constraints. Further robustness test shows that this conclusion holds for all enterprises of different ownership, and is more obvious for enterprises of larger size. The research conclusions not only enrich the literature on corporate performance, financing constraints and stock price crash risk, but also have important referenced value for reducing the stock price crash risk. Additionally, it promotes the healthy and stable development of China's capital market.

**Key words:** corporate performance; stock price crash risk; capital market; financing constraints.

## 1. Introduction

The fluctuation of stock price has always been an eternal topic in the capital market. People have been paying attention to the fluctuation of stock price for a long time in both theoretical research and practice. In most cases, these concerns regard stock price fluctuation as a risk that is responsible for losses of participants in the market (Adrianand Rosenberg, 2008). The stock market risk mainly comes from the fluctuation of stock price. From the macro level, the large fluctuation of stock price comes from the change of macroeconomic situation. From the micro perspective, stock price fluctuations come from enterprise risks, especially the release of operational risks (Wang Yang et al., 2014). Theoretically, the fluctuation of stock price reflects the change of enterprise's intrinsic value, which is determined by its investment and operation behavior to a certain extent. If an enterprise adopts a risky investment or operation, it is bound to affect the value of the enterprise, thus leading to stock price fluctuations (Wang Yang et al., 2014).

At present, China is in the period of economic transition, the phenomenon of difficult financing for enterprises has always been an important problem facing Our country, especially for small and medium-sized enterprises. Whether enterprises can obtain enough capital determines the survival and healthy development of enterprises. Therefore, how to solve the external financing dilemma of enterprises has always been a topic of common concern for academia and related practitioners. At present, facing the impact of the epidemic, the financing difficulty of enterprises has become more prominent. Part of the reason for the central bank to lower the reserve requirement ratio and release liquidity is to alleviate the financing difficulty of enterprises. In October 2020, Guangming Website released a news that when enterprises are financing, most banks will choose to provide real estate as a guarantee, but for the majority of small and medium-sized enterprises, the lack of real estate collateral is an important reason for financing difficulties. However, the Civil Code of the People's Republic of China clarifies the categories, registration and liquidation sequence of movable property pledge in the form of legislation, thus unlocking financing constraints for small, medium and micro enterprises.

Corporate performance is the embodiment of the comprehensive capabilities of the enterprise, directly reflects the profitability and asset operation level of the enterprise. In theory, Li Quan et al. (2010) proposed that enterprise corporate performance is an important basis for investors to make decisions, which can effectively stimulate the enthusiasm of enterprise managers. In fact, the low operating efficiency of State-owned enterprises in China will aggravate the phenomenon of inflation and deflation. Ensuring the stated-owned corporate performance is the key to follow the law of currency circulation (Yang Wei, 2000). Corporate performance is the enterprise financing situation good reflected. Li Xiaofen et al. and other scholars (2020) put forward due to the expected economic effect. Large Internet companies scale of debt financing and debt financing structure has a significant role in promoting for corporate performance, that is, good condition and the financing structure of promote the improvement of enterprise economic value. Guo Lili et al. (2021) believe that under the condition of relatively high financing constraints, capital will be limited and enterprises tend to shift from physical investment to financial investment. The negative impact of financialization on enterprise corporate performance will be magnified, and the transition from physical investment to financial investment will bring some fluctuations to the stock market. Therefore, corporate performance is of great significance to investors' decisions and currency circulation, and is also an important way to reflect the financing situation of enterprises.

In the market economy environment, financing constraints will increase the operational risk faced by enterprises, which is called "financing constraints risk" (Whited&Wu, 2006). Ball and Browns (1968) also believed that financing constraints information disclosed by listed companies would be transmitted to investors. Due to information asymmetry, external investors would regard the announcement of financing constraints made by business operators as a signal of the enterprise to the external market Wang et al. (2012) proved that financing constraints positively affect the idiosyncratic risk of enterprises, and the idiosyncratic risk premium is correspondingly higher. Based on the above considerations, this paper empirically analyzes the mechanism among corporate performance, stock price crash risk and financing constraints by taking the public data of China's A-share listed companies in Shanghai and Shenzhen in 2018 as the research sample. The results show that the stock price crash risk of listed companies is significantly negatively correlated with the degree of financing constraints, and the firm's corporate performance moderates the deterioration effect of stock price crash risk on financing constraints. The results held true after a series of robustness tests.

First of all, from the perspective of stock price crash risk, this paper broadens the research field of factors affecting the degree of financing constraints and enriches the research content in this field. Secondly, based on the degree of financing constraints, this paper discusses the economic consequences of the stock price crash risk, enriching the literature in this field. Thirdly, this paper enriches the driving factors of corporate financing constraints from the perspective of corporation performance. Finally, the research conclusion of this paper shows that moderate stock price crash risk can restrain the degree of financing constraints of enterprises, which provides a new idea for preventing and resolving financing constraints and promoting the healthy development of enterprises.

## 2. Literature References

Financing constraints has always been a hot topic in the field of corporate finance, and many scholars have studied it to a certain extent. Due to the incompleteness of the capital market, such as information asymmetry, agency problems, transaction costs and other factors, enterprises have financing constraints. Some scholars believe that financing constraints of enterprises come from external factors of enterprises. Fazzari&Athey (1987) found that the incomplete market caused by information asymmetry resulted in financing constraints for enterprises. Wei Zhihua et al. (2014) showed that favorable financial ecological environment, high level of financial development and other external factors alleviated financing constraints faced by enterprises. Hadlock&Pierce (2010) proposed to describe the degree of financing constraints of enterprises by internal characteristic indicators such as enterprise age and enterprise size. In addition, Ye Kangtao et al. (2010) believe

that enterprises with good reputations are often more widely recognized in the market, which can alleviate financing constraints faced by enterprises by alleviating information asymmetry between enterprises and banks. Gu Leilei et al. (2018) conducted an empirical analysis based on the structural equation model, and the results showed that the enterprise's own conditions had a stronger impact on financing constraints than the external environment. The existence of financing constraints will have an impact on the company's stock price, enterprise innovation and the risks faced by enterprises. Dhawan (2001) conducted an empirical study on listed companies in the United States and found that small companies faced stronger financing constraints and subsequently suffered higher risks, thus generating stronger innovation motivation. Li (2011) has a further explanation for this. He found that financing constraints increase the innovation risk of enterprises, so investors have higher requirements on the return of enterprise stocks, and there is a significant positive correlation between financing constraints and expected return of stocks. Whited et al. (1992) also found a positive relationship between financing constraints and corporate stock returns through empirical research. Wu Jia et al. (2014) established a dynamic enterprise investment decision model to construct financing constraints indicators, and based on which they found that enterprises with high financing constraints had higher stock risks and returns. Wang Jining et al. (2010) used Bassali model to analyze and conclude that compared with unconstrained enterprises, the financial risks of enterprises constrained by financing are higher.

It can be seen from the collation of literatures related to financing constraints that the existing literatures mainly study the formation reasons of financing constraints and their impact on listed companies, its impact on corporate investment behavior and thus on corporate value and corporate risk ultimately affecting corporate stock price volatility has not been directly studied. Such as enterprise innovation (Dhawan, 2001) and stock returns (Li, 2011; Whited, 1992), enterprise risk (Wu Jia, 2014; Wang Jining, 2010). For the stock price crash risk, many scholars have carried out relevant studies. Liu Yang (2015) examined the impact of accounting information transparency on stock price crash risk and found that accounting information transparency was significantly negatively correlated with stock price crash risk in the future. Yang Meimei (2019) proposed in her research that, compared with politically related enterprises, the stock price crash risk of enterprises without political affiliation can promote the accounting stability of enterprises. From the perspective of investor protection, Wang Huacheng (2014) empirically tested the significant negative correlation between local investor protection and the stock price crash risk of enterprises.

From the literature review on stock price crash risk, it can be seen that the current articles on stock price crash risk are mainly studied from the perspective of accounting information transparency, accounting robustness and investor protection. However, the impact of stock price crash risk on corporate financing constraints has not been directly studied. It can be seen from the collation of literatures related to financing constraints that the existing literatures mainly study the formation reasons of financing constraints and their impact on listed companies, such as enterprise innovation (Dhawan, 2001) and stock returns (Li, 2011; Whited, 1992), enterprise risk (Wu Jia, 2014; Wang Jining, 2010), which has not directly studied the influence of its investment behavior on enterprise value and enterprise risk on enterprise stock price volatility.

The relationship between corporate performance and corporate financing has always been the focus of scholars' attention. Li Chi (2021) proposed that improving the financing structure of enterprises is conducive to improving the corporate performance of enterprises. Yu Jinping et al. (2016) suggested that there is a certain causal relationship between the two factors. At the same time, both the expansion of financing scale and the increase in the proportion of equity financing in corporate financing can significantly improve the profitability of listed companies. From the perspective of the results caused by digital HP Finance, Cai Lulu et al. (2021) put forward that digital HP finance can reduce enterprise financing constraints and improve corporate performance. It can be seen from that there is a change relationship between corporate performance and financing constraints in the same direction.

It can be seen from the collation of documents related to enterprise corporate performance, most of the current articles about the corporate performance only focus on the relationship between the financing situation and corporate performance and the impact of the financing situation on corporate performance, such as the relationship between the two (Li Chi, 2021), influence (Yu Jinping et al., 2016). It has not been directly studied whether corporate performance can influence the financing status of enterprises as a moderating variable. Combined with the collation of related literature on financing constraints and stock price crash risk. Currently, the research on the interaction among corporate performance, stock price crash and financing constraints is still in the blank stage.

Compared with the above literature, the marginal contribution of this paper is as follows: Firstly, from the perspective of the crash risk of enterprise stock price, this paper discusses the impact of the crash risk of enterprise stock price on enterprise investment and then on financing constraints, which also relates the investment behavior of enterprise with the value and risk of enterprise and the ultimate volatility of enterprise stock price. Additionally, it enriches the driving factors affecting financing constraints and connects the factors affecting stock price crash with their impact on corporate financing. Thirdly, through the negative return skewness coefficient, the fluctuation of returns and other factors reflect stock price volatility, and then to explore the impact of stock price crash risk caused by stock price volatility on the subsequent financing constraints of enterprises. Last but not least, this paper enriched an economic consequence of corporate performance, also deeply analyzed the mechanism and interaction among corporate performance, stock price crash risk and financing constraints. This paper enriched the driving factors of financing constraints and financing constraints literature, filling up the gap.

### 3. Hypothesis

Stock price crash is a phenomenon that always exists in the financial market. And enterprises are also facing the problem of financing difficulties. By analyzing the influencing factors of stock price crash and the relationship between stock price crash and corporate financing constraints, the risk of stock price crash can aggravate the financing constraints of enterprises from the following three aspects: the association between enterprises and the government, investors' investment expectations and analysts of financial institutions. However, under the influence of corporate performance, the effect of the former on corporate financing constraints will be reduced.

Stock price crash risk makes investors hold negative investment expectations and enterprises find it difficult to raise funds in the market. The stock price crash risk not only greatly reduces investors' assets and their total assets, but also shakes the confidence of the capital market (Wang Huacheng, 2014). Therefore, investors' confidence is also affected. The investment demand is reduced, business risks of enterprises are aggravated, and financing constraints are further increased. Considering the influence of investor sentiment, the rising sentiment of investors will intensify the influence of stock liquidity on the risk of stock price crash (Li Yanjun et al., 2021). When the stock price crash risk intensifies, the investors' pessimism will rise. Thus, stock liquidity is increased. and even aggravated the stock price crash risk. It is difficult for enterprises to continue to obtain stable financing under the background of high liquidity, which further increases the operating risk of enterprises.

Companies with high levels of political engagement are more likely to face financing constraints when faced with a stock price crash. The higher the risk of a crash in share prices, the more vulnerable companies are to government regulation. However, Yang Meimei (2019) pointed out that the government holds important national resources, and enterprises with political ties to the government are more likely to be granted loan support or government preferential treatment when they fall into financial difficulties or economic crisis. However, if the company is subject to the government's special supervision after the stock price crash risk, it is easy to destroy the loans and tax advantages obtained by the company, thus making the financing of the company more difficult. There is an interaction between government regulation and stock price crash risk, and government regulation also affects stock price crash risk. He Jingqing et al. (2013) proposed that the higher the degree of political

connection of private entrepreneurs, the more obvious the loan effect of political connection in financial crisis will be. For private enterprises, although political connection can improve corporate value and facilitate financing under normal circumstances, it is not conducive to the effective allocation of bank credit funds in the financial crisis such as the stock price crash risk, and the loan effect is very obvious, which makes the financing of private enterprises very difficult. However, for some enterprises with outstanding corporate performance, the government's supervision on enterprises will be relatively relaxed. To sum up, political connection has a great impact on external financing of companies, which may be a resource for companies with good corporate performance, but it will also intensify the negative impact of financial crisis on corporate financing constraints.

The stock price crash attracted the attention of analysts at financial institutions, and the financing constraints were further exacerbated. High-quality information disclosed by enterprises can enhance investors' trust and improve the value relevance of information disclosure (Wang Jiabin, 2020). On the contrary, if the accounting information disclosed by enterprises reflects the situation of stock price crash with high risk, enterprises will be subject to varying degrees of restrictions from individual institutions when financing. At the same time, (Wu Di et al., 2021) proposed that the proportion and continuity of investors in heavy positions in financial institutions and their shareholding enterprises will affect the financing constraints of enterprises. In the face of the estimated crash risk, the proportion and continuity of the enterprise held by investors will be affected to varying degrees, which will make the investors of the financial institution lose information about the enterprise and increase the financing constraints of the enterprise.

To sum up, in the face of stock price crash, enterprises with high political participation are restricted by the government in dealing with this problem. The investors' investment expectations show a negative trend, and analysts of financial institutions also keep a high level of attention to enterprises, which aggravate the degree of financing constraints of enterprises. However, the corporate performance of an enterprise will mitigate the promotion effect of stock price crash risk on financing constraints. Based on this, hypotheses are proposed:

H1: The risk of stock price crash will intensify the financing constraints of enterprises,

H2: Corporate performance will reduce the promotion effect of stock price crash risk on corporate financing constraints.

## 4. Models, Variables and Data

### 4.1 Data Processing

This article selects asset-liability ratio, return on assets, the industry age, industry revenue growth and the company main indexes such as growth rate from CSMAR database in 2018 Shanghai and shenzhen listed company. We eliminate the ST companies and financial companies, excluding major variable is missing, A + H shares listed at the same time, as well as A sample of asset-liability ratio is negative. Finally, 3570 observations were obtained by tail reduction at the 1% and 99% levels.

### 4.2 Test The Model

In order to testify the hypothesis between stock price crash risk and corporate financing constraints, this paper established the following OLS model:

$$WW = \beta_0 + \beta_1 NCSKEW + \beta_2 Lnage + \beta_3 ROA + \beta_4 DAR + \beta_5 Lnemploy + \beta_6 Turnover + \beta_7 BM + \beta_8 Ret + \beta_9 Absacc + \beta_{10} Sigma + \mu \quad (1)$$

$$WW = \beta_0 + \beta_1 NCSKEW + \beta_2 NCSKEW * ROA + \beta_3 Lnage + \beta_4 ROA + \beta_5 DAR + \beta_6 Lnemploy + \beta_7 Turnover + \beta_8 BM + \beta_9 Ret + \beta_{10} Absacc + \beta_{11} Sigma + \mu \quad (2)$$

Observe the above formula (1), the dependent variable is the *i*th enterprise financing constraints in 2018, the independent variable is earnings ratio fluctuates up and down, respectively fixed number of years of the listed companies, enterprise total assets return rate, asset-liability ratio, enterprise scale, enterprise in excess, corporate accounts, ratio, average weekly return of the enterprise, information transparency, revenue volatility.

In formula (1)  $\beta_1$  indicates the impact of *NCSKEW* on *WW*. If it is positive, the stock price crash risk will increase the degree of financing constraints. If it's negative, it's the other way around. In formula (2)  $\beta_2$  indicates the moderating effect of corporate performance on the first-level relationship. It is positive, which means that good corporate performance will increase the promotion effect of stock price crash risk on financing constraints. If it's negative, it's the other way around.

### 4.3 Variable Definitions

#### 4.3.1 Explained Variable: Financing Constraints

The explained variable in the model is the degree of financing constraints of enterprises. In terms of the degree of financing constraints that enterprises are subject to, most of the existing literatures construct various indicators based on the financial statements of enterprises, and then identify whether enterprises are subject to financing constraints and the degree of financing constraints. However, the relationship between corporate behavior or financial characteristic variables and financing constraints is not stable or one-to-one, so the measurement of financing constraints has always been a controversial field in the literature. Financing constraints measurement methods mainly include: investment-cash flow sensitivity index proposed by Fazzari et al. (1987); Kaplan et al. (1997) designed the KZ index based on the comprehensive weighting of financial indicators. Whited and Wu (2006) obtained the financing constraints *WW* index based on the dynamic model structure. And SA index weighted by some company characteristic indicators (Livdan et al.,2009; Hadlock&Pierce,2010). Because the investment-cash flow sensitivity method is easy to produce errors (Lian Yujun, 2007), KZ index is easy to confuse financing constraints with financial distress. Therefore, this paper adopts *WW* index as a benchmark index to measure the relative financing constraints of enterprises by referring to the studies of Whited, Wu, Hadlock and Pierce. Specifically, Whited and Wu calculate the Euler equation by using the generalized moment estimation method to obtain six explanatory factors of financing constraints. They are long-term debt level TLTD (long-term debt/total assets), cash flow ratio CF (net cash flow from operating activities/total assets \*100%), virtual variable of cash dividend payment DIVPOS (the value of listed companies paying cash dividends is 1. Otherwise, the value is 0), natural logarithm of total assets (lnTA), growth rate of enterprise's operating income (SG) and growth rate of industry's operating income (ISG), and then calculated according to the given coefficient. The higher the value is, the higher the degree of financing constraints is (1)

#### 4.3.2 Explanatory Variable: Crash Risk

Referring to the research of Wang Huacheng et al., this paper adopts negative return skewness coefficient *NSCKEW* as the measurement of stock price crash risk of listed companies. The specific calculation method is as follows:

First of all, in order to strip out the impact of market returns on individual stocks, equation (3) is used to return the weekly return rate of company *i* by year, getting the company's weekly idiosyncratic rate of return:

$$Ret_{i,t} = \alpha_i + \beta_1 Ret_{m,t-2} + \beta_2 Ret_{m,t-1} + \beta_3 Ret_{m,t} + \beta_4 Ret_{m,t+1} + \beta_5 Ret_{m,t+2} + \varepsilon_{i,t} \quad (3)$$

Where,  $Ret_{i,t}$  is the yield of company *i* in week *T*,  $Ret_{m,t}$  is the Average market return in week *T*. In order to control the influence of non-synchronous stock trading, the advance term *T* + 1, *T* + 2 and the lag term *T*-1, *T*-2 are further added.  $\varepsilon_{i,t}$  is the residual of the equation. It is the part of stock return that cannot be explained by market return, that means the idiosyncratic rate of return. Define the

idiosyncratic rate of return of company  $i$  in week  $T$  is  $W_{i,t} = \ln(1 + \varepsilon_{i,t})$ , use  $W_{i,t}$  calculate proxy variables for stock price crashes.

The variable is the negative return skew coefficient ( $NCSKEW$ ), which is mainly used to measure the negative bias of a stock by the return rate. The greater the degree of negative bias, the greater the volatility of yield, the greater the risk of stock crash. Where,  $n$  represents the number of trading weeks of company  $i$  stock in a year. The calculation method is as follows:

$$NCSKEW_{i,t} = \frac{n(n-1)^2 \sum W_{i,t}^3}{(n-1)(n-2)(\sum W_{i,t}^2)^{\frac{3}{2}}} \quad (4)$$

### 4.3.3 Control Variables

Based on the studies of previous scholars, this paper further controls the enterprise characteristic variables as follows:

The control variable is enterprise Size (Size), which is represented by the logarithm of the total assets of the enterprise. The larger the enterprise Size is, the stronger its ability to resist risks is. It is expected that the volatility of stock price is inversely related to it. The second is the enterprise age ( $Lnage$ ), which is expressed by taking the logarithm of the company's listing years. The earlier the company is listed, the more experienced the company is in dealing with risks, and the expected stock price volatility is inversely related to it. The asset-liability ratio ( $DAR$ ) is expressed as the ratio of the total assets to the total assets, reflecting the debt level of an enterprise. The more debt an enterprise has, the greater the risk it will face. It is expected that stock price volatility is positively correlated with  $DAR$ . Return on assets ( $ROA$ ) is expressed as the ratio of total profits to total assets.

**Table 1.** Definition and description of main variables

| Variable types        | The variable name   | Variable symbol | Variable declaration   |
|-----------------------|---|-----------------|--|
| Explanatory variables | Negative return skewness coefficient  | $NCSKEW$        | The negative bias of the company's weekly stock returns in $T$ years           |
| Control variables     | Monthly excess turnover rate  | $Turnover$      | $T$ year monthly turnover rate and $T-1$ year monthly turnover rate difference |
|                       | Asset-liability ratio   | $DAR$           | Total liabilities/total assets   |
|                       | The company size  | $Lnemploy$      | Log of total ending assets   |
| Continued Table 1     |   |                 |  |
|                       | Comparison between the value on account and the practical value in the market | $BM$            | Net assets per share/share price   |
|                       | Return on total assets  | $ROA$           | Net profit/Total assets  |
|                       | Information transparency  | $Absacc$        | Correction of operating accruals derived from Jones model                      |
|                       | State-owned enterprises or not  | $Soe$           | Ownership for state-owned enterprises is 1, otherwise is 0                     |
|                       | industry  | $Ind$           | Industry dummy variables, 17 industry dummy variables                          |
| Explained variable    | Financing constraints   | $WW$            | A benchmark measure of a firm's relative degree of financing constraint        |

## 5. The Empirical Analysis

### 5.1 Correlation Analysis

In order to testify the basic correlation between stock price crash risk and financing constraints, correlation analysis was conducted on financing constraints variables, fluctuation of stock price,

negative return skewness rate and related control variables. The analysis results are shown in Table 3. The correlation coefficient between *NCSKEW* and *WW* is 0.086, and the correlation coefficient between *Lnage* and *WW* is 0.068. Correlation analysis shows that stock price crash risk is significantly positively correlated with financing constraints. There is no obvious collinear relationship between financing constraints *WW* and control variables.

**Table2.**Results of correlation analysis of main variables

| Variables           | (1)    | (2)    | (3)    | (4)    | (5)    | (6)    | (7)    | (8)    | (9)    | (10)   | (11)  |
|---------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|-------|
| (1) <i>WW</i>       | 1.000  |        |        |        |        |        |        |        |        |        |       |
| (2) <i>NCSKEW</i>   | 0.086  | 1.000  |        |        |        |        |        |        |        |        |       |
| (3) <i>Lnage</i>    | 0.068  | 0.007  | 1.000  |        |        |        |        |        |        |        |       |
| (4) <i>ROA</i>      | 0.263  | -0.086 | 0.048  | 1.000  |        |        |        |        |        |        |       |
| (5) <i>DAR</i>      | 0.219  | 0.042  | 0.059  | -0.535 | 1.000  |        |        |        |        |        |       |
| (6) <i>Lnemploy</i> | 0.682  | 0.062  | 0.065  | 0.096  | 0.299  | 1.000  |        |        |        |        |       |
| (7) <i>Turnover</i> | -0.267 | -0.082 | -0.037 | -0.005 | -0.095 | -0.230 | 1.000  |        |        |        |       |
| (8) <i>BM</i>       | 0.335  | 0.060  | 0.130  | -0.003 | 0.243  | 0.303  | -0.151 | 1.000  |        |        |       |
| (9) <i>Ret</i>      | 0.368  | 0.122  | 0.026  | 0.130  | 0.033  | 0.289  | -0.624 | 0.294  | 1.000  |        |       |
| (10) <i>Absacc</i>  | -0.044 | -0.020 | 0.046  | 0.058  | -0.019 | -0.025 | 0.047  | 0.082  | 0.019  | 1.000  |       |
| (11) <i>Sigma</i>   | -0.379 | -0.093 | -0.043 | -0.140 | -0.038 | -0.295 | 0.598  | -0.323 | -0.975 | -0.020 | 1.000 |

## 5.2 Regression Analysis

**Table 3.** Baseline regression: moderating effect

| variables         | (1)                | (2)                  | (3)                  | (4)                  |
|-------------------|--------------------|----------------------|----------------------|----------------------|
|                   | <i>WW</i>          | <i>WW</i>            | <i>WW</i>            | <i>WW</i>            |
| <i>NCSKEW</i>     | 0.007***<br>(2.95) | 0.004***<br>(2.69)   | 0.005***<br>(2.69)   | 0.004**<br>(2.47)    |
| <i>NCSKEW*ROA</i> |                    |                      | -0.042***<br>(-8.11) | -0.049***<br>(-9.36) |
| <i>Lnage</i>      |                    | -0.002<br>(-0.43)    | 0.000<br>(0.08)      | -0.002<br>(-0.58)    |
| <i>ROA</i>        |                    | 0.1***<br>(12.55)    | 0.168***<br>(15.34)  | 0.172***<br>(15.84)  |
| <i>DAR</i>        |                    | 0.057***<br>(7.67)   | 0.060***<br>(7.67)   | 0.051***<br>(7.16)   |
| <i>Lnemploy</i>   |                    | 0.029***<br>(23.04)  | 0.032***<br>(26.40)  | 0.028***<br>(23.19)  |
| <i>Turnover</i>   |                    | -0.004<br>(-1.38)    |                      | -0.006**<br>(-2.37)  |
| <i>BM</i>         |                    | 0.024***<br>(3.97)   |                      | 0.036***<br>(5.99)   |
| <i>Ret</i>        |                    | -1.648<br>(-0.26)    |                      | -3.458<br>(-0.57)    |
| <i>Absacc</i>     |                    | -0.047***<br>(-2.65) |                      | -0.069***<br>(-4.02) |
| <i>Sigma</i>      |                    | -0.555<br>(-1.63)    |                      | -0.498<br>(-1.51)    |
| Constant          | 1.022***(553.83)   | 0.782***<br>(41.98)  | 0.741***<br>(49.78)  | 0.777***<br>(43.27)  |

Note: \*, \*\*, and \*\*\* denote the 10%, 5%, and 1% significance levels, respectively; Values in parentheses are t-values, same below.

Robust Then we used the fluctuation ratio of stock price and negative return skewness coefficient to conduct regression analysis on financing constraints variables. Univariate regression analysis was performed in column (1) of Table 3; multivariate analysis was performed by adding relevant control variables of the company and industry in column (2); and regression analysis was performed by adding *NCSKEW\*ROA* and four control variables in column (3). In column (4), *NCSKEW\*ROA* and relevant control variables of the company and industry were added for multivariate analysis. When *NCSKEW* was used as a single variable for regression, as shown in Column (1) of the table, the regression coefficient was 0.007, which was significantly positive at 1% level. Multivariate regression analysis was conducted after other influencing factors were further controlled. The regression

coefficient becomes 0.004, significant at the 1% level. Based on this table, it can be concluded that the stock price crash risk may make enterprises subject to government supervision, and investors' pessimistic sentiment towards them has intensified the financing constraints of enterprises. In addition, the stock price crash risk will be reflected through the accounting information of enterprises, and the evaluation of enterprises by financial institutions will be affected, so that enterprises will be constrained to varying degrees in financing from financial institutions or investors. In order to study the influence of corporate performance on financing constraints,  $NCSKEW*ROA$  cross-product coefficient and significance level were observed, the coefficient is -0.049, which is negative and significant at 1% level. Return on total assets had a moderating effect to alleviate the promotion effect of stock price crash risk on financing constraints. In other words, corporate performance alleviates the promotion effect of stock price crash risk on financing constraints to a certain extent, assuming H2 is established.

## 6. test and Heterogeneity Analysis

In order to ensure the reliability of the research results, the following robust test and heterogeneity analysis were carried out in this paper. One is the heterogeneity analysis based on the size of the enterprise; the second is the heterogeneity analysis based on the size of the enterprise.

### 6.1 The Test is Based on the Size of the Enterprise

When  $NCSKEW$  is used as the explanatory variable to control the regression of four variables, and the enterprise is a large enterprise, the correlation coefficient is 0.006 and t value was 2.41. When the enterprise is not a large enterprise, the correlation coefficient is 0.004 and the T value is 1.27. When  $NCSKEW$  is used as the explanatory variable to control all the aforementioned control variables for regression, and the enterprise is a large enterprise, the correlation coefficient is 0.005 and t value is 2.41. When the enterprise is not a large enterprise, the correlation coefficient is 0.004 and the T value is 0.55. It can be concluded that in the face of stock price crash risk, large enterprises are more vulnerable to government supervision and disclosure by financial institutions, and are subject to more significant financing constraints. In addition, large enterprises have great social influence and attract more attention from investors. When they face the stock price crash risk, investors are more afraid of them than small investors, which also increases the financing difficulty of enterprises.

**Table 4.** Robust test: firm size and financing constraints

| Variables       | (1)                 | (2)                  | (3)                 | (4)                 |
|-----------------|---------------------|----------------------|---------------------|---------------------|
|                 | <i>WW</i>           | <i>WW</i>            | <i>WW</i>           | <i>WW</i>           |
| <i>NCSKEW</i>   | 0.006***<br>(2.41)  | 0.005**<br>(2.41)    | 0.004<br>(1.27)     | 0.002<br>(0.55)     |
| <i>Lnage</i>    | 0.003<br>(-0.01)    | 0.000<br>(-0.01)     | -0.014<br>(-1.47)   | -0.013<br>(-1.34)   |
| <i>ROA</i>      | 0.106***<br>(11.50) | 0.098***<br>(11.50)  | 0.157***<br>(6.04)  | 0.159***<br>(6.03)  |
| <i>DAR</i>      | 0.068***<br>(7.59)  | 0.062***<br>(7.59)   | 0.041**<br>(2.51)   | 0.029*<br>(1.85)    |
| <i>Lnemploy</i> | 0.033***<br>(19.86) | 0.030***<br>(19.86)  | 0.022***<br>(3.82)  | 0.013**<br>(2.26)   |
| <i>Turnover</i> |                     | -0.007**<br>(-2.10)  |                     | -0.001<br>(-0.22)   |
| <i>BM</i>       |                     | 0.020***<br>(3.09)   |                     | 0.061***<br>(4.15)  |
| <i>Ret</i>      |                     | 6.051<br>(0.77)      |                     | 3.301<br>(0.27)     |
| <i>Absacc</i>   |                     | -0.060***<br>(-2.97) |                     | -0.029<br>(-0.81)   |
| <i>Sigma</i>    |                     | -0.219<br>(-0.54)    |                     | 0.004<br>(0.00)     |
| Constant        | 0.727***<br>(40.99) | 0.765***<br>(35.56)  | 0.856***<br>(18.83) | 0.880***<br>(17.92) |

### 6.2 The Test is Based on Whether the Enterprise is Owned by the State

In condition that *NCSKEW* was used as the explanatory variable to control the regression of four variables: When the enterprise was a state-owned enterprise, the correlation coefficient was 0.009 and t value was 2.69; when the enterprise was not a state-owned enterprise, the correlation coefficient was 0.005 and t value was 2.57. Provided that *NCSKEW* was used as the explanatory variable to control all the aforementioned control variables for regression: When the enterprise was a state-owned enterprise, the correlation coefficient was 0.009 and t value was 2.69; when the enterprise is not state-owned enterprise, the correlation coefficient is 0.003 and t value is 1.86. It can be concluded that when state-owned enterprises face the stock price crash risk, financing constraints are more obvious. The risk of stock price crash significantly increases the degree of financing constraints. In the sample of enterprises with different ownership, this conclusion basically exists and is relatively stable.

**Table 5.** Robust test: state ownership and financing constraints

| Variables       | (1)                 | (2)                 | (3)                 | (4)                 |
|-----------------|---------------------|---------------------|---------------------|---------------------|
|                 | <i>WW</i>           | <i>WW</i>           | <i>WW</i>           | <i>WW</i>           |
| <i>NCSKEW</i>   | 0.009***<br>(2.69)  | 0.009***<br>(2.69)  | 0.005**<br>(2.57)   | 0.003*<br>(1.86)    |
| <i>Lnage</i>    | 0.016<br>(1.54)     | 0.002<br>(0.19)     | -0.009*<br>(-1.90)  | -0.009*<br>(-1.80)  |
| <i>ROA</i>      | 0.256***<br>(6.71)  | 0.285***<br>(7.50)  | 0.102***<br>(11.92) | 0.096***<br>(11.49) |
| <i>DAR</i>      | 0.056***<br>(3.89)  | 0.038***<br>(2.62)  | 0.065***<br>(7.36)  | 0.062***<br>(7.16)  |
| <i>Lnemploy</i> | 0.034***<br>(13.41) | 0.030***<br>(11.69) | 0.030***<br>(20.97) | 0.027***<br>(18.60) |
| <i>Turnover</i> |                     | 0.001<br>(0.06)     |                     | -0.005<br>(-1.60)   |
| <i>BM</i>       |                     | 0.053***<br>(4.27)  |                     | 0.017**<br>(2.52)   |
| <i>Ret</i>      |                     | -24.429<br>(-1.51)  |                     | -1.439<br>(-0.21)   |
| <i>Absacc</i>   |                     | -0.075**<br>(-2.11) |                     | -0.033<br>(-1.64)   |
| <i>Sigma</i>    |                     | -1.238<br>(-1.58)   |                     | -0.561<br>(-1.46)   |
| Constant        | 0.689***<br>(19.46) | 0.756***<br>(17.91) | 0.782***<br>(44.32) | 0.820***<br>(38.76) |

### 6.3 Further Verification

Another measure coefficient of stock price crash risk is the fluctuation ratio of returns (*DUVOL*). If the duration of negative returns is shorter and the degree of negative returns is larger, the larger this index is, the greater the risk of stock price crash is. Among them,  $n_u(n_d)$  indicates that  $t$   $w_{i,t}$  is greater than (more than) number of weeks of average market return.

$$DUVOL_{i,t} = \ln \left( \frac{\sum_{down} w_{i,t}^2}{n_d - 1} \right) - \ln \left( \frac{\sum_{up} w_{i,t}^2}{n_u - 1} \right) \quad (5)$$

Further regression analysis proves that stock price crash risk significantly increases the degree of financing constraints, and good corporate performance reduces the increasing effect of stock price crash risk on financing constraints. This conclusion is relatively robust.

Table 6. Regression test: further analysis

| Variables         | (1)                  | (2)                  | (3)                  | (4)                  |
|-------------------|----------------------|----------------------|----------------------|----------------------|
|                   | <i>WW</i>            | <i>WW</i>            | <i>WW</i>            | <i>WW</i>            |
| <i>DUVOL</i>      | 0.004*<br>(1.83)     | 0.004*<br>(1.83)     |                      |                      |
| <i>DUVOL*ROA</i>  |                      | -0.073***<br>(-8.81) |                      |                      |
| <i>NCSKEW</i>     |                      |                      | 0.004***<br>(2.69)   | 0.004**<br>(2.47)    |
| <i>NCSKEW*ROA</i> |                      |                      |                      | -0.049***<br>(-9.36) |
| <i>Lnage</i>      | -0.002***<br>(-0.42) | -0.002<br>(-0.42)    | -0.002<br>(-0.43)    | -0.002<br>(-0.58)    |
| <i>ROA</i>        | 0.099***<br>(12.40)  | 0.157***<br>(12.40)  | 0.1***<br>(12.55)    | 0.172***<br>(15.84)  |
| <i>DAR</i>        | 0.056***<br>(7.57)   | 0.051***<br>(7.57)   | 0.057***<br>(7.67)   | 0.051***<br>(7.16)   |
| <i>Lnemploy</i>   | 0.029***<br>(23.07)  | 0.029***<br>(23.07)  | 0.029***<br>(23.04)  | 0.028***<br>(23.19)  |
| <i>urnover</i>    | -0.004***<br>(-1.34) | -0.006**<br>(-1.34)  | -0.004<br>(-1.38)    | -0.006**<br>(-2.37)  |
| <i>BM</i>         | 0.024***<br>(4.05)   | 0.035***<br>(4.05)   | 0.024***<br>(3.97)   | 0.036***<br>(5.99)   |
| <i>Ret</i>        | -0.598***<br>(-0.10) | -1.718<br>(-0.10)    | -1.648<br>(-0.26)    | -3.458<br>(-0.57)    |
| <i>Absacc</i>     | -0.048***<br>(-2.67) | -0.067***<br>(-2.67) | -0.047***<br>(-2.65) | -0.069***<br>(-4.02) |
| <i>Sigma</i>      | -0.51***<br>(-1.50)  | -0.430<br>(-1.50)    | -0.555<br>(-1.63)    | -0.498<br>(-1.51)    |
| Constant          | 0.78***<br>(41.85)   | 0.775***<br>(41.85)  | 0.782***<br>(41.98)  | 0.777***<br>(43.27)  |

## 7. Conclusions and Recommendations

This paper uses the data of China's A-share listed companies in 2018 to study the interaction mechanism and relationship among corporate performance, stock price crash risk and financing constraints. The results show that stock price crash risk significantly influences the degree of financing constraints, and corporate performance moderates the deterioration effect of stock price crash risk on financing constraints. Further robustness test shows that this conclusion is valid for enterprises of different ownership and scale. In theory, this paper tests the relationship between corporate performance, stock price crash risk and financing constraints degree for the first time, and expands the research on the influencing factors of stock price crash risk and the economic consequences of corporate performance and financing constraints degree.

This paper has important implications. First of all, regulators and corporate managers should correct view how stock price crash risk, and financing constraints affect the enterprise management in order to moderate relief of listed companies financing constraints, increasing corporate performance, and avoiding the risk caused by the low stock price crash risk too much wait for a phenomenon, thus increasing degree of financing constraints. Secondly, we can improve the company's internal governance structure and external supervision mechanism. With reducing the degree of financing constraints, the stock price crash doesn't intensify the degree of stock price crash. So as to better promote the growth of enterprises and protect the interests of investors. It also can promote the healthy and stable development of China's capital market. Finally, listed companies should strengthen the information disclosure of the company's operating conditions, which can protect the interests of investors. So, investors can better understand the company's operating

conditions, and then make more effective investment decisions, and it can alleviate the financing constraints of enterprises with uncertain stock price to a certain extent.

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