

Equity Incentives and Stock Price Crash Risk: Evidence from China

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Abstract. The impact of equity incentive on stock price crash risk has been investigated in this paper. We solve these problems by using computer tools. We use Stata to analyze the relationship between these two variables in Chinese Market, and a variety of rigorous model calculation to obtain the results of the study. According to the results, equity incentive in China is positively associated with stock price crash risk. Based on a series of robustness tests, including alternative measures and multi-fixed effects model analysis, the relationship remained positive. Furthermore, it is found that the impact of equity incentive on the stock price crash risk is more pronounced in large and high institution ownership companies. According to our research, companies need to control the extent of equity incentives. These results shed light for the relationship between equity incentives and stock price crash risk is positive, especially when the size of company is huge enough.....

Keywords: Equity Incentives; Stock Price Crash Risk; China Stock Market; Institutional Ownership; Data Analyze.

1. Introduction

Management equity incentive can motivate managers to exert productive effort, but also induce managers to divert valuable firm resources to misrepresent performance [1]. Since it brings growth to the company, it is one of the most used methods to motivate employees. After performing management equity incentive, management will gain benefits from it if the stock price is kept in a high level. However, this beneficial mechanism forces management to avoid revealing heavy news to their employees, which increases the uncertainty. Since management controls the brain of a company, it is significant for people to pay attention to their commands. Whereas, if they cover bad issues because of selfishness, it may lead to people's wrong expectation to the company. Therefore, we have a hypothesis that there exists a positive relationship between management equity incentives and stock price crash risk. In other words, the more benefits on management, the higher the risk is.

Since 2015, the A-share market has repeatedly seen a thousand shares drop limit, which has had a negative impact on the interests of investors, confidence in China's stock market, the stability of the financial market and the development of the real economy. Therefore, Chinese listed firms have become an important sample for us to investigate the stock price crash risk.

The Reasons for selecting Chinese list companies as the samples for the study are based on two aspects. First, in China, the stock price crashing has a significant impact and is extremely harmful towards the society. For instance, under the current economic circumstances in our country, the crashing will lead to chaos, crimes, and other unstable factors. Moreover, the weak and unpractical system of the stock market is also an ideal platform for our research group to analyze the stock incentives. For example, the investors on the stock usually do not have much power and cannot make influential decisions. The strength of the implementations of the regulations on the stock are also insufficient, which still needs to put more effort to make the regulations practical. We use Stata to

analyze the relationship between equity incentive and stock market crash risk in the Chinese market. After a variety of rigorous model calculation, we obtain the results of the study. First, the effect of equity incentive on the risk of stock market crash is more significant in large companies than in small companies. Besides, the effect of equity incentive on the risk of stock market crash is more significant in high institution ownership companies than in low institution ownership companies.

Additionally, these results contribute to the literature by analyzing the stock price crashing and the stock incentives. Our result suggests that the stock price crashing will affect the risk of the stock incentive in a positive relationship, which gives further evidence to the managers as well as a new idea of how to utilize the stock incentives properly. As scholars Yuan et al. [2] wrote in their research essay about the Directors' and officers' liability insurance and stock price crash risk, our research group further analyzed the stock price crash risk based on the stock incentives, which is a relationship that people seldom pay attention to. According to the results, indeed, it contributes and supplements to the stock market.

The remainder of this paper is organized as follows. Section 2 summarizes the literature and put forward the hypothesis. Section 3 describes the research design. Section 4 presents the empirical results. Section 5 gives a brief summary.

2. Hypothesis

Steady stock price connects managers' wealth to a firm, which has long been viewed as an effective tool to align managers' incentives. One of the underlying assumptions for this belief is that stock price is an unbiased indicator of the firm's fundamental value. Drawing on the previous literatures, researchers have examined several possible factors, including corporate social responsibility [3], foreign investors [4], mandatory adoption of IFRS [5]. It is obvious that there are many factors affect the stock price crash in different aspects.

H1. High management equity incentive increases corporate stock price crash risk.

Based on our analysis, there is an upper limit to the amount of bad news that firms can absorb. Once the amount of accumulated bad news reaches a certain threshold, it becomes impossible to continue to withhold it. When the accumulation of bad news reaches a tipping point, it will likely all be released at once, leading to large, negative stock returns on the individual stocks concerned, that is, stock price crashes [6, 7]. To some extent, management can affect it in some way. Since management equity incentives will bring advantages to management, they will take consideration when any uncertainty appears. However, bad news is bomb in the company. Though not focusing on equity incentives, based on Jin and Myers's [7] findings, they provided detailed analysis of how bad news hoarding can lead to stock price crashes. When the accumulated bad news reaches this upper limit, it will come out all at once, leading to a large and sudden price decline [7]. Whereas management will cover negative news in order to increase and keep their own benefits. Covering bad news leads to a price decline but increases their own profits. Thus, we expect that high management equity incentives increases corporate stock price crash risk.

H2: The promoting effect of management equity incentive on corporate stock price crash risk is more pronounced in firms with large size.

About the risk of crash, the conventional wisdom in the industry is that managers try to withhold bad news, the distribution of stock returns should be asymmetric [6, 8]. China's financial market and listed firms are associated with a poor information environment [9]. Therefore, we start to study whether the company size is related to the Stock price crash risk. There is a significant positive correlation between the executive excess compensation of local state-owned listed companies and the risk of stock price collapse. Besides, in order to achieve political goals, the government influences the excessive investment of state-owned enterprises by intervening in the policies of state-owned enterprises [10]. The poor corporate governance makes the supervision function of equity incentive plan lower, but the welfare effect is obvious. Hence, assumptions can be proposed that promoting

effect of management equity incentive on corporate stock price crash risk is more pronounced in firms with large size.

H3: The promoting effect of management equity incentive on corporate stock price crash risk is more pronounced in firms with high institutional ownership.

Studies have shown that the quality of management is closely related to the risk of a collapse in the company's share price. To improve controlling of management processes and performance with the company's corporate governance mechanism, Vintila and Gherghina [11] mention that one of the ways is the ownership of financial institutions investors are better informed than individual investors, institutional investors will likely herd to undervalued stocks and away from overvalued stocks. Such herding can move prices toward, rather than away from, equilibrium values [12, 13]. The characteristics of institutional shareholders are obvious, and their companies are more likely to have short-sighted behavior. In this case, managers are more likely to be short-sighted when they exercise their rights (equity incentive) for their own interests, so as to cover up the bad news and increase the risk of stock price crash [14].

3. Research design

3.1 Sample and data

Data are retrieved from the CSMAR databases. Our sample includes firms listed on the Shenzhen Stock Exchange and Shanghai stock Exchange from 2007 to 2017, since the regulations published by the Shenzhen and Shanghai Stock Exchange only applies to public and listed firms. Firms labeled ST and financial firms are excluded from our sample. To exclude the extreme observation values, we minorize the first and 99th percentiles of our observations. Companies with missing research variables are deleted.

3.2 Measurement of stock price crash risk

According to the methods of Hutton [6] and Yuan [2], we use *NCSKEW* and *DUVOL* to measure the risk of stock price collapse. First, we calculate the return rate of week *t* of stock *i*. Therefore, we have established the following model:

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

where, $R_{i,t}$ are the returns of stock *i* in the *t*-th week, and $R_{m,t}$ and the market returns weighted by the total market value in the *t*-th week. In order to adjust the impact of asynchronous trading of stocks, the lag and lead of market return are added in formula (1). The stock specific rate of return is: $W_{i,t} = \ln(1 + \varepsilon_{i,t})$, where $\varepsilon_{i,t}$ is the residual of equation (1). Then, based on the special rate of return $W_{i,t}$, we construct the following two variables: (1) negative return skewness coefficient (*NCSKEW*_{*i,t*}): the negative return skewness coefficient (*NCSKEW*) is the negative return skewness coefficient

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

here, *n* is the number of trading weeks of stock *i* in each year. The larger the *NCSKEW*_{*i,t*} value, the greater the risk of stock price crash.

$$DUVOL_{i,t} = \log\{[(n_{UP} - 1) \sum_{DOWN} W_{i,t}^2] / [(n_{DOWN} - 1) \sum_{UP} W_{i,t}^2]\} \quad (3)$$

where n_{UP} (n_{down}) is the number of weeks when the weekly special rate of return $W_{i,t}$ of stock *i* is greater than (less than) the annual average rate of return. The greater the value of *DUVOL*, the higher the risk of stock price crash.

3.2.1 Measurement of equity incentive

The formula is as follow:

$$EI_t = 0.01 * \text{price} * \text{share} / (0.01 * \text{price} * \text{share} + \text{cashpay})$$

This formula measures the equity incentive of management, i.e., the proportion of the increment of equity value of senior executives to the sum of total compensation and equity value for every 1% rise in share price. Thereinto, price, share and cashpay each represents the stock price at the end of the year, the number of shares hold by the management at the end of the period and the total fixed salary of the management respectively. The larger the EI_t value is, the greater the equity incentive is.

3.2.2 Models

The hypothesis to be tested are the stock price crash risk is a function of management equity incentives and other control variables. The basic empirical model employed is:

where β_1 represents regression coefficients; and β_q is the

$$NCSKEW_{t+1}(DUVOL_{t+1}) = \beta_0 + \beta_1 EI_t + \sum_{q=2}^m \beta_q (qthControlVariable_t) + \varepsilon_t \quad (4)$$

ControlVariable_t. We control for several factors that have been shown to affect future stock price crash risk in studies, including standard deviation of firm-specific weekly returns(σ_t), detrended average daily turnover($Dturn_t$), natural logarithm value of the market value of equity($Size_t$), Book-to-market ratio, calculated by the book value of equity divided by the market value of equity(BM_t), firm financial leverage(LEV_t), return on assets, calculated as net profit divided by the book value of total assets(ROA_t), absolute accruals of firm, calculated as the absolute value of the estimated residuals from the adjusted-Jones model [15] ($Absacc_t$).

4. Empirical Results

4.1 Descriptive Results

Table 1 shows descriptive statistics of the variables. The means of $NCSKEW_{t+1}$ and EI_t are -0.395 and 0.324 , which is similar to Yuan et al.'s finding [2]. The mean of detrended average daily turnover is -0.158 , indicating the negative trend. The mean of σ_t , the standard deviation of firm-specific weekly return, is 0.050 . The standard deviation of $NCSKEW_{t+1}$ is 0.731 , which is a higher number from chart. According to this number, there is a difference on stock price crash risk between each sample.

Table 1. Descriptive statistics

Variables	N	Mean	Std. dev.	25th	Median	75th
$NCSKEW_{t+1}$	9487	-0.395	0.731	-0.782	-0.358	0.028
EI_t	9487	0.324	0.370	0	0.068	0.731
σ_t	9487	0.050	0.019	0.036	0.046	0.060
$Dturn_t$	9487	-0.158	0.513	-0.361	-0.088	0.117
$Size_t$	9487	6.558	0.474	6.222	6.530	6.842
BM_t	9487	0.814	0.739	0.361	0.584	0.981
LEV_t	9487	0.400	0.199	0.242	0.393	0.546
ROA_t	9487	0.0451	0.049	0.016	0.039	0.069
$Absacc_t$	9487	0.006	0.085	-0.041	0.001	0.047

This table reports the descriptive statistics of the variables. The sample includes 9487 firm–year observations listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange in China.

Additionally, a variance inflation factor (VIF) test is conducted to test whether there exists multicollinearity among the variables, and the results are summarized in Table 2. As one sees, all the

VIFs of all the explanatory variables are smaller than 10, indicating no issues of multicollinearity among our variables.

Table 2. VIF tests of key variables

	VIF	1/VIF
EI_t	1.138	0.879
$Sigma_t$	1.155	0.866
$Dturn_t$	1.192	0.839
$Size_t$	1.190	0.840
BM_t	1.553	0.644
LEV_t	1.587	0.630
ROA_t	1.337	0.748
$Absacc_t$	1.068	0.936
Mean	VIF	1.278

This table reports the VIF test results. The sample includes 9487 firm–year observations listed on the Shenzhen Stock Exchange and the Shenzhen Stock Exchange in China.

4.2 The Effect of Management Equity Incentive on Stock Price Crash Risk

From Table 3, we see the results of baseline regression. Column (1) shows the ordinary least square (OLS) regression results. The coefficient of EI_t is 0.097 and is significant at the 1% level, which indicates that management equity incentives boost stock price crash risk. Column (2) of Table 3 explains the results of industry-year effect regression, which increases the credibility of our hypothesis. The coefficient of EI_t is 3.84, which proves our conclusion above. The chart also shows there is negative correlation between Detrended average daily turnover ($Dturn_t$), Book-to-market ratio (BM_t). The results give us evidences to support our H1 that there exists positive relationship between management equity incentives and stock crash price risk. In other words, management equity incentives may intensify the speed of stock price crash.

Table 3. The influence of management equity incentive on stock price crash risk

Dependent variable=	$NCSKEW_{t+1}$	
	(1)	(2)
EI_t	0.097*** (3.84)	0.085*** (3.20)
$Sigma_t$	-1.025** (-2.44)	1.212** (2.22)
$Dturn_t$	-0.054*** (-3.43)	-0.018 (-1.01)
$Size_t$	0.117*** (6.29)	0.114*** (4.86)
BM_t	-0.089*** (-6.38)	-0.063*** (-4.22)
LEV_t	0.179*** (3.41)	0.126** (2.39)
ROA_t	0.864*** (4.66)	0.858*** (4.61)
$Absacc_t$	0.138 (1.51)	0.096 (1.06)
Constant	-1.187*** (-9.51)	-0.939*** (-5.49)
Year	No	Yes
Industry	No	Yes

Observations	9487	9487
Adjusted R ²	0.013	0.060

Table 3 shows the baseline results. The OLS regression results are reported in column (1). Results for the industry–year fixed effects model are reported in column (2). The variable NCSKEW_{t+1} measure Stock price crash risk, the negative skewness of firm-specific weekly returns of stock *i* in year *t*+1. See Eq. (1) for details. The other variables are defined in Table 1, and *t* ≥ statistics are reported in parentheses. The superscripts *, **, and *** indicate significance at the 10 %, 5 %, and 1 % confidence levels, respectively.

4.2.1 Robustness Checks

In this section, we perform two tests to test the robustness of our results, including alternative measures and multi-fixed effects model analysis.

In our previous regression analysis, we focus the effects that management equity incentives bring to stock price crash risk, and the results support our hypothesis that there exists a positive relationship between them. In this section, we take the down-to-up volatility (*DUVOL*_{*t*+1}) as our new measurement of stock price crash risk and test its relationship with management equity incentives.

Table 5 lists the results of alternative measures. Column (1) shows the ordinary least square (OLS) regression results. The coefficient of down-to-up volatility is 0.045 at the 1% confidence level, which also shows a moderately positive relationship. Column (2) explains the results of industry-year effect regression. The results are consistent with that of the baseline regression. Therefore, the above conclusion is robust.

Table 4. Robustness checks: Alternative measures

Dependent variable=	<i>DUVOL</i> _{<i>t</i>+1}	
	(1)	(2)
<i>El</i> _{<i>t</i>}	0.045*** (2.81)	0.037** (2.20)
<i>Sigma</i> _{<i>t</i>}	-1.181*** (-4.23)	0.321 (0.89)
<i>Dturn</i> _{<i>t</i>}	-0.042*** (-4.02)	-0.015 (-1.28)
<i>Size</i> _{<i>t</i>}	0.071*** (5.84)	0.066*** (4.37)
<i>BM</i> _{<i>t</i>}	-0.056*** (-6.21)	-0.036*** (-3.70)
<i>LEV</i> _{<i>t</i>}	0.113*** (3.34)	0.074** (2.19)
<i>ROA</i> _{<i>t</i>}	0.652*** (5.36)	0.662*** (5.43)
<i>Absacc</i> _{<i>t</i>}	0.067 (1.10)	0.042 (0.70)
Constant	-0.736*** (-9.05)	-0.555*** (-5.06)
Year	No	Yes
Industry	No	Yes
Observations	9487	9487
Adjusted R ²	0.015	0.063

Table 4 shows the results of alternative measures. The OLS regression results are reported in column (1). Results for the industry–year fixed effects model are reported in column (2). The variable

Duvolt+1 measures the firm's down-to-up volatility. The other variables are defined in Table 1, and $t \geq$ statistics are reported in parentheses. The superscripts *, **, and *** indicate significance at the 10 %, 5 %, and 1 % confidence levels, respectively.

From this table, column (1) and (2) report the results of year and firm effects and firm fixed effects with province-year interactions. The coefficients of EI_t are respectively 0.122 and 0.126, which are positive and statistically significant. On this basis, one can safely arrive at the conclusion that our results are stable.

Table 5. Robustness checks: Multi-fixed effects model analysis

Dependent variable=	$NCSKEW_{t+1}$	
	(1)	(2)
EI_t	0.122** (2.00)	0.126** (2.03)
$Sigma_t$	2.389*** (3.67)	2.578*** (3.85)
$Dturn_t$	-0.019 (-0.94)	-0.019 (-0.90)
$Size_t$	0.172*** (3.86)	0.169*** (3.64)
BM_t	-0.034 (-1.52)	-0.030 (-1.30)
LEV_t	0.037 (0.48)	0.046 (0.57)
ROA_t	0.612*** (2.65)	0.584** (2.46)
$Absacc_t$	0.051 (0.51)	0.049 (0.47)
Constant	-1.484*** (-5.42)	-1.476*** (-4.68)
Year	Yes	No
Firm	Yes	Yes
Province*Year	No	Yes
Observations	9487	9487
Adjusted R^2	0.061	0.094

The table reports the results of Multi-fixed effects model analysis, Column (1) to (4) report the results of firm and year fixed effects, firm fixed effects with Province-Year interactions, respectively. The variable EI_t measures the equity incentive degree of management. The higher the value, the higher the risk of the stock crash. The superscripts *, **, and *** indicate significance at the 10 %, 5 %, and 1 % confidence levels, respectively.

4.2.2 Heterogeneity analysis

To further investigate the impact of management equity incentive on stock price crash risk is related to the size of the company, we divided the sample into two groups based on the size (namely Large size group and Small size group). Subsequently, regression experiments and analysis are carried out. The results are presented in Table 6. We can learn from it that the coefficients of EI_t is significant at the 1% level in column (1) but not significant in column (2), which suggest that the positive influence of equity incentive for $NCSKEW$ is more likely to happen in large companies than small ones.

Table 6. Heterogeneity analysis: Firm size

Dependent variable=	$NCSKEW_{t+1}$	
	Large size	Small size
EI_t	0.125*** (3.76)	0.033 (0.82)
Σ_t	2.091*** (2.86)	0.014 (0.02)
$Dturn_t$	-0.030 (-1.10)	-0.020 (-0.83)
$Size_t$	0.106*** (3.51)	0.140** (2.46)
BM_t	-0.069*** (-4.30)	-0.036 (-1.10)
LEV_t	0.300*** (4.36)	-0.041 (-0.52)
ROA_t	1.634*** (6.89)	0.194 (0.67)
$Absacc_t$	0.065 (0.54)	0.142 (1.05)
Constant	-1.094*** (-4.79)	-0.938*** (-2.62)
Year	Yes	Yes
Industry	Yes	Yes
Observations	5115	4372
Adjusted R^2	0.095	0.035

This table reports the results of the heterogeneity analysis of firm size. Column (1) reports the Large size regression results. Column (2) reports the Small size regression results. The variable EI_t measures the equity incentive degree of management. The variable $NCSKEW_{t+1}$ is the side return skewness coefficient. The higher the value, the higher the risk of the stock crash. The superscripts *, **, and *** indicate significance at the 10 %, 5 %, and 1 % confidence levels, respectively.

4.3 Conditional on Institution ownership

Similar experiment to above, we split the sample into two sets of subsamples to further study the impact of management equity incentive on stock price crash risk is related to the institution ownership: High institution ownership and Low institution ownership. The sample analysis is performed based on the baseline model. We find that the coefficients of EI_t is significant at the 1% level in column (1) but not significant in column (2), which suggest that the positive influence of equity incentive for $NCSKEW$ is more likely to happen in firms with high institution ownership than that with Low institution ownership.

Table 7. Heterogeneity analysis: Institution ownership

Dependent variable=	$NCSKEW_{t+1}$	
	High institution ownership	Low institution ownership
EI_t	0.167*** (3.79)	0.040 (1.03)
Σ_t	2.481*** (3.35)	0.104 (0.13)
$Dturn_t$	-0.018 (-0.63)	-0.017 (-0.72)
$Size_t$	0.093*** (3.10)	0.107** (2.57)

BM_t	-0.058*** (-3.27)	-0.057** (-2.07)
LEV_t	0.076 (1.05)	0.169** (2.19)
ROA_t	1.203*** (4.71)	0.434 (1.58)
$Absacc_t$	-0.108 (-0.88)	0.349*** (2.62)
Constant	-0.930*** (-4.13)	-0.861*** (-3.04)
Year	Yes	Yes
Industry	Yes	Yes
Observations	5164	4323
Adjusted R^2	0.073	0.049

This table reports the results of the heterogeneity analysis of institution ownership. Column (1) reports the High institution ownership regression results. Column (2) reports the Low institution ownership regression results. The variable El_t measures the equity incentive degree of management. The variable $NCSKEW_{t+1}$ is the side return skewness coefficient. The higher the value, the higher the risk of the stock crash. The superscripts *, **, and *** indicate significance at the 10 %, 5 %, and 1 % confidence levels, respectively.

5. Conclusion

Based on our analysis, the size of the company and institution ownership have a great impact on the risk of stock market crash. Specifically, the promoting effect of equity incentive on stock market crash risk in large companies and high institution ownership companies are more significant. Our findings provide support to the notion that management equity incentives affect Stock price crash risk. This is different from other factors under the context of developed markets. In China, there doesn't exist a perfect system of management equity incentives, i.e., the leverage effect of insurance premiums becomes pronounced. Therefore, under the reconsideration and focus of management, managers in the high level are difficult to hide bad news of firms in China, leading to lower stock price crash risk.

Our study adds to the growing literature on Management equity incentives and its implications on both firms and investors. We focus on the role of Management equity incentives in affecting crash risk and provide new evidence on the economic consequences. Moreover, the study extends prior studies on crash risk by identifying a new factor that has an incremental mitigating effect on future stock price crash risk. Our results are beneficial to firms and investors who want to manage crash risk in the stock market. Additionally, our findings also have important policy implications. As actions of management have a significant impact on stock price crash risk, firms will pay more attention to their moves and information in order to avoid stock price crash risk.

Appendix. Definitions of variables

Variables	Definitions
$NCSKEW_{t+1}$	Stock price crash risk, the negative skewness of firm-specific weekly returns of stock i in year $t+1$. See Eq. (1) for details.
El_t	Management equity incentive, that is, for every 1% increase in stock price, the increment of executive equity value accounts for the proportion of total compensation and equity value.
$Sigma_t$	Standard deviation of firm-specific weekly returns of firm i over the fiscal year t .

$Dturn_t$	Detrended average daily turnover of firm i in year t , calculated as the average monthly stock turnover in year t minus the average daily stock turnover in year $t-1$.
$Size_t$	Natural logarithm value of the market value of equity on firm i in year t .
BM_t	Book-to-market ratio, calculated by the book value of equity divided by the market value of equity on firm i in year t .
LEV_t	Firm financial leverage on firm i in year t , calculated as the book value of total debt divided by the book value of total assets.
ROA_t	Return on assets of firm i in year t , calculated as net profit divided by the book value of total assets.
$Absacc_t$	Absolute accruals of firm i in year t , calculated as the absolute value of the estimated residuals from the adjusted-Jones model (Dechow et al., 1995).
$DUVOL_{t+1}$	Yearly down-to-up volatility of stock i in year $t+1$. See Eq. (4) for details.

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