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Equity Incentives, Inefficient Investment and Stock Price Crash Risk

—Taking GEM as an Example

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Abstract

The crash effect brought about by the "slump" of the stock price of the capital market has severely damaged the stability of the financial market, and the existing research mainly focuses on the reasons for the risk of the stock price crash. From the perspective of how to mitigate the risk of crash, this article discusses the governance effect of equity incentives to resolve the risk of stock price crash, and intends to clarify the logical relationship among equity incentives, inefficient investment, and stock price crash risk. Research shows that there is a significant negative correlation between equity incentives and the risk of stock price collapse on the GEM; equity incentives can effectively suppress the inefficient investment of executives, especially the tendency of overinvestment, thereby reducing the risk of the company's stock price crash; that is, inefficient investment plays an incomplete intermediary role. The conclusion of the study provides important inspiration for the company's internal governance and capital market risk prevention.

Keywords

Equity Incentives, Inefficient Investment, Overinvestment, Risk of Stock Price Crash

1. Introduction

From the development of the capital market, due to the uncertainty of the macro situation, the irrational investors, the immature market, and the inadequate institutional mechanisms, it is common for stock prices to "pump". For example, in October 2019, Salubris' stock price fell sharply when the market trend was

stable, which caused the company to immediately launch a share repurchase plan (Li, 2019); and Ping An of China, which has a return on net assets of more than 15% for 7 consecutive years, has been falling since 2020, with an annual decline of 14.5%, the company's net profit in the first quarter fell by 42.7% year-on-year (Laoma, 2020); the overnight flash crash of Luckin Coffee in March 2020 has seriously endangered investor confidence in the capital market and the stable development of listed companies.

The phenomenon of stock price collapse has always attracted the attention of scholars, governments and the industry, and scholars have done extensive research on the causes and influencing factors of stock price collapse. Based on agency theory, Jin & Myers (2006) believe that the concentrated outbreak of bad news hidden by management for financial or non-financial motives directly caused the phenomenon of stock price collapse from the micro-level of the company; based on foreign research results, domestic scholars pointed out that institutional investors herding behavior, accounting conservatism, major shareholder selling, corporate tax avoidance, and excessive investment are all important reasons for the risk of stock price collapse (Xu et al., 2013; Wang & Xie, 2013; Wu & Li, 2015; Sun et al., 2013; Lin, 2016).

However, in view of the harmful and contagious characteristics of stock price crashes, it is necessary to pay more attention to the ways in which the practical field can control the occurrence of stock price crashes. For high-growth and highly innovative companies listed on the Growth Enterprise Market, their stock prices fluctuate more frequently and risks are more likely to be formed. For example, Chinasun Pharmaceutical once suffered a 90% drop in stock prices due to its deep debt vortex. In addition, under the trend of rapid development of industries with high technological content and R&D investment, in order to maintain the competitive advantage of talents, listed companies on GEM are increasingly keen on equity incentives. Statistics show that from 2010 to 2015, more and more listed companies have launched equity incentive plans on the Growth Enterprise Market, and their absolute numbers are increasing, with an average growth rate of 227%. Through the institutional arrangements that enable managers to obtain equity in the company and participate in the decision-making process of the company as shareholders, a long-term cooperation mechanism for profit sharing and risk sharing between company management and owners is formed, reducing agency costs and prompting management sincerely serve the company's medium and long-term development goals. Equity incentives play an important role in solving corporate governance issues, motivating corporate management and innovative talents (Wan, 2018).

However, with the deepening of research, some scholars have gradually pointed out that the equity incentive system has some drawbacks. When the company's internal governance mechanism weakens, equity incentives still cannot improve agency conflicts, and managers will use their power advantages to make excessive investments in order to maximize personal interests (Jian et al., 2011; Wang

& Xie, 2013), and there have also been cases in which the performance of executives has dropped sharply after exercising their rights, and moral hazard triggered the managers' earnings management and performance manipulation behavior (Quan et al., 2010; Su & Lin, 2010). Equity incentives will deviate from company performance and become an important manifestation of agency problems, rather than a governance mechanism to alleviate agency problems. The theory of management power shows that executives use management power to explicitly set their own salaries or use hidden opportunistic behavior (such as earnings management, dividend policy, mergers and acquisitions, etc.) capture excess compensation (Li et al., 2020). It can be seen that the academic research on equity incentives under different time periods and different backgrounds reach a consensus conclusion, there is still a lot of room for the exploration of equity incentives on the governance effects of listed companies. The study found that the main driving factor for GEM companies to adopt equity incentives is human resource demand, not management power (Wei, 2019), so whether the implementation of the equity incentive system for GEM listed companies can really reduce agency conflicts and reflect benign corporate governance effect? Furthermore, can the company's implementation of equity incentive plans become a powerful tool to control the stock price collapse to a certain extent? If so, what path was used to suppress the occurrence of the stock price crash? In order to answer the above thinking, this article selects the GEM listed companies that have successfully implemented the equity incentive plan as the research sample, trying to analyze the inherent logical relationship among equity incentives, inefficient investment and stock price collapse risk from both theoretical and empirical aspects. Taking the GEM as a typical example, this article develops a useful attempt to mitigate the risk of stock price collapse.

The research contributions of this article are mainly reflected as follows: First, from the perspective of corporate governance, the research focus on how to prevent the formation of the risk of stock price collapse, and it is pointed out that the implementation of equity incentives for senior management will inhibit their inefficient investment tendency, which indirectly inhibits the risk of the company's stock crash is controllable in a certain extent; Second, the current research on equity incentives is focused on the main board market, and the conclusions are different. This article takes small and medium-sized, innovative, and growth-oriented companies on the GEM as the research object, and analyzes the impact of the implementation of equity incentive programs on the majority of growth-oriented companies. The governance effect produced by the enterprise has certain practical significance and provides more empirical evidence for guiding the direction of enterprise reform; Third, this article examines executive equity incentives, inefficient investments, and stock price collapse risks as an organic whole for the first time, analyzes the internal logical connection between the three, it enriches the existing research on corporate governance, investment efficiency and the risk of stock price collapse in the capital market.

2. Theoretical Analysis and Hypothesis

2.1. Equity Incentives and Stock Price Collapse

The stock price is the main indicator that reflects the company's growth and operation. The false high of the stock price and the subsequent collapse will cause great harm to the company's development. The formation of the risk of stock price collapse lies in the "bubble" of the company's previous stock price, and the formation of the "bubble" lies in the misleading of the company's information to investors (Jin & Myers, 2006). Studies have found that charitable donations are a tool to conceal negative information, it is a potential way to exacerbate the risk of stock price collapse, the concealed negative information is eventually discovered by the capital market, which triggers the collapse (Cao & Meng, 2019). In addition, the agency conflict between the company's owner and management rather than the manager's overconfidence is an important reason for the risk of stock price collapse (Jiang & Xu, 2015). The principal-agent theory believes that there is an implicit conflict of interest between the company's principal and the agent, that the agent has the motivation and ability to infringe on the interests of the principal in the process of pursuing the maximization of its own interests because of the direct participation in the company's business decision-making. In order to avoid being punished when the management conducts private operations, it is easy to adopt corresponding "strategies" to hide unfavorable information that is about to be released in business decisions. The concealment of bad news and the centralized disclosure of good news are the main reasons that mislead investors to judge the company's value. Once the deposited negative news reaches the threshold and is released in a concentrated manner, it will cause huge fluctuations in investor sentiment, form market panic and cause stock price collapse.

And equity incentives can effectively reduce agency conflicts by changing the identity of the agent from a single identity as an operator to a dual identity as both a company manager and an owner. Fu et al. (2020) research shows that equity incentives can alleviate the agency problem of information disclosure between management and shareholders, and encourage management to disclose more high-quality company fundamental information to external investors. Starting from the optimal contract theory, Frydman & Saks (2010) also mentioned that if the design of the compensation contract is reasonable and effective, the convergence of the interests of executives and shareholders will make both parties show a more consistent compensation performance sensitivity. The realization of the incentive function of the compensation contract will help reduce the agency cost under the self-interested motivation of the managers. It can be seen that, as a long-term mechanism of corporate governance, equity incentives can effectively solve the agency problem within the company (Jensen & Murphy, 1990). Compared with shareholders, management has obvious advantages in obtaining information, the coordination of conflicts of interest makes the management's behavior in the company's daily operations more reasonable and com-

pliant, information disclosure becomes more standardized. And "cover the stock" by self-interested motives driven are better suppressed. As a result, the company's risk of stock price collapse is reduced.

Based on the above analysis, we propose hypotheses:

H1: The implementation of equity incentive plans for companies listed on the GEM can effectively reduce the risk of stock price collapse.

2.2. Equity Incentives and Inefficient Investment

According to the basic theory of company investment, in an idealized perfect frictionless market, the only driving factor for management to make investment decisions is the return on the value of speculative opportunities. Invest in accordance with the principle of maximizing shareholder value, and select the project's net present value positive investment plan to achieve the best investment efficiency (Modigliani & Miller, 1959). However, in practice, due to a series of problems such as information asymmetry and agency conflicts, it is difficult for the management's investment efficiency to achieve the optimal, and even to a large extent deviate from the principle of shareholder value maximization, resulting in inefficient investment. Inefficient investment refers to the irrational investment made by management in violation of the basic relationship between marginal revenue and marginal cost. It mainly manifests in two forms: overinvestment and underinvestment.

But a sound incentive system is the key to solving the principal-agent problem (Jensen & Meckling, 1976). It can weaken managers' self-interested motivation, reduce their opportunistic behavior and improve the investment efficiency of listed companies. The domestic scholar Luo et al. (2008) pointed out that the development of equity incentive plans can positively increase the investment volume of listed companies without distinguishing between overinvestment and underinvestment. When distinguishing overinvestment and underinvestment, in view of the complex market competition conditions, enterprise investment faces greater uncertainties, and because of the requirements of exercise conditions, equity incentives can only be realized the management has the possibility of obtaining equity compensation only when the stock price is higher than the exercise price, so it can improve the management's risk acceptance to some extent, thereby reducing its underinvestment (Xu, 2014). The implementation of equity incentives has indeed restrained the occurrence of inefficient investment (Zhang et al., 2018). In addition, from the perspective of agency theory, since equity incentives have formed a long-term cooperative mechanism of profit sharing and risk sharing between shareholders and management, managers' over-investment has caused damage to the company's value. Managers' excessive investment causes damage to the company's value, and makes company owners question the professional capabilities of managers. Eventually, it will also threaten the vital interests of the managers and even cause them to be fired. Therefore, rational senior managers will be more cautious when facing investment projects with negative

net present values, reduce excessive investment on the basis of a balance of interests.

Based on the above analysis, we put forward hypotheses:

H2: The equity incentive plan implemented by listed companies on the GEM can effectively curb the inefficient investment behavior of managers.

2.3. Inefficient Investment and Stock Price Collapse

Under the guidance of agency theory, scholars have found that because the management is rational, even when they know that investment projects will lose the overall interests of shareholders, they will also produce inefficient investment behavior out of consideration of their own interests. The manifestations are underinvestment and overinvestment. The large amount of free cash flow generated in the company's past investment projects, "ambitious" managers, out of the political ambition of building a business empire, are often not used for dividend distribution to shareholders, instead, invest in investment projects that are riskier and may have a negative net present value (Benmelech & Kanddel, 2010). To the management, excessive investment may seem unreasonable, but it can earn more non-monetary returns, establish higher business prestige, establish stronger relationship bonds, and enjoy more in their business circles. In-service consumption, etc., the temptation of benefits far exceeds the basic compensation generated by rational investment. Therefore, the management has a strong motivation to make inefficient investment behaviors that violate the interests of shareholders. However, once the management's dereliction of duty is exposed, shareholders will naturally punish the managers, and there may be incidents such as senior management being dismissed or required to voluntarily resign. To avoid such accidents, management often does not disclose in time, the real situation of the cash flow of the investment project is to prevent the failure of the investment project to proceed smoothly due to the boycott of the shareholder meeting and the board of directors, resulting in double loss of reputation and profit. At the same time, the bad news generated in the investment expansion is often deliberately hidden, wait for an opportunity to disclose after the investment project is completed. Another example, the holding of financial assets by listed companies in order to hide negative information will also increase the probability of a company's stock price collapse (Peng et al., 2018). However, the "bubble" is real, whether it is a self-interested investment or inefficient investment generated by blind self-confidence, once the negative information hidden by the management is disclosed and released to the capital market, investors will immediately appear the behavior of "foot voting" serves as a protection for one's own rights. The future stock price of a company is prone to collapse, and the future business prospects of the company are worrying.

Based on the above analysis, this article proposes the hypotheses:

H3: If a company listed on the Growth Enterprise Market makes inefficient investment, it will increase the risk of the company's future stock price collapse.

2.4. Mediating Role of Inefficient Investment

From the perspective of principal-agent theory, if a listed company's equity incentive plan is designed reasonably and implemented effectively, it will be able to give full play to its incentive role, unite the common interests of the management and shareholders, improve the management of the listed company, and promote the realization of the company maximization of overall value. Investment activities, as one of the most important parts of the company's daily business activities, have a vital impact on the survival and development of the company and the stability of stock prices. If the agency conflict is effectively resolved, business managers will be more sensible from the perspective of the company as a whole and its own long-term interests when facing the temptation of a large amount of free cash flow, and consciously control the excessive investment caused by its impulse to expand. Finally, make more prudent investment decisions. On the other hand, an effective incentive mechanism can increase the risk-taking willingness of more conservative management, because more incentive benefits must be accompanied by higher operating performance. According to the prospect theory, people's aversion to losses is significantly higher than keeping with the hypothesis of the happiness brought by the existing benefits. After the management weighs the pros and cons between a reasonable increase in investment and abandoning the opportunity cost of investment, they tend to "risk" and accept investment projects with a positive net present value. The insufficient situation will be improved. Good investment opportunities are seized, investment projects that are detrimental to the interests of shareholders are abandoned, and the overall investment efficiency of the management is improved. Therefore, when facing the company's information disclosure requirements, they will be able to behave more openly. The situation of "covering the disc" for hiding self-interested behavior motives will be alleviated. The content of information disclosure has become more transparent and comprehensive. For investors, it shows that the stock price as a reflection of the management and governance status of listed companies has more reference significance. With a sound and stable company internal governance mechanism is coupled with an efficient external supervision mechanism, the risk of stock price collapse of GEM companies will be reduced.

Therefore, we believe that if a well-designed and smoothly operating equity incentive mechanism can control management's inefficient investment behavior by reducing agency conflicts. Improving the investment efficiency of listed companies on the Growth Enterprise Market will strengthen the transparency and compliance of company operations, and promote the increase of market participants' investment rationality. Then the possibility of a large number of share price "bubbles" will be reduced, indicating that equity incentives can suppress the formation of stock price collapse risks through investment paths.

Through the analysis of the above content, the following hypotheses are proposed:

H4: Inefficient investment plays an intermediary role in the impact of equity

incentives on the risk of stock price collapse.

3. Research Design

3.1. Data Sources

This article selects 570 listed companies on the Growth Enterprise Market as the research objects. As the stock price collapse risk indicator involves the previous year's data, and the GEM was officially listed in 2009 to allow stock trading and trading, moreover the continued escalation of the Sino-US trade war in 2018, the stock market plummeted. To prevent external environmental shocks, the research results, therefore, the final sample year selected in this article is 2010-2017. The data mainly comes from CSMAR and Wind database. In the selection of data, this article follows the following principles: 1) Eliminate companies that have ST or ST during the selected sample period; 2) Eliminate abnormal financial data or missing data in the sample data; 3) Eliminate Data of sample companies that stopped implementing equity incentive plans during the sample period; 4) In order to avoid the possible influence of extreme outliers on the regression results, this paper has performed winsorize shrinking processing for the main continuous variables involved in the quantile of more than 1% and less than 99%. Finally, we obtained 2501 observations on the GEM, and used Stata 14.0 for data processing.

3.2. Variable Measure

3.2.1. Measuring Inefficient Investment

According to the research models and measurement methods of Richardson (2006) and Lin (2016), inefficient investment is estimated, and the residual of the actual new investment minus the fitted value of the new investment is used to represent the expected foreign investment level, namely inefficient investment (*ieffi*). When the residual item is greater than 0, the expected foreign investment is positive, indicating that there is over-investment (*over*); when the residual item is less than 0, the expected foreign investment is negative, indicating that there is under-investment (*under*).

3.2.2. Measuring Stock Price Crash Risk

Based on the research of Hutton et al. (2009) and Kim et al. (2011), this paper adopts two methods to measure the risk of stock price collapse using the degree of negative stock price return (*NCSKEW*) and the weekly return volatility ratio (*DUVOL*).

The larger the *NCSKEW*, the greater the degree of negative skewness coefficient, and the more serious the risk of stock price collapse the company faces. The larger the *DUVOL*, the greater the degree of left-bias of the return, and the higher the risk of the company's stocks from crashing.

3.2.3. Control Variable

In order to control the possible impact of the growth of the listed companies on the research conclusions, this paper uses the book-to-market value ratio (*Bm*)

and Tobin's Q value (*Tbq*) to measure; In view of the size of free cash flow will affect the management's private operation space, the more cash flow generated from operating activities, it will provide management with more opportunities to accomplish private goals, thus controlling free cash flow (*FCF*); Considering that the company's debt situation will affect the management's free cash flow, which in turn affects the management's investment decisions, this article selects the asset-liability ratio indicator (*Lev*) to control the impact of the capital structure of the GEM listed companies on investment; In addition, referring to previous studies, this article also selects executive shareholding ratio (*Mgr*), proportion of independent directors (*Ddr*), company size (*Size*), institutional shareholding ratio (*Insar*), return on assets (Roa), market conditions (*Ret*), stock return volatility (Sigma), turnover rate (*Hslb*), and company information transparency variable (*Zda*) as control variables. In order to alleviate the possible endogenous problems, this paper deals with the main variables in a lagging period in Table 1.

Table 1. Definition and explanation of main variables.

Variable Name	Definition
option	Dummy variable, set to 1 if the equity incentive plan was implemented in the current year, otherwise set to 0
ieffi	Residual error obtained after regression processing using Richardson (2006) model
over	The residual value is positive, over = |*ieffi*|; the residual value is negative, over = 0
under	The residual value is negative, under = |*ieffi*|; the residual value is positive, under = 0
NCSKEW	See the formula Hutton et al. (2009) for specific calculations
DUVOL	For specific calculation, see the formula Kim et al. (2011)
Mgr	Number of shares held by executives/total number of shares
Ddr	Number of independent directors/number of board of directors
Size	The natural logarithm of the company's total assets for the year
Bm	Number of outstanding shares of net assets per share/company market value
Tbq	(The value of tradable shares and non-tradable stocks at the end of the year + the value of long-term and short-term liabilities)/total assets at the end of the year
Insar	Institutional investment/registered capital
Roa	Net profit after tax/total assets
Ret	Shanghai and Shenzhen Composite Index returns over the same period
Zda	See the formula Dechow et al. (1995) for specific calculations
Sigma	The standard deviation of the weekly specific return of each equity year
Hslb	(Monthly trading volume/total circulating equity) × 100%
Dual	Dummy variable, set both chairman and CEO to 1, otherwise set to 0
FCF	(Net cash flow from operating activities-expected new investment)/Total assets at the end of the previous year

3.3. The Model

This paper constructs a multiple regression model and draws on the test method of Wen's (2004) intermediary effect to judge the role of inefficient investment in the relationship between equity incentives and the risk of stock price collapse. The test steps of the coefficient method of intermediary effect are as follows (**Figure 1**):

First verify the coefficient *c*, determine whether executive equity incentives will affect the risk of stock price collapse, and determine the direction of the impact based on the sign of the coefficient; If the coefficient *c* is significant, verify the coefficient *a* to determine whether the executive equity incentive will affect their investment efficiency, whether it will aggravate inefficient investment or inhibit inefficient investment; Judging whether *b* is significant on the basis of the significant coefficient *c*. Furthermore, according to the formula $Y = c'X + bM + \varepsilon 3$, the coefficient *c'* judges whether there is a complete mediation effect or an incomplete mediation effect. If *c'* is not significant, then a complete mediation effect exists; Finally, according to the coefficient symbols obtained from the above test, the logical relationship between the equity incentive system's influence on inefficient investment and the risk of stock price collapse is clarified. The specific empirical model of this paper is as follows:

In the first step, in order to study the impact of equity incentives implemented by GEM executives on the risk of stock price collapse of listed companies, this paper constructs model (a). Among them, $Crash_{i,t}$ is a stock price collapse risk indicator, which is replaced by $NCSKEW_{i,t}$ and $DUVOL_{i,t}$ in the empirical process.

$$\begin{aligned} Crash_{i,t} = {} & \alpha + \beta_1 option + \beta_2 Mgr_{i,t-1} + \beta_3 Ddr_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 Bm_{i,t-1} \\ & + \beta_6 Tbq_{i,t-1} + \beta_7 Insar_{i,t-1} + \beta_8 Roa_{i,t-1} + \beta_9 Ret_{i,t-1} + \beta_{10} Zda_{i,t-1} \\ & + \beta_{11} Sigma_{i,t-1} + \beta_{12} Hslb_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (a)$$

The second step is to test whether the implementation of equity incentives on the GEM can effectively alleviate the agency conflicts between corporate shareholders and managers can reduce management's inefficient investment behavior. This article designs a model (b) to judge the relationship between investment efficiency and equity incentives.

$$\begin{aligned} ieffi_{i,t} = {} & \alpha + \beta_1 option + \beta_2 Mgr_{i,t-1} + \beta_3 Ddr_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 Bm_{i,t-1} \\ & + \beta_6 Tbq_{i,t-1} + \beta_7 Insar_{i,t-1} + \beta_8 Roa_{i,t-1} + \beta_9 FCF_{i,t-1} + \beta_{10} dual_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (b)$$

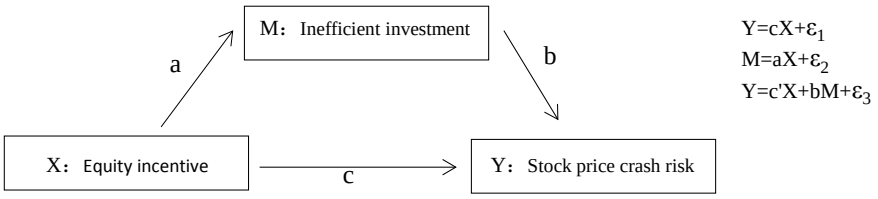

Figure 1. Logical diagram of the intermediary effect test.

The third step is using model (c) to examine the possible impact of the investment efficiency of listed companies on the Growth Enterprise Market on the risk of stock price crashes, and to verify whether the occurrence of stock price crashes can be suppressed through investment channels.

$$\begin{aligned} Crash_{i,t} = {} & \alpha + \beta_1 ieffi_{i,t-1} + \beta_2 Mgr_{i,t-1} + \beta_3 Ddr_{i,t-1} + \beta_4 Size_{i,t-1} + \beta_5 Bm_{i,t-1} \\ & + \beta_6 Tbq_{i,t-1} + \beta_7 Insar_{i,t-1} + \beta_8 Roa_{i,t-1} + \beta_9 Ret_{i,t-1} + \beta_{10} Zda_{i,t-1} \\ & + \beta_{11} Sigma_{i,t-1} + \beta_{12} Hslb_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (c)$$

In the fourth step, based on the tests of model (a) and model (b), if the hypothesis H2 is verified, it can be further judged a mediation effect test, that the implementation of equity incentives for listed companies on the GEM will reduce the risk of stock price collapse by restraining inefficient investment paths. Therefore, drawing on the test method of Wen (2004), a test on model (d) is needed to determine in order to judge whether there is a complete mediation effect or an incomplete mediation effect.

$$\begin{aligned} Crash_{i,t} = {} & \alpha + \beta_1 option + \beta_2 ieffi_{i,t-1} + \beta_3 Mgr_{i,t-1} + \beta_4 Ddr_{i,t-1} + \beta_5 Size_{i,t-1} \\ & + \beta_6 Bm_{i,t-1} + \beta_7 Tbq_{i,t-1} + \beta_8 Insar_{i,t-1} + \beta_9 Roa_{i,t-1} + \beta_{10} Ret_{i,t-1} \\ & + \beta_{11} Zda_{i,t-1} + \beta_{12} Sigma_{i,t-1} + \beta_{13} Hslb_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (d)$$

4. Empirical Results

4.1. Descriptive Statistics

Table 2 shows the descriptive statistical results of the main variables in this paper. Among them, the average value of the dummy variable *Option* for equity incentives is 0.344, indicating that the number of companies implementing equity incentives during the sample period accounts for approximately 34.4% of the total number of companies listed on the GEM. The minimum value of the stock price collapse risk variable *NCSKEW* is −1.962, the maximum value is 2.476, and the standard deviation is 0.948. The minimum value of *DUVOL* is −2.295, the maximum value is 2.243, and the standard deviation is 0.931. It shows that there are big differences in the risk of stock price collapse between companies on the GEM. The mean value of inefficient investment *ieffi* is 0.001, and the standard deviation is 0.047. It can be seen that inefficient investment in my country's GEM listed companies tends to be over-investment.

4.2. The Impact of Equity Incentives on the Risk of Stock Price Collapse

Table 3 reports the empirical test results on the impact of equity incentives on the stock price collapse risk of listed companies. It can be seen from the regression results of model (1) and model (2) in Table 3, the equity incentive *Option* has a significant negative correlation with the stock price collapse risk indicators *NCSKEW* and *DUNVOL*, with a significance level of 1%, indicating that the equity incentive plan successfully implemented by a company listed on the GEM

can effectively suppress the possibility of stock price collapse. Equity incentives can drive management's interests to shareholders, thereby alleviating the company's internal entrusted agency problems, reducing self-interested behavior, and ultimately reducing the company's stock price collapse risk. Incentives have good corporate governance effectiveness. In addition, the correlation coefficients between book-to-market value ratio *Bm* and stock price collapse risk *NCSKEW* and *DUNVOL* are −0.169 and −0.246 respectively, and both are significant at the 1% level. This means that a listed company with a high book-to-market value ratio has a lower share price collapse possibility than a listed company with a low book-to-market value ratio. This may be because the stocks of companies with low book-to-market value ratios are mostly growth stocks, and the stocks of companies with high book-to-market value ratios are mostly value stocks. Value stocks have good profitability and low price-earnings ratios. The possibility of a "bubble" due to an overvalued stock is low, so the risk of stock price collapse is low. The risk of stock price collapse is significantly positively correlated with the return on assets *Roa*. *Roa*, a measure of company profitability, cannot conceal the risk when listed companies are chasing high profits. It means that if you blindly earn investment income through debt leverage but ignore the rationality of the capital structure, it will increase the risk of future stock price fluctuations. The hypothesis H1 of this paper has been verified.

Table 2. Descriptive statistics of variables.

Variable	Mean	Std. Dev	Min	Median	Max
Option	0.344	0.475	0	0	1
NCSKEW	0.148	0.948	−1.962	0.163	2.476
DUNVOL	0.096	0.931	−2.295	0.131	2.243
Over	0.018	0.035	0	0	0.164
Under	0.016	0.020	0	0.009	0.093
ieffi	0.001	0.047	−0.093	−0.009	0.163
Mgr	0.172	0.181	0	0.103	0.648
Ddr	0.381	0.054	0.333	0.375	0.571
Size	0.023	0.024	0.004	0.015	0.152
Lev	0.280	0.164	0.035	0.252	0.707
Bm	0.414	0.241	0.080	0.354	1.254
Tbq	3.404	2.211	0.797	2.829	12.570
Insar	0.222	0.196	0	0.158	0.756
Roa	0.050	0.043	−0.107	0.048	0.170
Ret	0.005	0.009	−0.007	0.001	0.0350
Zda	0.068	0.076	0.007	0.049	0.566
Sigma	0.041	0.018	0.025	0.035	0.091
Hslb	−0.024	0.076	−0.328	−0.011	0.193
FCF	0.001	0.004	−0.062	0	0.147
Dual	0.421	0.494	0	0	1

Table 3. The impact of equity incentives on the risk of stock price collapse and inefficient investment.

	(1)	(2)	(3)	(4)	(5)
	NCSKEW	*DUNVOL*	*ieffi*	*Over*	*Under*
Option	−0.192***	−0.178***	−0.005*	−0.005**	0.001
	(0.061)	(0.056)	(0.003)	(0.002)	(0.001)
Mgr	0.125	0.296	0.022**	0.0140	−0.00800
	(0.312)	(0.304)	(0.011)	(0.009)	(0.006)
Ddr	−0.211	−0.149	−0.0150	−0.00800	0.00600
	(0.857)	(0.815)	(0.034)	(0.024)	(0.015)
Size	1.357	1.013	0.137	0.066	−0.072*
	(1.633)	(1.503)	(0.097)	(0.075)	(0.038)
Bm	−1.096***	−1.246***	0.018**	0.013**	−0.005
	(0.177)	(0.178)	(0.007)	(0.005)	(0.004)
Lev	−0.409	−0.329	−0.012	−0.006	0.006
	(0.275)	(0.269)	(0.012)	(0.010)	(0.005)
Tbq	0.027	0.042**	0.001*	0.001	−0.001
	(0.019)	(0.019)	(0.001)	(0.001)	(0.000)
Insar	−0.367*	−0.344*	−0.005	−0.005	0.001
	(0.204)	(0.202)	(0.008)	(0.006)	(0.004)
Roa	2.330***	2.778***	0.105***	0.083***	−0.022
	(0.778)	(0.735)	(0.033)	(0.023)	(0.017)
Ret	−0.669	−1.419			
	(3.457)	(3.586)			
Zda	−0.291	−0.252			
	(0.498)	(0.451)			
Sigma	−0.700	−0.023			
	(1.586)	(1.630)			
Hslb	2.055***	1.950***			
	(0.270)	(0.276)			
Dual			0.008**	0.005*	−0.003
			(0.004)	(0.003)	(0.002)
FCF			0.381	0.426	0.045
			(0.457)	(0.344)	(0.149)
Cons	0.783**	0.615*	−0.018	0.004	0.022***
	(0.370)	(0.350)	(0.016)	(0.011)	(0.007)
N	2501	2501	2501	2501	2501
R^2	0.0951	0.1280	0.0170	0.0190	0.0070
Adj.R-Sq	0.0950	0.1280	0.0170	0.0190	0.0070

Note: *, ** and *** are significant at 10% 5% and 1% levels respectively, the same below.

4.3. The Impact of Equity Incentives on Inefficient Investment

Model (3) to (5) in Table 3 reports the regression results of the relationship between equity incentive plans and their management's inefficient investment. From the table, it can be seen that equity incentives and inefficient investment have a significant negative correlation. It shows that the implementation of equity incentive plans for companies listed on the GEM can improve the investment status of their plans, reduce inefficient investment and ease agency conflicts; Secondly, after dividing inefficient investment into two indicators of overinvestment and underinvestment, the regression found that equity incentives have a significant inhibitory effect on overinvestment, and its correlation coefficient is exactly the same as inefficient investment, the standard deviation is very close and the level of significance has increased. But the effect on underinvestment is not obvious. There is an obvious positive correlation between the control variable Dual and the overall inefficient investment *ieffi* and overinvestment *Over*. It shows that if the company's chairman and CEO have two concurrent positions, it will have a negative impact on the governance effect of equity incentives. Equity incentives may even become a channel for executives to convey self-interest in disguise, and their role in incentives to improve investment efficiency will be weakened. In this way, the hypothesis H2 of this article has been verified.

This shows that for companies listed on GEM, equity incentives mainly improve the inefficient investment of executives from the channels of restraining excessive investment. It means that equity incentives have achieved a certain degree of governance effectiveness in coordinating the agency conflict between management and shareholders. In order to obtain the incentive benefits specified in the contract, the management is less likely to seek personal gain through inefficient investment, and its investment decision-making process is more reasonable and standardized. Therefore, we believe that in the case of a good internal governance mechanism of the company, a reasonable design and implementation of an effective equity incentive plan will improve the investment efficiency of managers, and in particular, have a better inhibitory effect on their excessive investment behavior.

4.4. The Impact of Inefficient Investment on the Risk of Stock Price Crash

Models (1) to (4) in Table 4 report the relationship between inefficient investment (*ieffi* and *Over*) and stock price collapse risk (*NCSKEW* and *DUNVOL*). It can be seen that there is an obvious positive correlation between the inefficient investment and the risk of stock price collapse. It means that the more inefficient investment of listed companies on the GEM, the greater the possibility of a stock price collapse in the future. Therefore, the hypothesis H3 of this article has been verified. Following the logic above, the restraining effect of equity incentives on inefficient investment is mainly reflected in restraining excessive investment.

Table 4. The impact of inefficient investment on the risk of stock price crash and its intermediary effect.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	NCSKEW	*DUNVOL*	*NCSKEW*	*DUNVOL*	*NCSKEW*	*DUNVOL*	*NCSKEW*	*DUNVOL*
ieffi	0.809*	0.875*					0.762*	0.830*
	(0.459)	(0.469)					(0.456)	(0.467)
Over			1.098*	1.064*				
			(0.610)	(0.626)				
Option					−0.192***	−0.178***	−0.188***	−0.176***
					(0.061)	(0.056)	(0.061)	(0.058)
Mgr	0.184	0.348	0.189	0.355	−0.211	−0.149	−0.201	−0.138
	(0.312)	(0.304)	(0.311)	(0.304)	(0.857)	(0.815)	(0.856)	(0.815)
Ddr	−0.190	−0.128	−0.193	−0.132	1.357	1.013	1.260	0.908
	(0.859)	(0.818)	(0.860)	(0.820)	(1.633)	(1.503)	(1.626)	(1.501)
Size	0.753	0.433	0.789	0.478	−1.096***	−1.246***	−0.401	−0.319
	(1.621)	(1.498)	(1.622)	(1.498)	(0.177)	(0.178)	(0.274)	(0.268)
Lev	−0.471*	−0.385	−0.473*	−0.389	−0.409	−0.329	−1.108***	−1.260***
	(0.273)	(0.267)	(0.273)	(0.267)	(0.275)	(0.269)	(0.176)	(0.177)
Bm	−1.092***	−1.245***	−1.093***	−1.244***	0.027	0.042**	0.026	0.041**
	(0.176)	(0.177)	(0.176)	(0.177)	(0.019)	(0.019)	(0.018)	(0.019)
Tbq	0.026	0.041**	0.0270	0.041**	−0.367*	−0.344*	−0.359*	−0.336*
	(0.019)	(0.019)	(0.019)	(0.019)	(0.204)	(0.202)	(0.203)	(0.201)
Insar	−0.395**	−0.369*	−0.394**	−0.370*	2.330***	2.778***	2.253***	2.694***
	(0.200)	(0.197)	(0.200)	(0.197)	(0.778)	(0.735)	(0.782)	(0.738)
Roa	2.013***	2.469***	2.006***	2.471***	−0.669	−1.419	−0.550	−1.289
	(0.773)	(0.726)	(0.774)	(0.728)	(3.457)	(3.586)	(3.458)	(3.596)
Ret	−1.075	−1.781	−1.149	−1.867	−0.291	−0.252	−0.281	−0.242
	(3.454)	(3.589)	(3.451)	(3.583)	(0.498)	(0.451)	(0.496)	(0.449)
Zda	−0.320	−0.278	−0.315	−0.275	−0.700	−0.023	−0.729	−0.055
	(0.503)	(0.453)	(0.502)	(0.452)	(1.586)	(1.630)	(1.588)	(1.633)
Sigma	−0.663	0.007	−0.627	0.0460	2.055***	1.950***	2.065***	1.960***
	(1.586)	(1.630)	(1.587)	(1.631)	(0.270)	(0.276)	(0.270)	(0.275)
Hslb	2.047***	1.943***	2.053***	1.948***	0.783**	0.615*	0.793**	0.626*
	(0.272)	(0.277)	(0.272)	(0.277)	(0.370)	(0.350)	(0.370)	(0.351)
Cons	0.755**	0.590*	0.735**	0.570	2501	2501	2501	2501
	(0.369)	(0.350)	(0.370)	(0.351)	0.0951	0.1280	0.0960	0.129
N	2501	2501	2501	2501	0.0950	0.1280	0.0960	0.129
R^2	0.0920	0.125	0.0920	0.125				
Adj.R-Sq	0.0920	0.125	0.0920	0.125				

The regression results here show that there is also a significant positive correlation between overinvestment and the risk of stock price collapse, and the correlation coefficient is greater than that of inefficient investment. It will speculate that the reason why the equity incentive system implemented on the GEM can reduce the risk of stock price collapse. It is achieved through channels that suppress the inefficient investment behavior of executives' overinvestment. In model (1)-model (4), it can be seen that the control variable stock turnover rate (Hslb) and the risk of stock price collapse (NCSKEW and DUNVOL) both show a clear positive correlation.

It indicates that the greater the monthly trading volume of individual stocks, the more popular and highly speculated stocks in the capital market, the more likely it is that stock prices will plummet in the future. Stock prices need to correctly reflect their intrinsic value, and high stock prices should be supported by good company fundamentals, otherwise it will be difficult to maintain them in the long term.

4.5. The Mediation Effect

In order to verify whether the stock price incentive plan reduces the risk of stock price collapse by suppressing the inefficient investment behavior of executives, that is, whether inefficient investment has an intermediary transmission effect. This article attempts to test the mediation effect model of "implementing equity incentives-restraining inefficient investment-reducing the risk of stock price collapse". The mediation effect test procedure is divided into three steps. The first is about the test of the correlation between equity incentives and the risk of stock price collapse. From the above hypothesis H1, it can be seen that companies which successfully implement equity incentive plans on the GEM will have a significant decline in the possibility of future stock price crashes, and there is a significant negative correlation between equity incentives and stock price crash risks; Secondly, it is to regress the intermediary variable inefficiency investment to equity incentives to determine whether its coefficient is significant. As the hypothesis H2 has been verified, it shows that designing a reasonable and effective equity incentive plan in GEM listed companies can effectively improve the investment efficiency of management, and inefficient investment (especially excessive investment) has been well restrained. There is a significant negative correlation between inefficient investment and equity incentives; Finally, inefficient investment is added to the first step of the test procedure for regression to determine whether there is a complete mediation effect or an incomplete mediation effect.

Models (5) to (8) in Table 4 report their results. It can be seen from model (7) and model (8) that after adding inefficient investment on the basis of model (5) and model (6), equity incentives and inefficient investment are respectively significantly affect the risk of stock price collapse at the levels of 1% and 10%. Compared model (5) with model (6), it is found that *Option* regression coeffi-

cients have changed from −0.192 and −0.178 to −0.188 and −0.176. The absolute values have all decreased, indicating that the intermediary effect of inefficient investment is established and there is an incomplete intermediary mechanism. The successful implementation of equity incentive plans for companies listed on the Growth Enterprise Market can reduce the risk of future stock price collapse by restraining the inefficient investment behavior of executives. Based on the above analysis, the hypothesis H4 of this article has been verified.

4.6. Robustness Test

In order to enhance the reliability of the research results, we made the following robustness test design. In view of the fact that the main object of this paper is the implementation effect of the equity incentive plan on the GEM, the measurement indicators of equity incentives are changed, and dummy variables are no longer used for regression. Using Bergstresser and Philippon (2006) to measure the salary structure, select the equity incentive intensity index *Incentive*, that is, the ratio of the number of equity incentives granted to executives in the form of stock options, restricted stocks, and stock appreciation rights to the total number of incentives is used as a substitute variable. Repeat the above steps. The regression coefficients of equity incentive intensity Incentive and stock price collapse risk are −0.480 and −0.493 respectively, both of which are significantly negative at the 5% level. It shows that the equity incentive plan implemented on the GEM can effectively reduce the possibility of its future stock price collapse, consistent with the previous research conclusions. Judging from the regression results of model (3) and model (4) in **Table 5**, the equity incentive intensity (*Incentive*) has a negative correlation with inefficient investment (*ieffi*) and over-investment (*Over*), and the impact on over-investment is more significant. It shows that the equity incentive plan successfully implemented on the GEM can effectively reduce agency conflicts and weaken the inefficient investment motivation of senior managers. Among them, the inhibitory effect on excessive investment is stronger, with a coefficient of −0.014, significantly negative at the 10% level; The regression coefficient of *Incentive* and *Under* is 0.002, which is not significant, indicating that equity incentives have limited ability to improve underinvestment, and even slightly aggravate underinvestment to some extent. This may be due to the formation of a consistent risk-taking mechanism between management and shareholders, and their actual investment operations will be more cautious, which is basically consistent with the above empirical results. Therefore, it is assumed that the empirical conclusion of H2 is robust and reliable, and has certain reference value.

Regarding the research conclusion of hypothesis H4, the model (1) and model (2) in **Table 6** show that the coefficients between the equity incentive intensity (*Incentive*) and the stock price collapse risk (*NCSKEW and DUNVOL*) are −0.480 and −0.493, respectively. And they all have a significant negative correlation at the 5% level; In addition, after adding inefficient investment (*ieffi*) on the

Table 5. Robustness test of equity incentives on stock price collapse risk and inefficient investment.

	(1)	(2)	(3)	(4)	(5)
	NCSKEW	*DUNVOL*	*ieffi*	*Over*	*Under*
Incentive	−0.480**	−0.493**	−0.016	−0.014*	0.002
	(0.226)	(0.213)	(0.011)	(0.008)	(0.005)
N	2501	2501	2501	2501	2501
R^2	0.0930	0.126	0.0180	0.0190	0.0100
Adj.R-Sq	0.0930	0.126	0.0180	0.0190	0.0100

Table 6. Robustness test of inefficient investment mediation.

	(1)	(2)	(3)	(4)
	NCSKEW	*DUNVOL*	*NCSKEW*	*DUNVOL*
ieffi			0.777*	0.841*
			(0.455)	(0.466)
Incentive	−0.480**	−0.493**	−0.468**	−0.479**
	(0.226)	(0.213)	(0.225)	(0.212)
N	2501	2501	2501	2501
R^2	0.0930	0.126	0.0940	0.128
Adj.R-Sq	0.0930	0.126	0.0940	0.128

basis of model (1) and model (2), the coefficients between inefficient investment (*ieffi*) and stock price collapse risk (*NCSKEW* and *DUNVOL*) in model (3) and model (4) are 0.777 and 0.841, respectively, which is significantly positive at the 10% level, while the significance level of the *Incentive* coefficient remains unchanged, with the coefficient values being −0.468 and −0.479, respectively. Compared with model (1) and model (2), the absolute value of the coefficient drops slightly, which is basically consistent with the previous test results. The difference after using the equity incentive intensity *Incentive* instead of the equity incentive dummy variable *Option* is that the absolute value of *Incentive*'s coefficient is significantly greater than the absolute value of *Option*, which means that the intensity of equity incentive will have a greater impact on the possibility of stock price collapse.

If the equity incentive plan implements more incentives, it can better reduce the possibility of its future stock price collapse. The test results of the remaining control variables are basically the same. Therefore, combined with the results of the robustness test in the previous article, the hypothesis of the mediation effect in H4 of this article is reasonable and reliable.

5. Conclusion

This article discusses the effectiveness of the implementation of the equity in-

centive system on the Growth Enterprise Market. It also analyzes the possible impact of the equity incentive plan on the company's senior management's inefficient investment and the risk of future stock price collapse, and opens up the internal logical connection channels among the three. First, well-designed and successful equity incentive plans for companies listed on the Growth Enterprise Market can effectively reduce the risk of stock price collapse in the future. Second, there is a significant negative correlation between equity incentives and inefficient investment by executives of listed companies on the GEM. It means that the development of equity incentive plans can coordinate the conflict of interests between management and shareholders. After forming a consistent utility function, the investment behavior of management has been improved, and its inefficient investment behavior has been significantly reduced. In addition, after distinguishing inefficient investment into two forms of overinvestment and underinvestment, it is found that the effect of equity incentives on investment efficiency is mainly reflected in the suppression of excessive investment. Third, the more inefficient investment, the greater the possibility that listed companies will face a plunge in stock prices. Further study of the relationship between equity incentives, inefficient investment and stock price collapse risk found that the implementation of equity incentive plans for executives effectively reduced their inefficient investment behavior, thereby reducing the risk of future stock price collapses. That is, inefficient investment plays an intermediary mechanism in the process of equity incentives restraining the risk of stock price collapse.

Research shows that the implementation of equity incentive plans can reduce agency problems and play a positive role in corporate governance; In the process of corporate governance, the relationship between the senior management and the board of directors should be strengthened to form an internal company operating mechanism with clear division of labor, clear powers and responsibilities, and efficient operation; Preventing and resolving the risk of stock price collapse in the form of equity incentives requires attention to the effectiveness of the company's internal control. A high-quality internal control system can increase the transparency of financial information disclosure and reduce the possibility of management's "covering". Finally, the small sample size of GEM listed companies and the short observation period for some companies to implement equity incentive plan, and the research results may lack universality. It is expected to expand the scope of research samples in the future. In addition, considering that the existing research conclusions on the implementation effects of equity incentives are not consistent, subsequent research can further consider the motives of distinguishing equity incentives based on a large sample. Judge its impact on investment efficiency and stock price collapse risk separately, and open up more in-depth research ideas.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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