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Course of Corporate Governance

Innovation, enterprise internal compensation gap and firm's financial performance -
Based on the Analysis of Listed

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摘要

基于创新理论，技术创新对企业乃至国家都有重要意义。由于全球科技竞争越来越激烈，中国提出了创新战略并创立了科创板推动企业的创新活动。企业创新的核心问题在于如何将人力资源和企业资源相融合。基于委托代理理论，企业创新活动不能只依赖于监督机制，适当的薪酬激励能够让企业以比较小的代价激励企业成员提升绩效。本文研究企业创新投入对科创板企业内部薪酬差距的影响，以及创新投入、企业内部薪酬差距是否能够给企业带来好的绩效。本文进一步研究了创新投入对企业内部薪酬差距与企业绩效之间关系的调节作用。

以往研究中大多围绕高管-员工薪酬差距展开，本文主要研究高管-员工薪酬差距，研究员工-普通员工薪酬差距。在企业绩效衡量上，除了 ROE、ROA 这类传统指标，本文基于科创板企业人才密集的特征，增加了人力资本投资回报率。本文选取了 2018-2020 年科创板上市企业的数据进行分析，构建模型中采用了滞后一期的解释变量。实证结果表明：第一，科创板企业的创新投入强度与内部薪酬差距之间不存在显著相关性。第二，高管-员工薪酬差距对企业 ROE 和 ROA 存在显著的正影响，研发员工-普通员工薪酬差距对企业的人力资本回报率存在显著的正影响。第三，研发强度对企业绩效存在显著负影响。第四，研发强度对高管-员工薪酬差距与企业绩效之间的正相关性具有显著的负面调节作用。虽然研发强度对研发员工-普通员工薪酬差距与企业绩效之间的正相关性具有负面的调节作用，但是这个影响并不显著。结论说明在企业创新投入强度较高的情况下，企业不适合继续用扩大薪酬差距的方式去激励员工提升业绩。

基于实证结果，本文建议：第一，投资者选择研发强度高的公司，在短期内是无法获得较高的投资回报的。因为企业研发强度高会在短时间内增加企业的经营风险。投资者可以通过薪酬差距了解目标公司的治理水平。投资者应该关注高管是否存在过度投资行为或者利用分配资源的权力进行利益输送。其次，对于管理者，企业管理者可以通过设置合理的监督机制和薪酬机制来激励企业成员参与创新活动。企业适当拉大薪酬差距有利于企业业绩提高。最后，政府相关机构应该对企业的创新活动提供支持和持续监督，完善保护知识产权的法律。政府应对企业情况进行调查，保证补贴和税收优惠能够精准地帮助到真正有需求的企业，

发挥市场作用，缓解企业研发项目的融资困难。

关键词：创新;薪酬差距;企业绩效;科创板

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Abstract

Based on Innovation Theory, technology innovation is of great significance to enterprises and even countries. Due to the increasingly fierce global scientific and technological competition, China proposed Innovation Strategy and established Science and Technology Innovation Board to promote the innovation activities of enterprises. The core issue of enterprise innovation is how to integrate human capital and enterprise resources. According to the Principal-agent theory, supervision mechanisms are not adequate to engage the enterprise members in innovation activities. However, the appropriate compensation incentive can encourage enterprise members to improve performance at a relatively small cost. This paper studies the impact of Sci-tech innovation enterprises' innovation investment on the internal compensation gap and the interactive effect of the innovation investment and inner compensation gap on the financial performance. This paper further studies the moderating impact of innovation investment on the relationship between the internal compensation gap and firm performance.

Previous studies have explored factors influencing the compensation gap between the management or between executives and staff. This paper divides the internal compensation gap into four indicators: the compensation gap between the CEO and other executives, the gap between key executives and other executives, the gap between executives and staff, gap between R&D staff and other staff. In the measurement of firm performance, in addition to the traditional indicators such as ROE and ROA, this paper increases the return on human capital investment based on the talent-intensive characteristics of Sci-tech innovation enterprises. This paper selects the data of listed companies of the science and technology innovation board from 2018 to 2020 to analyze and constructs the model with a lag of explanatory variables. The empirical results show that: ①There is no significant correlation between the innovation investment intensity of science and technology innovation board enterprises and the internal pay gap. ② The executive-staff compensation gap has a significant positive impact on ROE and ROA. The compensation gap between the R&D staff and

other staff has a significant positive effect on the return on human capital (ROP). ③Significant negative correlation was found between the R&D intensity and the performance. ④The R&D intensity has a negative moderating effect on the correlation between the firm performance and the compensation gap between executive and staff. Though the negative moderating effect of R&D intensity has been found on the relationship between the compensation gap between R&D staff and other staff and the firm performance, the effect is not that significant. The findings suggest that under high R&D intensity, the Sci-tech companies are not suitable to continue encouraging employees to improve performance by expanding the compensation gap.

Based on the experimental results, this paper recommends that: First, investors cannot obtain a positive return on the investment in the companies with high R&D intensity in the short term. High R&D intensity might increase the operational risks of enterprises in a short time. Investors had better understand the governance level of the target company through the compensation gap and pay attention to whether executives have excessive investment behavior or use the power to distribute resources for interest transmission. Secondly, the managers can encourage enterprise members to participate in innovation activities by setting reasonable supervision mechanisms and compensation mechanisms. Appropriately widening the pay gap is conducive to improving corporate performance. Finally, the relevant government institutes should provide support and continuous supervision of enterprise innovation activities and improve intellectual property law protection. The government should investigate the situation of enterprises to ensure that subsidies and tax incentives can accurately help enterprises with real needs. The role of market mechanisms should be exercised to ease the financing difficulties of enterprise R&D projects.

Key words：Innovation; Compensation Gap; Firm Performance; Science And Technology Innovation Board;

CLC Number: F275

1.Introduction

1.1 Background and Significance

1.1.1 Research Background

General Secretary Xi Jinping once proposed that *innovation is the first driving force for development. To grasp innovation is to grasp development, and to seek innovation is to seek the future.*"[1]。The country attaches great importance to science and technology innovation to an unprecedented height. Rich technical reserves and a high-level research workforce enable China to give full play to its unique advantages in certain areas and build an innovative highland with global influence. However, there is still much room for development in Innovation and R&D compared with high-income countries. At present, the autonomous innovation pattern of many Chinese enterprises is still primarily on passive technology imitation and business model innovation. The support of applied fundamental research is not strong enough, and some strategic emerging areas are under-invested, which restricts the development of innovation-driven strategy. In July 2019, Science and Technology Innovation Board will be officially launched at the National Innovation Development Strategy request. The Sci-tech innovation board is positioned as a specialized capital market segment serving high-market-recognized technology companies that align with national strategies and breakthrough key core technologies, promoting economic transformation and high-quality development by integrating service technology and capital2. The establishment of the Sci-tech innovation board is conducive to cultivating leading technology innovation companies with global influence, promoting the national innovation-driven strategy to take root, and promoting the improvement of my country's comprehensive national strength.

The report of the Nineteenth National Congress of the Communist Party of China emphasized the necessity to accelerate the construction of an innovation-oriented

[1] Citation from "*Excerpts from Xi Jinping's exposition on innovation in science and technology*" (《习近平关于科技创新论述摘编》)

[2] In January 2019, China Securities Regulatory Commission (CSRC) issued *the implementation opinions on the establishment of the science and technology innovation board and the pilot registration system in Shanghai Stock Exchange.*

country with the establishment of a market-oriented technology innovation system with enterprises as the main body, explore a combination of production, learning, and research, promote the transformation of scientific and technological achievements. As we can see, innovation has become the key to enterprise development. However, in the short term, enterprises can not obtain the return on R&D investment in the current period. Innovation R&D activities are an enormous economic burden for enterprises, resulting in the rise of business risk. If the R&D project fails, the company will consume many R&D expenses in vain. From a long-term perspective, creative R&D activities can help companies gain core competitiveness and are also the key to their long-term development.

Many factors affect enterprise technology innovation. From the outside of the enterprise, the influencing factors include the capital market, industrial policy, and the protection of intellectual property rights by law. From the inside of the enterprise, the influencing factors include profitability, management's attitudes, the R&D investment intensity, particularly stress on brainpower, internal control, effective governance, etc. The above factors will have a meaningful impact on technological innovation.

In the Sci-tech innovation board market, eligible Sci-tech innovation enterprises expand their business scale by equity financing, continuously increase R&D investment, attract scientific research and innovation talents, and enhance their innovation ability. The government utilizes tax convenience and considerable government subsidies to support the enterprises' R&D activities. The approach is to encourage enterprises to attach importance to innovation. Enterprises pay more attention to R&D and the protection of intellectual property rights. Therefore, no matter the state, capital market, or the enterprises are increasing their investment in R&D, attaching importance to Innovation and R&D is the general trend of society.

Inside the enterprise, the enterprise's continuous innovation R&D activities depend on excellent managers and top researchers. To ensure the sustainability of innovation activities, the company protects R&D innovation results and encourages enterprise members to participate in innovation activities. Enterprises tend to give

promotion incentives and higher pay to employees who have made outstanding contributions to the business. As a result, senior administrators and core technicians are entitled to several times higher compensation than the average employee in the corporate compensation distribution process (see Figure 1.1).

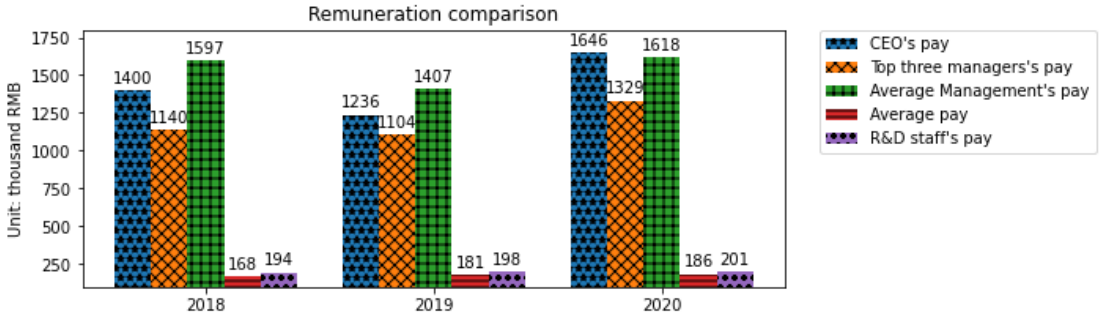

Figure 1.1 Comparison of the Remuneration among Sci-tech Enterprise Members

At the same time, corporate Internal compensation gaps have brought a lot of controversy about fairness and efficiency. According to Principal-agent theory, companies utilize high salaries to motivate executives to make management decisions conducive to business development and encourage core technology developers to increase research and development output, thereby increasing their market competitiveness and enabling them to earn excess returns. But in enterprises, officials' exceptional compensation is in sharp contrast to the low salary of ordinary employees at the bottom. Indeed, the income imbalance harms enterprise development. The Chinese government has introduced policies to limit excessive executive pay and has imposed a cap on executive pay at central companies not exceeding 20 times the average employee's salary3. In 2015, the Chinese government unveiled a reform plan on the compensation of heads of enterprises subject to the central authority. The regulation adjusted the upper limit of the remuneration gap between executives and employees of state-owned enterprises to 8 times. Suppose regulators allow companies the freedom to expand the Internal compensation gap. In that case, it will discourage the bottom staff from working and producing, undermine internal cohesion and collaboration, and reduce financial performance, which is not conducive to the firm's

[3] In 2009, the six central ministries jointly issued "Guiding Opinions on Further Standardizing the Salary Management of central enterprises", which stipulates that the maximum remuneration of executives in central enterprises shall not exceed 20 times the average wage of ordinary employees.

long-term development.

Based on the above, this paper studies the impact of R&D intensity on Sci-tech innovation board listed companies' internal compensation gap and discusses the relationship among the R&D intensity, the inner compensation gap of executives, and financial performance. Under the background of increasing R&D investment in society, will enterprises widen the pay gap and attract or retain core technicians and excellent managers with several times higher salaries than ordinary employees? What is the impact of salary arrangement on production efficiency and performance of enterprises? This study provides practical experience for internal compensation gap research of Sci-tech innovation board enterprises. It provides a reference for the salary arrangement of science and technology enterprises at the level of corporate governance.

1.1.2 Research Significance

（1）Theoretical significance

① First of all, this paper expands the relevant literature about Sci-tech Innovation Board listed companies' compensation contract theory. At present, there are few studies on the impact of the internal compensation gap of Sci-tech innovation board listed companies, and there are many studies on the effect of R&D investment, technological innovation, and corporate performance of Sci-tech innovation board. This paper studies the impact between R&D investment and internal compensation gap of Sci-tech Innovation listed enterprises and the effect mechanisms of inner compensation gap and R&D investment on the firm's performance. The study enriches the research on compensation contract theory.

②According to Tournament theory and Behavioral theory, several domestic and foreign studies have used longitudinal data to examine the internal compensation gap and mainly focuses on the gap between executive officers and the gap between CEO and executives. This paper also considers the traditional classifiers: the gap between executives and employees. Besides, It introduces the compensation gap between R&D personnel and other employees when studying the influence of the internal

compensation gap. For Sci-tech innovation companies with a high talent density and emphasis on R&D investment, R&D personnel enjoys a higher salary than ordinary employees. According to public data, more than half of the directors of Sci-tech innovation board companies are core technicians. Therefore it is indispensable to study the salary gap between R&D personnel and ordinary employees.

With the advancement of the registration system reform of the Sci-tech innovation board, regulators put forward higher requirements for the governance level and the quality of information disclosure of listed companies. Senior management, such as the chairman and general manager, are critical players in receiving Sci-tech innovation board supervision. This paper's research on Sci-tech innovation board enterprise Internal compensation gap reflects the governance decisions of company managers in terms of compensation from the side. It provides an empirical reference on Sci-tech innovation listed corporate governance.

③There are some differences between this paper's research on the Internal compensation gap and enterprise research and development investment. In reviewing the literature, a considerable amount of literature has demonstrated the mechanisms of the internal compensation gap on executive and shareholder decision-making on R&D investment. The conclusion often surrounds the effects of the inner compensation gap on the changes in corporate R&D investment. This paper derives from the reverse path and studies the impact of R&D investment on the changes in the internal pay gap. Under the Sci-tech innovation board registration system, the company can initiate public offering under the condition of negative profit financing. Still, a high proportion of R&D investment is not a small economic burden and lets the enterprise face the risk of R&D failure. Sci-tech innovation listed companies can increase R&D investment through financing to alleviate short-term financial pressure. At the same time, preferential government policies might encourage Sci-tech Innovation listed companies to increase R&D investment. But after the enterprise's R&D investment increases, how can the enterprise allocate resources internally? Will the growing investment in research and development increase the Internet gap of large enterprises? If the agent's decision

to increase research and development investment will widen the pay gap, how will this affect the company's performance? The research in this paper enriches the relevant literature on R&D investment, internal compensation gap, and corporate performance of Sci-tech innovation board. It deepens the understanding of corporate governance of Sci-tech innovation enterprises.

（2）Practical Significance

① Empirical research shows that the R&D intensity has no significant impact on the internal compensation gap of the Sci-tech companies. The findings suggest that the Sci-tech companies have an unclear preference of the compensation gap, at least in the current. I believe further studies on Sci-tech companies would help to establish a greater degree of accuracy on this matter.

② From the empirical research results, a significant correlation was found between the executive-staff compensation gap and the financial performance. The compensation gap between R&D employees and other employees can significantly improve the performance of the human capital return. The findings suggest enterprises can perform better by appropriately widening the internal compensation gap.

By contrast, there is a significant negative correlation between corporate R&D intensity and one-period-lagged corporate performance. It demonstrates that in the short term, high R&D investment burdens the firm performance. The possible reason might be the corporate cannot guarantee the successful conversion of R&D expenditures to positive returns in a short period. As a result, the increasing R&D investment is associated with an increased risk of poor short-term financial performance of enterprises.

Furthermore, R&D intensity has a significant negative moderating effect on the positive correlation between firm performance and the executive-staff compensation gap. Though R&D intensity also has a negative moderating impact on the correlation between firm performance and the compensation gap between R&D staff and other staff, the impact is not significant. The conclusions indicate that high R&D intensity will impair the positive impact of the compensation gap between R&D staff and other staff

on the firm performance.

③This paper includes several controlled variables, which can be listed as follows: the property of enterprises, CEO-chairman duality, firm size, economic development level of the company's registered areas (which is measured by Regional Total Factor Productivity), industrial competition degree, industrial remuneration level. The control variables are used to illustrate the impact of other factors inside and outside the company. This paper provides references for enterprises to formulate compensation systems and make R&D investment decisions. This paper also provides investment suggestions based on the conclusions from the empirical results.

1.2 Route and Method

1.2.1 Research route

There is a great controversy in the academic circle about the influence of the internal compensation gap, R&D investment, and corporate performance. It is necessary to objectively and comprehensively study the relationship between innovation and the inner compensation gap and the influence of these two factors on corporate performance. This paper defines the concepts of R&D investment intensity, internal compensation gap, and corporate performance after reviewing scholars' research in China and abroad on related issues. The literature review helps to pave a theoretical foundation for the empirical investigation of this paper and construct a research framework.

Secondly, this paper analyzes the effect of R&D investment on the internal compensation gap and the function mechanism of the innovation and inner compensation gap on the corporate performance. On this basis, it puts forward five hypotheses. Subsequently, this paper explores the impact of R&D investment on the internal compensation gap from two perspectives: ① Executives and employees, ② R&D department employees and other employees. This paper further studies the moderating effect of innovation on the relationship between the internal compensation gap and corporate performance. (see Figure 1.2 for the specific research ideas).

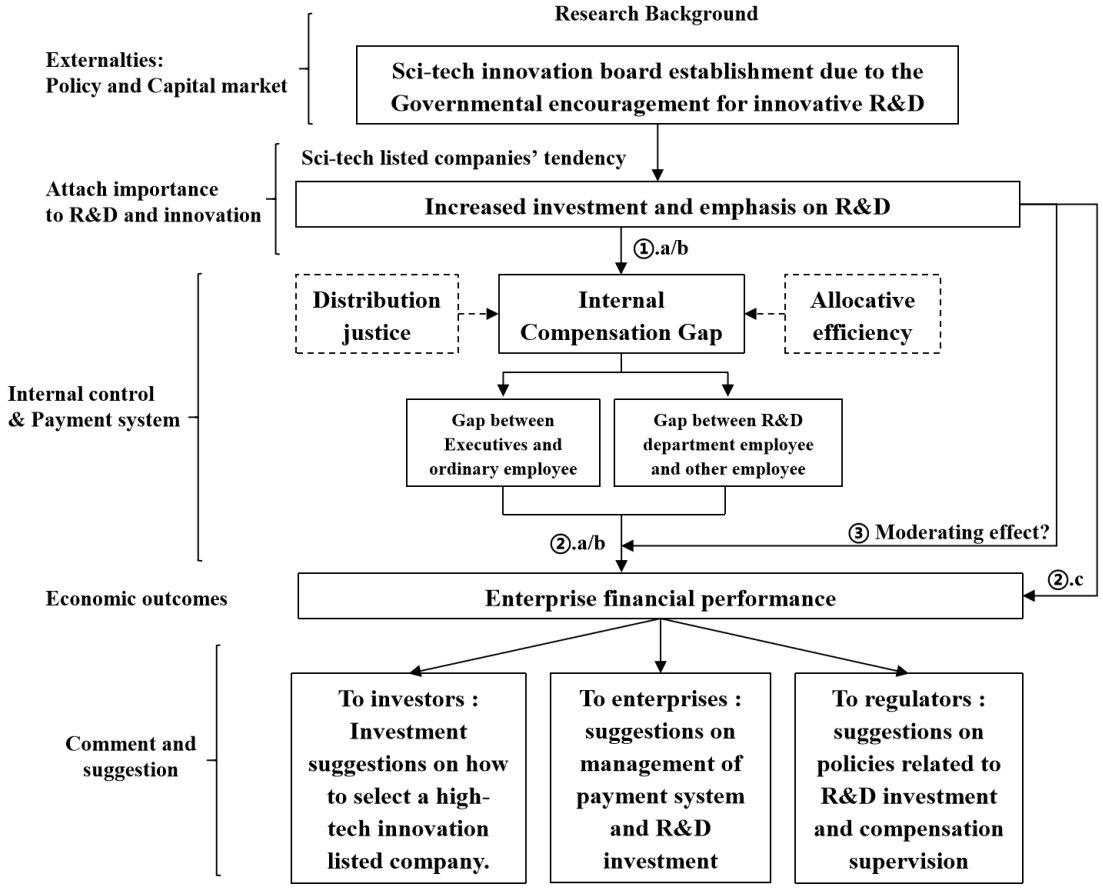

Figure 1.2 Research Route

Finally, according to the proposed assumptions, a multiple regression model is established. This paper selects Sci-tech innovation board companies listed in China's A-share market as the research sample until May 27, 2021, and studies the impact of R&D investment intensity on the internal compensation gap of Sci-tech innovation board companies through empirical research methods. To ensure the reliability and accuracy of the research results, in all models, the independent variables are tested one-period lagged to reduce the impact of enterprise endogeneity.

1.2.2 Research method

To the achievement of the research objectives, this paper mainly uses the following research methods for analysis :

①Normative analysis. By reading the literature at home and abroad, this paper summarizes the research results and practical experience related to salary gap, R&D investment, and enterprise performance with the combination of the theory of corporate

governance discipline. This paper clarifies the logical relationship between the three, looks for research problems that are insufficient or still need to be solved, describes the research objectives and research direction of this paper, and paves the way for the follow-up theoretical assumptions of this paper. Based on the literature review, this paper proposed the hypothesis:

H1a: The R&D intensity positively correlates to the Internal compensation gap.

H1b: The R&D intensity negatively impacts the Internal compensation gap.

H2a: The internal compensation gap positively impacts financial performance.

H2b: The R&D intensity inhibits financial performance in the short term.

H3: R&D intensity has a negative moderating effect on the relationship between the inner compensation gap and corporate performance.

②Empirical analysis. This paper takes Sci-tech innovation board listed companies as the research sample by May 7, 2021, and comprehensively uses descriptive statistics, regression analysis, robustness test, and other empirical analysis methods. This paper first selects the appropriate variables and describes the distribution of variables after winsorizing data. Then multiple regression model is carried out to analyze the relationship between R&D investment, internal compensation gap, and corporate financial performance. To solve the endogeneity problem, the independent variable of this paper adopts the lag data. After combing the relationship between the research object, this paper adds the R&D investment index as a moderator in the regression model, analyzes the function mechanism of 'Innovation-Internal Compensation Gap-Corporate Performance,' and further explores the moderating effect of R&D investment.

Finally, this paper uses the proportion of R&D investment in total assets as the substitution variable to conduct a robustness test to verify the hypothesis. All the data analysis and regression tests in this paper are completed by data processing and analysis software such as Excel and Stata. The empirical conclusions of this paper will provide valuable reference experience for Sci-tech innovation board listed companies to make R&D decisions and payment design.

1.3 Framework

There are six chapters in this paper, as follows.

Ch.1: Introduction. This chapter mainly introduces the background of Sci-tech innovation board listed companies, expounds on the research significance, research ideas, research methods, and research framework of this paper. The end of this chapter introduced the creative points of this paper.

Ch.2: Literature Review. This chapter mainly from the following three aspects of the literature review: First, the impact of R&D investment and internal compensation gap literature review. Second, the literature review is conducted on the effect of R&D investment on corporate performance. Third, this paper reviews the impact of the internal compensation gap on corporate performance. Finally, the research results of the existing literature are briefly reviewed.

Ch.3: Theoretical Foundation and Hypothesis. This chapter introduces the theoretical basis of R&D investment, internal compensation gap, and corporate performance in detail, including the *Innovation theory, Principal-agent theory, Tournament theory, Behavioral theory*. Based on theoretical analysis, the research hypotheses are given, including 1) the impact of R&D investment on internal compensation gap, 2) the effect of R&D investment and inner compensation gap, respectively, on corporate financial performance, and 3) the moderating effect of R&D intensity on the relationship between internal compensation gap and corporate financial performance.

Ch.4: Model Design. Based on the second chapter and the third chapter, this chapter defines the relevant variables, gives the measurement standard, and constructs the research model for three assumptions.

Ch.5: Empirical Results Analysis. This chapter analyzes and discusses the empirical results of the fourth chapter model, including descriptive analysis, correlation analysis, multiple regression analysis, and verifies the hypothesis through a robustness test.

Ch.6: Research Conclusions and Recommendations. This chapter summarizes the

results of the full-text empirical research, draws specific research conclusions, and makes recommendations to investors, Sci-tech innovation board listed enterprises, and relevant government departments. Furthermore, this chapter analyzes the research limitations existing in this paper and puts forward the future research prospect.

The research framework of this paper is shown in Figure 1.3.

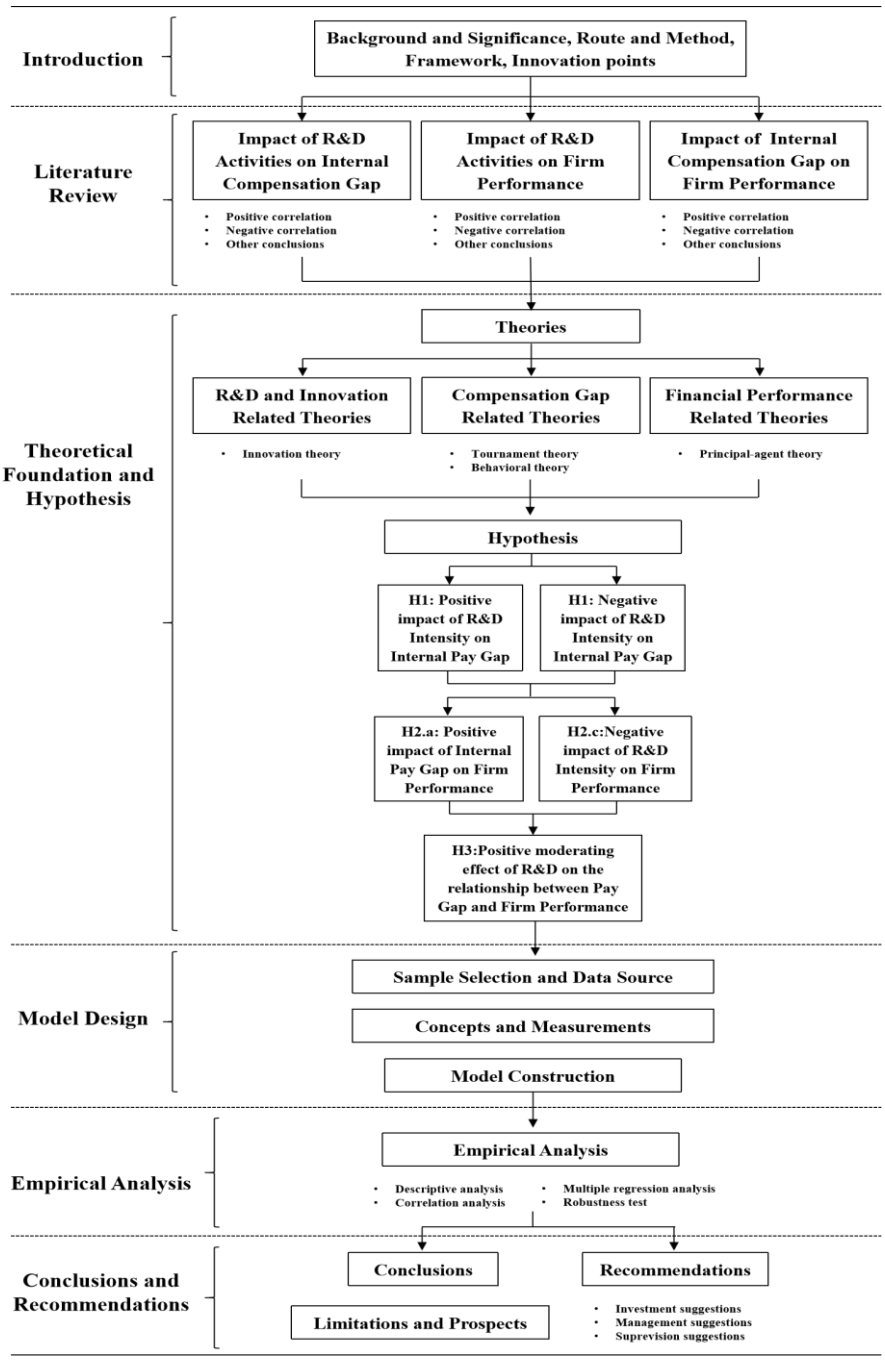

Figure 1.3 Research Framework

1.4 Innovation points

Specifically, the innovation points of this paper include the following aspects :

(1) From the perspective of empirical research, this paper selects Sci-tech innovation board companies as the research object. Since China's Sci-tech innovation board was opened in July 2019, most studies in the internal compensation gap of Sci-tech Innovation listed companies have only been carried out in a small number of areas. This study makes up for the deficiency in this regard and has the value of experience reference.

(2) As for the research on enterprise R&D investment intensity and pay gap, there has been no detailed investigation of the effect of innovation on the remuneration incentives. Most literature takes the pay gap as the influencing factor of enterprise R&D investment. On the contrary, this paper takes R&D investment as the impact factor of enterprise compensation gap because the increase of R&D investment results from the environment in which China encourages entrepreneurship, innovation, and a creative economy. Many Sci-tech innovation enterprises enjoy tax incentives for R&D expenses. Besides, due to the requirements of listing rules, enterprises tend to increase R&D investment. Obviously, in Sci-tech Innovation listed companies, at least 50 % of R&D costs are used to pay R&D staff salaries. This paper studies the impact of R&D investment on the fairness and efficiency of pay distribution at all levels within the company, especially in the inner pay gap, and further studies the economic outcomes of the effects. Based on the research, this paper will provide appropriate policy recommendations for regulators.

(3) In view of all that has been mentioned so far, the studies mainly discussed the internal compensation gap between high-level executives or between the executives and the employees rather than the gap between different department employees. Characterization of the compensation gap between R&D department staff and other staff is essential for our increased understanding of the internal compensation gap changes in the Sci-tech Innovation listed companies. This paper further explores the impact of the inter-departmental pay gap on the performance of the Sci-tech Innovation

Board, which emphasizes R&D. It enriches the existing research perspective on the pay gap.

(4) This paper further explores the moderating effect of R&D investment on the relationship between the internal compensation gap and corporate performance. These conclusions help to understand better the effect mechanism in the interaction of R&D investment, internal compensation gap, and corporate performance. The conclusion of this paper is advantageous for the Sci-tech enterprises in decision-making on the allocation of internal resources reasonably. Entrepreneurs can take the experimental conclusions to generate effective salary arrangements for the better development of enterprises. Empirical outcomes also help investors to make an investment decision and select eligible companies.

2. Literature Review

2.1 Impact of Innovation on Internal Compensation Gap

2.1.1 Positive correlation between Innovation and Internal Compensation Gap

Many scholars have unveiled a positive correlation between R&D investment and the internal compensation gap (Sun et al., 2020; Li, 2017)，backing of the Tournament theory. Following the addition of the internal pay gap, a significant increase in the firm's innovation outputs was recorded. (Shen and Zhang, 2018; Zhao and Wang, 2019). Chang (2020) studied China's agricultural listed companies. The evidence from the observations disclosed that the executives' internal compensation gap significantly impacts the enterprise's growth and R&D investment. R&D investment has played a full intermediary role in the correlation of executives' internal compensation gap and enterprise growth.

Based on Managerial power theory, in reality, senior managers have significant decision-making power in salary arrangement and R&D projects. Turtoheti (2017) examined Chinese listed companies from 2010 to 2015 and discovered that the size of the executive team would inhibit the positive correlation between the executive pay gap and R&D investment. The conclusions of her findings were the company should limit the size of the executive team within a reasonable range and reduce the internal conflict of the team. Guo et al. et al. (2019) research indicated that both executive overseas background and executives' pay gap significantly promote enterprise technology innovation investment. Guo et al. et al. (2019) mentioned that the diversification of government support and business objectives in state-owned enterprises would weaken the positive impact of overseas executive background on enterprise R&D innovation investment. Zhao (2017) found that the internal compensation gap of the top management team was positively correlated with R&D investment, and the salary gap can alleviate the negative impact of the age difference of the top management team on R&D investment. Jiang (2018) studied Chinese listed companies and found that tournament promotion incentives can promote corporate R&D investment, and the pay gap between CEOs and executives has a positive effect on R&D investment. Although

the replacement of the CEO can give executives greater opportunities for promotion, the replacement of the CEO brings instability to enterprise management decisions. It weakens the positive impact of promotion incentives on R&D investment. Chen (2020) found that ownership concentration has a negative moderating effect on the positive correlation between executive pay gap and enterprise R&D investment, indicating that enterprises should increase the compensation incentive for executives and reasonably arrange the ownership structure to improve R&D innovation.

The positive correlation between R&D investment and the pay gap is also affected by the differences in property rights, regional development level, and industries. Lu (2017) studied Chinese listed companies from 2009 to 2015 based on regional and industry differences. She found that the executive pay gap positively impacts corporate R&D investment, which is more significant in the more developed eastern high-tech companies. Ren and Sun (2019) found that government subsidies promote R&D investment in small and medium-sized enterprises, and the executive internal compensation gap plays a partial mediating role between government subsidies and R&D investment.

2.1.2 Negative correlation between Innovation and Internal Compensation Gap

Some scholars' experimental conclusions support the negative correlation between R&D investment and the Internal compensation gap (Chan et al., 2020)， this is consistent with the view of Equity theory. Ding et al. (2021) found that the low pay gap is more conducive to R&D investment performance than a high pay gap. Kang et al. (2020) found a significant negative correlation between the pay gap and R&D investment between CEOs and vice-president managers, and business risk played an important moderating role.

So far, If companies do not constrain senior managers' behavior, executive power rent-seeking will widen the company's internal compensation gap, which is not conducive to R&D investment and performance. Wang (2017) found that the higher the executive monetary compensation and on-the-job consumption level, the more inclined

to increase corporate R&D investment, but the widening pay gap harms corporate R&D investment. Zhong et al. (2019) studied the listed companies in China's manufacturing industry. They found that the more significant the pay gap of the executive team is, the less the R&D investment of enterprises is, which further leads to a lower firm's financial performance. However, after introducing the board supervision scenario, the negative impact of the pay gap on the R&D investment of enterprises was weakened by the separation of duties, the size of the board, and the flow rate of directors. The action mechanism is moderated by the difference in property rights and the degree of industrial competition. Huang and Yang's (2018) studies concluded that the negative correlation between internal compensation gap and R&D investment is more significant in non-state-owned listed companies, and the negative moderating effect of companies with high quality of internal control on the negative correlation between internal compensation gap and R&D investment is more significant. In other words, if the quality of internal control is high, although the inner compensation gap is widening, the tendency to reduce R&D investment will decrease. Niu and Lu (2019) pointed out that in listed companies in the information technology industry, the negative correlation between internal compensation gap and R&D investment of state-owned enterprises is lower than that of non-state-owned enterprises, and the negative correlation between inner compensation gap and R&D investment will significantly increase when the enterprise faces the high-level industry competition. Ran and Liu's (2015) investigation disclosed that the more intense the market competition of non-financial listed companies is, the stronger the negative correlation between the internal compensation gap of the executive team and enterprise R&D is.

2.1.3 Other conclusions

Many scholars have discovered an "inverted U-shaped" relationship between the Internal compensation gap and R&D investment (Huang, 2018; Li, 2019). A possible explanation for these results may be after a particular stage. The expansion of the internal compensation gap no longer promotes R&D investment but reduces the R&D

intensity of enterprises, proving that Tournament theory and Behavioral theory are not entirely contradictory. The view was also supported by Han (2017). There was a significant non-monotonic correlation between the compensation gap and the firm's performance. Below a certain critical level, expanding the salary gap will increase corporate risks, including increasing the R&D intensity. However, after the salary gap between CEO and CFO reaches a certain level, If the pay gap continues to widen, it will weaken the intensity of corporate research and development. Zhou (2019)studies Chinese listed companies from 2013 to 2017 and finds that the appropriate internal compensation gap of the management team has a positive impact on R&D investment. However, when the gap is too large, the positive impact will be weakened and become no longer significant. Moreover, if the management power is too large, it will undermine the positive effects of the internal compensation gap on R&D investment.

In addition, Balkin D B. et al. (2000)found that in high-tech enterprises, the short-term executive incentive is not related to R&D innovation, and long-term motivation is weakly related to R&D innovation. In the study of the GEM-listed companies in China from 2009 to 2013, Kang et al. (2016) found a significant negative correlation between executive promotion incentives and R&D investment. Still, there was a significant positive correlation between employee promotion incentives and R&D investment.

2.2 Impact of Innovation on Firm Performance

2.2.1 Positive correlation between Innovation and Firm Performance

R&D investment is conducive to the company's core competitiveness, thereby improving the firm's financial performance. Some studies have shown that Chinese listed companies have found a positive correlation between corporate R&D investment and corporate financial performance R&D (Shi and Xie, 2021; Wang and Zhang, 2021; Zhong and Guo, 2021). Nemlioglu and Mallick (2021) studied Turkish listed companies and found that all innovation activities boost profitability.

Differences in executives' backgrounds will have a moderating effect, and the moderating influence of the pay gap of critical executives will be more significant.

Zheng and Li (2021) found that age and education differences, as indicators of the management team's background, negatively affected the positive correlation between R&D investment and a firm's financial performance. In contrast, the senior managers' overseas background and vocational background positively correlated the positive correlation between R&D investment and a firm's financial performance. Song (2021)found that increasing R&D investment can improve the company's s financial performance and exacerbate performance volatility. The critical executive pay gap significantly affects the positive correlation between R&D investment and corporate performance.

The introduction of highly educated talents to enterprises can promote R&D investment and, at the same time, bring benefits to a firm's financial performance. Liu et al. (2021) found that the introduction of highly educated talents, human capital investment, R&D intensity, and R&D personnel investment played a role in promoting enterprises' current gross sales rate. Although the R&D project put enterprises' solvency and operational capacity to the test in the current period, it could bring financial benefits to enterprises in the lagged 2-3 report periods. Liu and Fan (2021) studied supply chain management's perspective. The technological innovation of manufacturing enterprises has a nonlinear relationship with the firm's financial performance, and there is a significant positive correlation between them. However, the impact of the number of researchers on the firm's financial performance is limited by supply chain management capabilities.

The difference in property rights will affect R&D and corporate performance. Liu (2019) studied Chinese listed companies from 2010 to 2016 and found that increasing R&D investment can significantly improve corporate financial performance. At the same time, the more significant the pay gap between executives and employees is, the more influential the role of R&D investment in promoting a firm's financial performance is. From the perspective of the nature of property rights, the pay gap between executives and employees in state-owned enterprises has a significant positive moderating effect on the relationship between R&D investment and a firm's financial

performance. A study of listed companies in Jiangsu Province by Fang (2021) found that non-state-owned enterprises have a more significant positive correlation between R&D investment and a firm's financial performance. In contrast, the managers of state-owned enterprises tend to over-invest, which harms the firm's economic performance.

In addition, Wang et al. (2021)discovered a positive correlation between R&D investment and a firm's financial performance, and R&D investment plays an intermediary role in the positive correlation between ownership concentration and financial performance. Zhai and Wang (2021) considered that R&D investment lagged 2-3 periods had a significant positive correlation with the company's financial performance, and the internal financing ability of enterprises would enhance this positive correlation.

2.2.2 Negative correlation between Innovation and Firm Performance

Li et al. (2021) R&D investment in automobile manufacturing listed companies hurts the financial performance of the current period. Although part of the reason is that the economic return cycle of R&D investment is relatively long, in the two-phase regression test, R&D investment has no positive impact on financial performance. Li et al. (2021) studied the software and information technology service industry listed companies in the Shanghai and Shenzhen stock markets and found a significant negative correlation between corporate R&D investment and a firm's financial performance. However, the negative impact of executive compensation incentives on a firm's financial performance is not substantial. Xia and Ge's (2021) research found that under conditions of high uncertainty in external economic policies, more increased R&D investment will lead to low performance of enterprises.

2.2.3 Other conclusions

Swift's (2008) research proved that companies with more volatile R&D investments have better project monitoring capabilities and can generate incremental innovations. This study shows that stable R&D investment does not significantly

promote technological innovation but may result from managerial entrenchment and overinvestment. Leung and Sharma (2021) researched listed companies in the Shanghai and Shenzhen markets and pointed out that R&D investment has a negative impact on the profitability of companies in the short term and a positive effect in the long time. The internationalization of R&D activities has a positive impact on the export performance of companies. However, there is no impact of R&D on either long-term or short-term financial performance of the company. Hazarika (2021) research shows that it is difficult to achieve a win-win situation between the company's environmental and financial goals in ecological research and development. After the development of the enterprise has experienced an inflection point, the financial income of R&D investment can offset the initial investment cost.

Zhong and Ren (2021) studied Shanghai's high-tech enterprises. In their findings, the scale of the scientific research team, capital scale, and R&D funding will promote the enterprise's innovation performance and operational performance. In addition, the investment in scientific and technological activities will increase the output of patents. Thus, the inflow of government funds can promote the innovation of the enterprise. However, operating performance is negatively correlated with government funding.

2.3 Impact of Internal Compensation Gap on Firm Performance

2.3.1 Positive correlation between Internal Compensation Gap and Firm Performance

Some scholars have shown that the salary gap positively impacts individuals and organizations (Bloom, 1999). Strategically organizing tournaments can motivate employees to achieve higher levels of performance (DeVaro, 2006). Chen and Ji (2020) studied 165 listed companies in the information technology industry in China's A-share market. They found a significant positive correlation between the internal compensation gap and the financial performance of information technology company executives. Financial performance has played a positive role in moderating. Li's (2020) research on China's GEM listed companies found that widening the salary gap can reduce

executives' short-sighted behavior and allow executives to make decisions to increase corporate R&D investment, thereby significantly improving corporate performance. The results indicate that internal compensation for executives is through R&D investment to affect the firm's financial performance. There is no lag in the impact of R&D investment on the firm's financial performance. Ao's (2020) research shows that the executive promotion incentives of Chinese A-share listed companies have a positive correlation with corporate financial performance, and promotion incentives and R&D investment are also significantly positively correlated. R&D investment starts in the relationship between executive promotion incentives and corporate financial performance To part of the intermediary role.

2.3.2 Negative correlation between Internal Compensation Gap and Firm Performance

Some evidence shows that executives have too much power to determine their remuneration package. In this case, there is no positive relationship between executive compensation incentives and corporate performance. (Duffhues and Kabir, 2008). Li's (2017) research proved that based on Behavioral theory, the internal compensation gap of executives and R&D investment negatively impacts the company's performance. R&D investment plays a positive role in regulating the effect of the current executives' inner compensation gap on the company's performance, indicating the company's internal compensation gap. Therefore, the expansion is not conducive to unity and cooperation within the enterprise. At the same time, the enterprise increases the research and development expenses, which causes the profit margin to be compressed, which adversely affects the current corporate performance. If the research and development investment is to be converted into corporate profits, it will take longer.

2.3.3 Other conclusions

Based on Tournament theory, as the position level and the number of participants increase, the salary gap will continue to grow, which might promote the firm's financial performance. Shen and Zhang (2018) studied Taiwanese companies and found that

Tournament-performance is specific to specific industries. For companies in non-tech industries, Tournament theory is effective. However, a widening salary gap may not necessarily promote a firm's financial performance. Li et al. (2021) research believes that executive pay inequality negatively impacts a firm's financial performance in the short term and positively impacts the long term.

Hua and Jing (2019) found an inverted U-shaped correlation between the compensation gap between the key executive officer and staff and the firm's financial performance of a new generation of listed companies in the information technology industry. R&D investment intensity has an inverted U-shaped relationship between the compensation gap between the critical executive officer and staff and corporate performance. However, the association has a positive moderating effect. Li's (2017) research on Chinese GEM companies found that both executive shareholding and salary incentives can promote R&D investment. Still, the correlation between promotion incentives and corporate performance is not significant, and R&D investment has not played an intermediary role in the connection between promotion incentives and financial performance.

2.4 Literature Comment

There are many controversies in the literature, and scholars cannot reach a consensus on their research. Moreover, the relationship between R&D investment, internal compensation gap, and corporate performance is affected by many factors inside and outside the company, including the demographic characteristics of the senior management team, the power of the management, the nature of corporate property rights, regional differences, and industry differences. In studying the relationship among the three, this paper draws on the literature review, takes important indicators as control variables, and discusses the results.

Together, the current study on the impact of the internal compensation gap mainly focuses on the compensation gap between CEO and other executives, the compensation gap between executives, and the compensation gap between executives and employees.

But the internal compensation gap between R&D employees and ordinary employees is included in the scope of the study.

From a research perspective, many scholars have studied the topic of "R&D investment, internal compensation gap and firm's financial performance." But most of them use the Internal compensation gap as an explanatory variable for R&D investment. This paper takes the R&D intensity of enterprises as an explanatory variable to understand better the impact of increased R&D investment on internal salary disparity in the context of technology financing. Furthermore, this paper discusses the economic outcomes of enterprise R&D intensity and the inner compensation gap.

In addition, there is indeed a lot of experience from Chinese listed companies in the selection of research samples. Still, few studies are on the impact of the internal compensation gap of listed companies on the Sci-tech innovation board. Therefore, this article believes that there is still room for research in the above aspects.

3. Theoretical Foundation and Hypothesis

This chapter introduces in detail the relevant theories of R&D investment, Internal compensation gap, and corporate performance, including Innovation theory, Tournament theory, Behavioral theory, Principal-agent theory. In addition, this chapter defines the concepts and measurement standards of the three. The relationship derives from the hypothesis of this article.

3.1 Theoretical Foundation

3.1.1 Innovation Theory

The Sci-tech innovation board of the Shanghai Stock Exchange serves Chinese emerging industry companies or Chinese technological innovation companies that are in line with national strategies and are highly recognized by the market with the breakthrough in core technologies. The Sci-tech innovation board is essential for Chinese companies to participate in the future global technological competition. Therefore, the Sci-tech innovation board market has higher requirements for companies' innovation capabilities. Enterprise innovation involves many aspects of enterprise management. The innovation activities of an enterprise determine the company's development direction, development scale, and development speed.

In the academic research of enterprise innovation, the most famous is Schumpeter's Innovation theory(Schumpeter, 1934). In 1912, he first proposed "Enterprise Innovation Theory" in his "Economic Development Theory." Schumpeter proposed that innovation refers to introducing a new "combination" of production factors and production conditions into the production system. He regards enterprises as the main body of innovation. He believes that invention includes five situations: introducing a new product, introducing a new production method, opening up a new market, obtaining a new supply of raw materials or semi-finished products, and New organizational form(Ding, 2002). After Schumpeter, Innovation theory divided into two schools: one is the technological innovation school headed by Kamien and Schwartz (1982); Mansfield (1981), and the other is institutional innovation represented by Davis et al. (1971) school. With the rapid development of science and technology, innovation

has played an essential role in realizing the rapid growth of the national economy. In the 1990s, the national innovation system theory represented Freeman (1995), Lundvall et al. (2002) appeared, which combined technological innovation with Government functions are combined. The government often adopts tax incentives or direct subsidy policies to encourage enterprises' R&D activities (Lei, 2016). However, as far as the enterprise is concerned, an invention comes first, and innovation comes second. Only by combining knowledge, ability, skills, and resources can an enterprise turn invention into creation. (Carland and Carland, 2009).

Innovation, entrepreneurship, and the creative economy are almost inseparable. A creative economy is positively associated with the rule of law and market size (Raul et al., 2021). Schumpeter was the first to propose linking the innovation performance of enterprises with the dynamic operation of capital markets. In the early stage, he studied the innovation motivation of start-up companies and tracked the change of capital demand in the whole industry life cycle. In different stages of enterprise development, financing purposes and forms are different: bootstrapping, crowdfunding, angel investors, venture capital (VC), banks, and initial public offer (IPO). The most common is venture capital, which can bring capital to enterprises, accompanied by knowledge, experience, and innovation (Moirangthem and Nag, 2021). Brown et al.'s (2009) research found that some start-ups have to rely more on the stock market to provide financial support for their R&D activities. Enterprises lacking resources attach importance to innovation activities, which can help start-ups retain external investment(Tang et al., 2021).

Many factors affect enterprise innovation activities. The internal perspective includes enterprise culture, management, technology, talents, assets, etc. The creative sectors can develop innovations and experiences as part of their own activities, as well as procedures, technologies, and routines in business models(Jesus, 2020). On the other side, the external perspective includes market, policy, law, economy, and other major environmental factors. The reasons for the failure of enterprise R&D are as follows: insufficient resources, poor teamwork, failure of senior managers, difficulty in

technological development, and changes in the external environment. (Wenhong and Yuan, 2011).

In the early stage of China's s capital market reform, scientific and technological R&D activities and capital investment were mainly supported by the government. As a result, the marketization level was low. As a result, the level of scientific and technological R&D activities was low, which did not substantially impact economic growth. China has made rapid progress in the past two decades, and its comprehensive national strength has risen. The proportion of R&D expenditure in GDP has also been rising, although there is still some gap apart from 3 % in high-income countries (see Figs. 3.1 and 3.2). The Chinese market has also cultivated several scientific and technological companies with excellent innovation capabilities, such as Alibaba, Tencent, Huawei, and Xiaomi. (Justin Manly et al., 2021). As a result, science and technology R&D activities change from government-led to enterprise-led (see Figure 3-3 in detail).

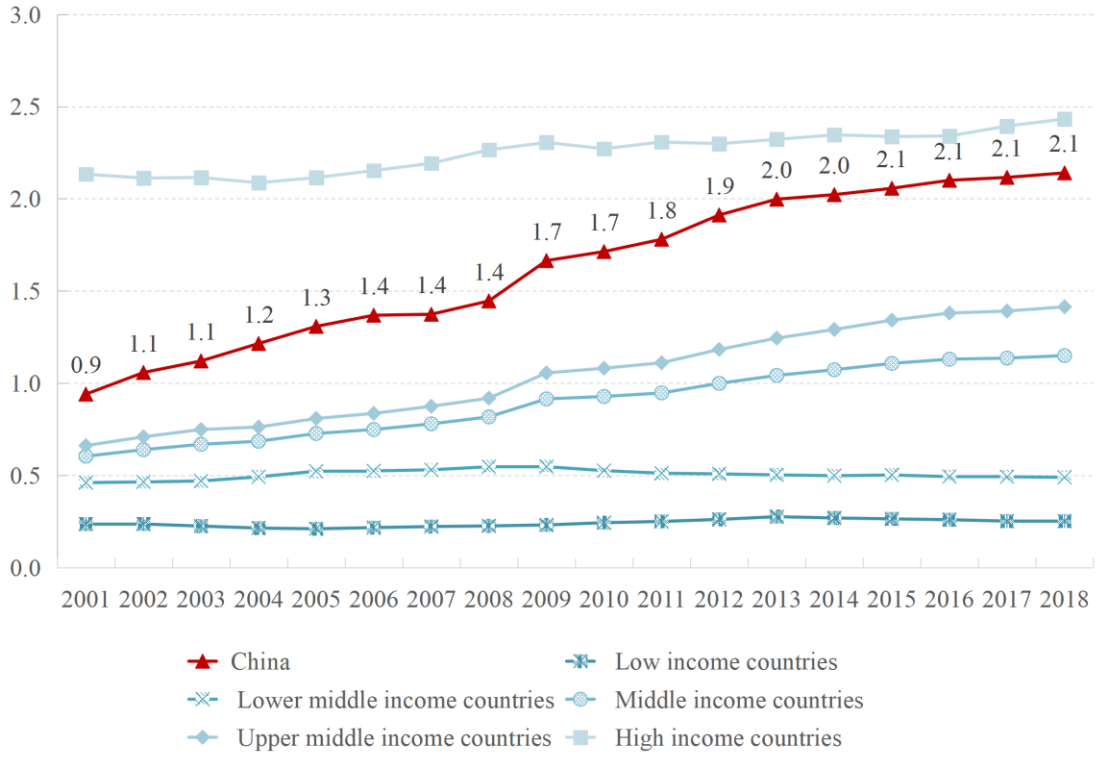

Figure 3.1 Comparison of China's Gross domestic expenditures on R&D % of GDP and other countries in the world, from 2001 to 2018(Unesco Institute For Statistics, 2021)

Ranking, Gross domestic expenditures on R&D % of GDP

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
NO.1	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel	Israel
NO.2	Sweden	Sweden	Sweden	Sweden	Sweden	Sweden	Japan	Finland	Finland	Finland	Finland	Republic of Korea	Republic of Korea	Republic of Korea	Republic of Korea	Republic of Korea	Republic of Korea	Republic of Korea
NO.3	Finland	Finland	Finland	Finland	Finland	Finland	Finland	Sweden	Sweden	Republic of Korea	Republic of Korea	Finland	Japan	Japan	Switzerland	Sweden	Switzerland	Sweden
NO.4	Japan	Japan	Japan	Japan	Japan	Japan	Sweden	Japan	Japan	Sweden	Japan	Sweden	Finland	Finland	Japan	Japan	Sweden	Japan
NO.5	Iceland	Iceland	Iceland	Iceland	Iceland	Iceland	Republic of Korea	Republic of Korea	Republic of Korea	Japan	Sweden	Japan	Sweden	Sweden	Sweden	Austria	Japan	Austria
NO.6	USA	USA	USA	Switzerland	Republic of Korea	Republic of Korea	USA	Denmark	Denmark	Denmark	Denmark	Switzerland	Denmark	Austria	Denmark	Denmark	Germany	Germany
NO.7	Germany	Denmark	Denmark	USA	USA	USA	Iceland	USA	USA	USA	Germany	Denmark	Austria	Denmark	Austria	Germany	Denmark	Denmark
NO.8	Denmark	Germany	Germany	Republic of Korea	Germany	Germany	Denmark	Switzerland	Germany	Germany	USA	Austria	Germany	Germany	Germany	USA	Austria	USA
NO.9	Republic of Korea	Republic of Korea	Republic of Korea	Germany	Denmark	Denmark	Germany	Germany	Austria	Austria	Austria	Germany	USA	USA	Finland	Finland	USA	Belgium
NO.10	France	France	Austria	Denmark	Austria	Austria	Austria	Singapore	Iceland	Iceland	Iceland	USA	Slovenia	Belgium	USA	Belgium	Finland	Finland
NO.11	Belgium	Austria	France	Austria	Singapore	Australia	Singapore	Austria	France	Australia	Slovenia	Slovenia	Belgium	Slovenia	Belgium	France	Belgium	France
NO.12	Canada	Singapore	Singapore	France	France	Singapore	France	Iceland	Singapore	France	Estonia	Belgium	France	France	France	Iceland	France	Netherlands
NO.13	Singapore	Canada	Canada	Singapore	Canada	France	Canada	Australia	Belgium	Belgium	Australia	France	Australia	Singapore	Iceland	China	China	China
NO.14	Austria	Belgium	Belgium	Canada	Belgium	Canada	Belgium	France	Canada	Slovenia	France	Estonia	China	China	Slovenia	Singapore	Iceland	Norway
NO.15	Australia	Netherlands	Netherlands	Australia	Netherlands	Belgium	Netherlands	Belgium	Slovenia	Singapore	Belgium	Iceland	Netherlands	Netherlands	Singapore	Norway	Norway	Iceland
NO.16	Netherlands	United Kingdom	Norway	Belgium	Luxembourg	Netherlands	United Kingdom	Canada	Norway	Canada	Singapore	Singapore	Singapore	Czechia	China	Slovenia	Netherlands	Slovenia
NO.17	Norway	Norway	Luxembourg	Netherlands	United Kingdom	Luxembourg	Luxembourg	Slovenia	Luxembourg	China	Netherlands	Netherlands	Czechia	Iceland	Netherlands	Netherlands	Singapore	Czechia
NO.18	United Kingdom	Slovenia	United Kingdom	Luxembourg	Norway	United Kingdom	Norway	Luxembourg	United Kingdom	Netherlands	Canada	China	Estonia	Norway	Norway	Canada	Australia	United Kingdom
NO.19	Slovenia	Russian Federation	Russian Federation	Norway	Slovenia	Slovenia	Slovenia	Netherlands	Netherlands	Norway	China	Czechia	Canada	Canada	Czechia	Czechia	Slovenia	Canada
NO.20	Russian Federation	Czechia	Slovenia	United Kingdom	China	Norway	China	United Kingdom	China	United Kingdom	United Kingdom	Canada	Iceland	United Kingdom	Australia	United Kingdom	Czechia	Hungary

Data extracted on 06 Jun 2021 02:56 UTC (GMT) from UIS.Stat

Figure 3.2 2001-2018 Gross domestic expenditures on R&D % of GDP, Top 20(Unesco Institute For Statistics, 2021)

(China's ranking has been rising over the years)

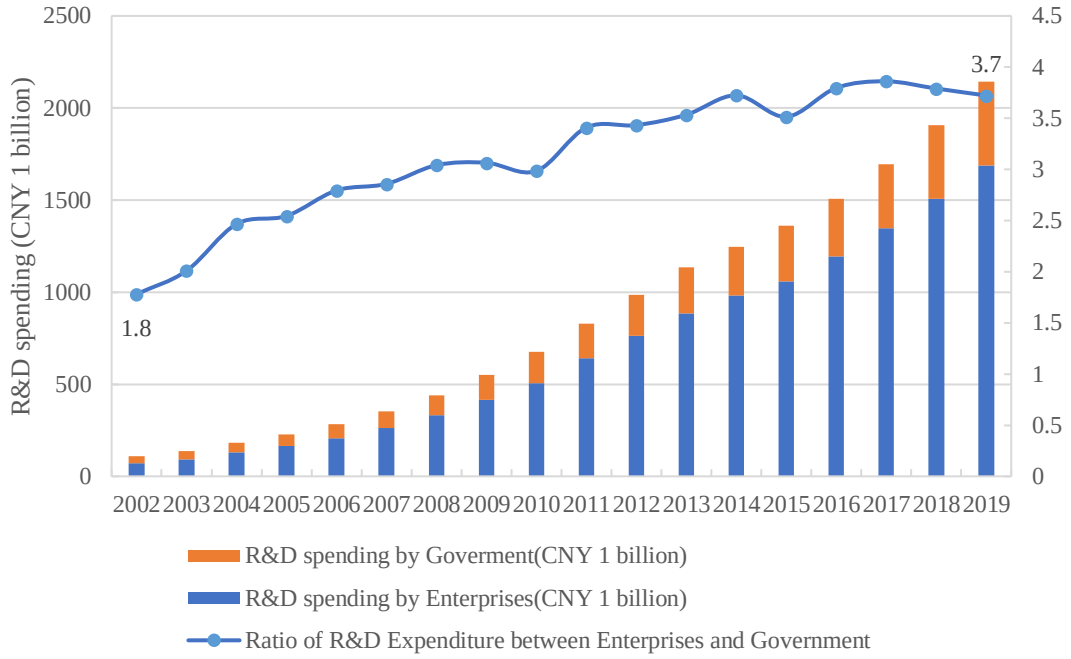

Figure 3.3 2002-2019 Comparison of R&D expenditures funded by Enterprises and Government in China. Enterprises lead R&D activities in China. (Data extracted from CSMAR database)

3.1.2 Tournament Theory

In terms of income distribution, Clark (1901), an economist in the 19th century, first proposed the marginal productivity theory of Marginal Productive. He believes

that the marginal productivity of labor determines wages, that is, the output of the last worker employed by the manufacturer - the marginal product of labor. Marshall (1890) also supported the marginal productivity theory based on supply and demand equilibrium price. He pointed out that the equilibrium price of labor is the price of labor market supply and demand equilibrium. The marginal productivity of labor determines the wage level that manufacturers are willing to pay. According to Clark and Marshall, income distribution is fair, and the income gap between different employees depends on their production efficiency.

The standard economic theory considers that the marginal output determines the salary level, but in fact, the compensation gap in the enterprise is not entirely determined by the marginal productivity of labor. Lazear E. P. and Rosen S. (1981) jointly proposed the Tournament theory. They said once a person is promoted from deputy general manager to general manager. His salary level may double in a day. It is difficult to say that this person's ability doubles in a day. Tournament theory regards promotion as a competition. According to the ranking, winners get promotions and won all the bonuses. Tournament theory links the salary level of employees with job promotion. Suppose the promotion of employees ' positions can bring about a substantial increase in wages. In that case, it will stimulate employees' enthusiasm to work hard, thereby improving the company's performance.

In Tournament, compensation is related to the ranking of employee marginal output, not to the specific marginal output. According to Tournament theory, in the case of complex production links and difficult supervision, the client only needs to determine the position promotion according to the marginal output of the staff, and the decision-making process is relatively simple, which can reduce the cost of supervision. Suppose specific marginal production is used to determine compensation. In that case, once the cost of the investigation is high, business managers may have a strong motive for laziness. It becomes more challenging for the employer to determine the best candidate in the promotion process (Jensen and Meckling. W. H., 1976). Therefore, as the administrative level increases, the salary level increases, and the salary gap between

employees at adjacent levels increases. It can motivate employees to improve efficiency and strive for higher rankings, and at the same time encourage the winners in the past promotion competition to move on.

The premise for Tournament theory to work is that the promotion criteria of the enterprise must be specific, accurate, and reasonably predictable. In addition, the enterprise must try to ensure the fairness of the competitive environment. Otherwise, it will dampen the work enthusiasm of employees. When the ranking is affected by too many external uncertain factors, the ranking might lack credibility, and the motivation of employees to participate in the competition will be reduced. Therefore, the company must ensure that the promotion of an employee's position to a large extent is related to the employee's effort and the economic benefits he brings to the company. Under a level playing field, Tournament theory supports companies to widen the pay gap, thereby promoting the firm's financial performance.

3.1.3 Behavioral Theory

Contrary to Tournament theory, Behavioral theory opposes widening the pay gap and believes that companies should emphasize fairness and unity and improve employees' enthusiasm by narrowing the pay gap. The behavioral theory includes the Relative Deprivation Theory, Organizational Politics Theory, Allocation Preferences Theory, and Equity Theory.

Relative Deprivation Theory believes that a person will feel exploited if he gets far less than he deserves (Martin, 1979). For example, in a company, an employee compares his salary with the salary of a higher-level person in the organization. If the employee feels that he has not received deserved compensation, he will feel exploited. This will lead to employees' sabotage, strikes, and other negative behaviors. It will also lead to employees' indifference to the organization's goals, resulting in a decline in corporate cohesion(Cowherd, D. M., and I., 1992). According to scholars of relative exploitation theory, it is easy for employers to judge how much employees should be paid based on how much employees have produced rather than how much they have invested. Therefore, employees can easily feel the salary gap between themselves and

others based on what they have received rather than what they have contributed. Therefore, the gap in the personal abilities of employees is difficult to be directly reflected in the salary gap, and there is a gap in each person's input. So even if employees get promotions and higher salaries because of their excellent production efficiency, it will cause dissatisfaction in the hearts of other employees.

Organizational Politics Theory believes that corporate members will do their best to influence the behavior of corporate decision-makers for their interests-"political conspiracy" behavior (Paul R. Milgrom and John Roberts, 1988). On the surface, this behavior will increase the profit of the enterprise, but it will also generate higher invisible operating costs because of ineffective teamwork. For example, suppose the company's pay gap is too large. In that case, its members will be more inclined to engage in self-interested "political conspiracy" activities, resulting in higher levels of effort that will not increase the benefits to make up for the increased costs caused by the destruction of corporate cooperation. Enterprises have ambiguous policies in human resource management (personnel selection, performance appraisal, etc.), which can easily lead to the political behavior of corporate members (Ferris and Kacmar, 1992). The theory of organizational politics suggests that companies should appropriately reduce the pay gap between executives when teamwork is more important. Narrowing the pay gap can effectively curb "political conspiracy" behaviors caused by promotion and competition and promote communication among corporate members. Cooperation, and ultimately encourage firm's financial performance.

Different from Relative Deprivation Theory and Organizational Politics Theory, Allocation Preferences Theory focuses not on the behavioral results caused by the salary gap but on the pre-set salary. Allocation Preferences Theory believes that the salary of company members is identified in the interaction between the salary setter and the recipient. If the company unilaterally regulates the compensation and ignores the dissatisfaction that employees may have, it will significantly reduce the rationality of the salary system. Allocation Preferences Theory recommends narrowing the salary gap under the following circumstances: (1) Personal marginal product is challenging to

measure. (2) Teamwork has become very important. (3) Team members tend to engage in "political conspiracy" activities.

Equity Theory is a vital theory explaining the sense of fairness (Adams, 1965; Homans, 1961). Equity Theory was put forward under the influence of Social Comparison Theory. Social Comparison Theory believes that individuals in a group have a psychological tendency to compare themselves with others to determine their self-worth (Allan and Gilbert, 1995; Festinger, 1954; Goethals and Darley, 1987). Equity Theory believes that a person will care about his absolute income and his relative income. Everyone compares the labor he has paid and the remuneration received with others (social comparison) and compared with the past (historical comparison). When an employee finds that his income and expenditure ratio is lower than that of others or that his current income and expenditure ratio is lower than the past income and expenditure ratio, he will feel pain because of unfairness. His motivation to work will also decrease. If people find that they are in an unequal relationship, they will rebuild their sense of fairness in two ways to alleviate their suffering. One is to achieve fair employees by changing their gains or the gains of others, such as reducing rewards to others. Or ask others to pay the corresponding price. The second is to rebuild a sense of fairness by distorting the facts, such as convincing yourself that unfair relationships are fair, and people may subjectively exaggerate their investment or reduce their value. But there is a price to rebuild psychological justice, which is detrimental to the individual's physical and mental health(Walster et al., 1978). Therefore, only when employees feel the fairness of income distribution can they work with peace of mind.

3.1.4 Principal-agent Theory

The principal-agent theory was proposed by the American economists Berle and Means (1932) in the study of the separation of the ownership and control of a company. Ownership and management rights are split in the principal-agent relationship, which results in conflicting goals between the principal and the agent. The principal-agent theory has been recognized and discussed in depth by many scholars.

Jensen and Meckling. W. H. (1976) assumed that there are two kinds of agency

conflicts in the case of separation of management rights and ownership: agency conflicts between shareholders and management and agency conflicts between equity holders and creditors. According to the assumption of rational man, both the principal and the agent are rational, and they are pursuing the maximization of their own interests. As the principals, the shareholders have the enterprise's ownership with the right to claim the residual interests. The goal of shareholders is to maximize the enterprise value in line with the personal wealth. The operator is an agent who only owns the management right of the enterprise. But the operator does not have the ownership and does not enjoy the residual interests of the enterprise. The material interests (salary, bonus, and on-the-job consumption) and spiritual interests (honor) of agents are not closely related to the growth of corporate wealth. Therefore, in the case of inadequate supervision or insufficient incentives, the agents will make decisions that maximize their interests instead of maximizing corporate interests (Feng and Westerfield, 2020). Because of the information asymmetry, the agent retains an advantage in the information, while the principal at a disadvantage. The agent can always use the information advantage to make the principal's supervision effective, and the principal solely relies on surveillance to restrain the agent will pay A considerable price. The core of the principal-agent problem is how to design a reasonable compensation plan for the shareholder as the principal so that the operator as the agent is willing to make the most significant effort for the principal's goal and profit with the minimum cost. Although salary incentives are one way to reduce agency costs (Holmstrom and Tirole, 1989), incentive mechanisms will be more effective than supervision mechanisms to resolve the conflict of interest between the principal and the agent.

3.2 Research Hypothesis

3.2.1 Hypothesis on the relationship between R&D intensity and Internal Compensation Gap

（1）From the perspective of reducing the supervision cost. Compared with other industries, the Sci-tech companies are in the industry with the characterization of the

high R&D intensity. There are more technological R&D projects with high technological complexity. The companies face a more complex outside environment. Thus, the R&D project management of Sci-tech companies is more difficult with the high cost of supervision. Due to the high risk of the firm's R&D activities, the management will invest in projects with low risk and low income in order to avoid risks, refuse to invest in projects with high risk and high income, and lack the drivers to participate in the R&D activities (Hitt et al., 1997). Enterprises need to set up a suitable salary incentive mechanism to reduce the cost of supervision and management. Based on the tournament theory, with the increase of the R&D intensity, the difficulty of project management increases, and the compensation gap is appropriately widened, which can prevent the slack and short-sighted behavior of the executives or the core technical personnel. However, according to the behavioral theory, accompanied by the rise of the R&D intensity and the technical complexity, the employees' marginal production is more challenging to measure. Suppose the enterprises widen the compensation gap. It would come up with more political conspiracy behavior of the team members, possibly disrupting the team's cooperation.

（2）From the perspective of motivating employees. This paper studies the firm's internal compensation gap： the compensation gap between the executives and employees and the compensation gap between the R&D staff and ordinary staff. Indeed, the executives and the R&D employees are categorized as *'Knowledge workers.'* American scholar Drucker (1998) identified knowledge workers as the group of people who skillfully master and use relevant symbols, concepts, knowledge, and information in their work. The knowledge workers are capable of using their knowledge to carry out innovative work and provide the basis for innovation (Woodruffe, 1999). Intellectual capital is essential to enterprise innovation (Lao et al., 2021; Shuyang et al., 2021). Talents are the main driving force for the sustainable development of enterprises (Liu, 2021). Lack of compensation incentives for knowledge workers will lead to talent drain. Employees who master core technology or business secrets leave will leak core technology or business secrets. Especially when the executives or R&D employees

jump to competitors, enterprises will face more fierce competition. If the core employees resign, enterprises cannot make up for the vacancies in core positions quickly. It will affect the regular operation of enterprises. Once knowledge workers leave, such as senior executives leave, a group of employees may follow, which has a domino effect on the loss of enterprises. Enterprises must invest time and energy in recruiting and training new employees, and the productivity of new employees cannot meet their needs immediately (Zheng 2009). Therefore, due to the huge loss of the executives and the R&D staff, enterprises need to settle down a reasonable pay gap to meet the salary expectations of knowledge workers and improve their performance.

On the one hand, some studies support high-technology companies preferring tournament incentives (Cui et al., 2019; Liu et al., 2020; Zhao and Wang, 2019). Innovation tournaments have a long history of driving progress (Terwiesch et al., 2009). An innovation tournament, just like its counterpart in sports, starts with a large number of candidates, with opportunities as the players. Balafoutas et al. (2012) studied employees' preference for the pay gap from the perspective of the applied psychology. They suggested that efficiency-minded subjects preferred the tournament most frequently when given a choice between a tournament and a piece rate scheme. A smaller pay gap cannot motivate employees' work efficiency. Most of the current research on the high-tech enterprises in China supports the practice of widening the internal compensation gap of enterprises (Cai, 2010; Chen 2012; Huang, 2010; Wang, 2008; Yang, 2014; Zhang, 2019). These findings reflect that if the firm's background is high-tech, it is better to apply the tournament theory. In other words, high-tech firms should widen the internal compensation gap.

But on the other hand, Grund and Westergård-Nielsen (2005) did not approve of the view of the tournament, and they studied the salary structure of British computer companies. The results showed that when the salary gap between engineers and ordinary employees is less than three times, the employees will not feel unfair. Once the gap is larger than five times, the employees would have a strong sense of injustice, bringing adverse effects on corporate performance. Phyllis et al. (2006) studied

American high-tech companies and discovered that a smaller compensation gap among the team of the top management is advantageous for the cooperation and communication of the management team. Some domestic scholars demonstrated that in China, the high-tech companies more stress on the internal group work than the traditional companies. Due to the high complementarity of the management team, the compensation gap between the executives is relatively small (Feng, 2011; Lu, 2017).

The research on high-tech background companies has the great controversy over the correlation between the R&D intensity and the pay gap. This paper puts forward two competing hypotheses:

H1a: The R&D intensity has a positive effect on the internal compensation gap.

H1b: The R&D intensity has a negative effect on the internal compensation gap.

3.2.2 Hypothesis on the relationship between Internal Compensation Gap and Financial performance

This paper carried out simple statistics and preliminary judgment on the existing data of the Sci-tech companies' internal compensation gap. The statistics revealed that enterprises experienced a poor market performance, possibly because of the COVID-19. However, the market revived, and the firm performance rose again in 2020. In line with the change of the firm performance, the internal compensation gap has declined in 2019 and rebounded in 2020, which indicated that the Sci-tech companies paid more attention to the team's stability. The data initially identified the tendency of the tournament-performance in the Sci-tech companies: the internal compensation gap and the performance change in the same direction.

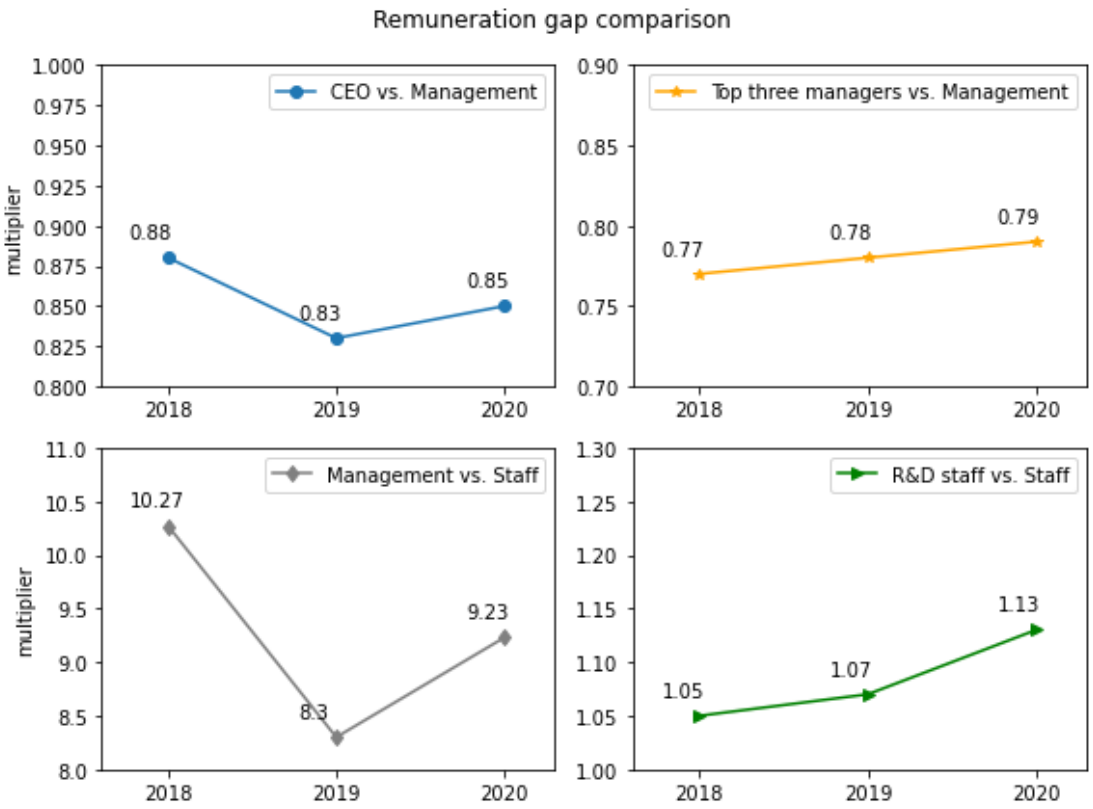

Figure 3.5 Tendency of Remuneration Gap Change

In the current, most studies on the mechanical effect of China high-tech companies' internal compensation gap and firm's performance support the view of tournament theory(Cai, 2010; Chen, 2012; Huang, 2010; Yang, 2014; Zhang, 2019). We have reviewed the literature about the tournament theory in the sector of theory foundation: in the view of the tournament theory, if companies increase the remuneration disparity, it will improve the firm performance. And the tournament-performance effects on the high-tech companies are particularly prominent. Sci-tech companies invest strongly in R&D, which is the premise. But in the longer period of the R&D activities, enterprises cannot precisely determine the individual marginal production. Under the principal-agent theory, if there are no effective mechanisms of supervision and incentives, the agents will appear opportunistic and short-sighted behavior in enterprise management decision-making, resulting in low investment efficiency and unfavorable outcomes. If enterprises only rely on supervision to solve the principal-agent problem, the supervision cost will be very high. Therefore, the reasonable salary gap can create a competitive atmosphere, making the candidates supervise each other in the tournament.

In this way, the firm can effectively reduce the supervision cost. From the perspective of incentive effect, if the salary gap is too small, it cannot have a significant incentive effect on the executives or the R&D employees. Zhao and Wang (2019) demonstrated that internal compensation incentives have an important impact on inventors' innovative behavior. These initiatives encourage inventors' technological innovation if firms provide substantial rewards for successful inventors and firms tolerate inventors who fail in innovation.

On the contrary, if firms provide insufficient incentives for innovation, inventors do not have the incentive to devote themselves to technological innovation activities. Therefore, widening the internal compensation gap enables the executives and R&D employees to enhance their work initiative, strive for a ladder-like increase in the compensation, and win a sense of honor in the competition. The performance improvement of these knowledge workers can promote the overall performance of the enterprise. Based on this, this paper puts forward the hypothesis:

H2.a: Internal compensation gap is positively correlated with a firm's financial performance.

3.2.3 Hypothesis on the relationship between R&D intensity and Financial performance

Compared with the Small and Medium-sized Board and GEM, the Science and Technology Innovation Board puts forward higher requirements for the scientific innovation attributes of the listed companies. The file is named “Administration methods of Stock Registration for the IPO of Science and Technology Innovation Board (Trial).” It clearly stipulates that “R&D investment should account for more than 5 % of operating income in the last three years” and “more than five invention patents should form main operating income” shall be included in the listing conditions of Sci-tech companies. Undoubtedly, R&D investment and technical innovation criteria positively impact the application of IPO on the Sci-tech innovation board. According to the statistics, in 2020, in the last three years, the cumulative R&D expenditure

accounted for more than 10 % of the total operating income in the last three years reached 109, accounting for 40.5 % of the total number of enterprises, the proportion of more than 5 % reached 212, accounting for 78.8 % of the total number of enterprises. In the past three years, the Sci-tech companies' R&D investment showed a gradual upward trend. In 2020, up to 201 listed companies with more than 15% R&D employees, accounting for 75% of the total number of enterprises. As of May 7, 2021, the total number of patents accumulated by Sci-tech companies reached 35383. There are 245 enterprises (accounted for 91% of the total number of enterprises) with more than five invention patents. Overall, no matter the proportion of R&D expenditures, the number of R&D employees, or the number of patents, the indicators have shown that the Sci-tech companies' R&D investment level is far more than the companies on the other board.

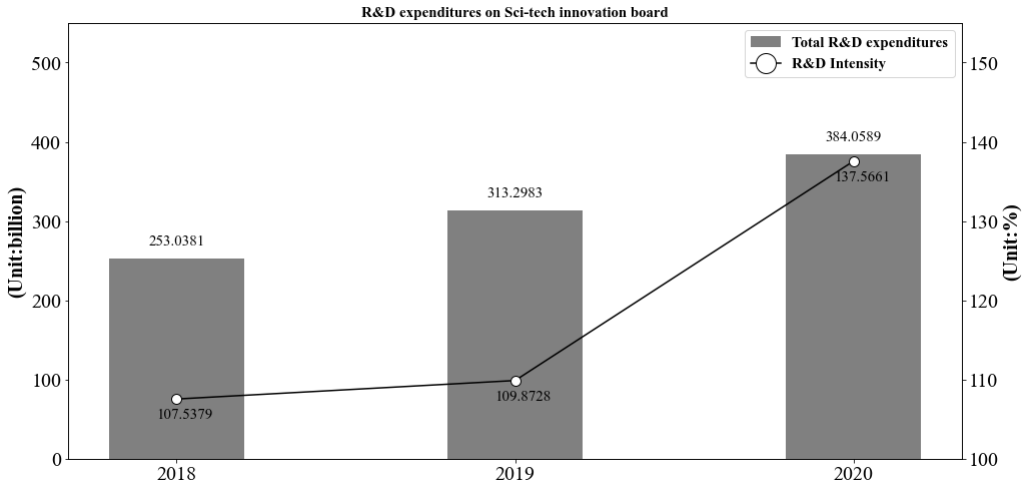

Figure 3.4 Total R&D expenditures of companies listed on Sci-tech innovation board

Some research indicated that the Sci-tech enterprises' innovation investment positively correlates with the firm's financial performance (Li, 2020). But the technical innovation project usually needs to last a long time, the conversion of the R&D is risky. In the short period, enterprises would not obtain considerable profits from the innovation activities, which means the positive return of R&D investment is lagged(Zhang and Ying, 2021; Li, 2017; Yang et al., 2021; Zheng and Zhao, 2021). And the effect of the two or more periods lagged is more significant. Although the average time to market is only 2~3 years for the most Sci-tech listed companies, the

Sci-tech enterprises have a relatively high level of R&D investment, which might be unfavorable to the firm's financial performance. To summarize, the paper assumes that:

H2.b: The R&D investment intensity is negatively correlated with the firm's financial performance.

3.2.4 Hypothesis on moderating effect of R&D intensity on the relationship between Internal Compensation Gap and Financial performance

In accordance with the innovation theory, high-risk and high-profit characterize enterprises' innovation, with large uncertainty. In the early days of the R&D project, companies need to experiment many times and may face failures. Before the success of the R&D project, the managers will be questioned for the unwise decision, and also, the R&D employees should be responsible for the consequences of the failure. According to the traditional salary incentives, employee compensation links with the individual performance, the enterprises would punish the R&D employees and the managers who failed in the innovation by the reduction of the rank and benefits. As stated by the tournament theory, the winner of the past game cannot do it once for all. If the previous winner loses the game, the treatment and ranking would dramatically decline due to the huge pay gap, which is psychologically unacceptable. The more times the R&D fails, the greater the blow to the managers and the R&D employees. Based on the principal-agent theory, ownership is apart from the operating rights. Therefore, the managers will make more conservative investment decisions and choose to reduce the innovation activities to avoid R&D failures. The action will subsequently harm the shareholder's interests and discourage the long-term development and expansion of the enterprises. Consequently, the high-tech enterprises invest more in R&D projects, and the executives and the R&D employees will face a higher risk of R&D failure. The larger internal compensation gap will hit the initiative of the executives and the R&D employees, which is not conducive to the improvement of enterprise performance. Zhang (2008) studied the examples of China-listed companies. With the increase in the technical complexity of the enterprises' R&D activities, employees emphasize the

equality of the treatment and request the employer to decline the compensation gap. Similarly, Zhang's (2017) research findings also proved that the technical complexity of innovation activities would impair the positive effect of the internal pay gap on the firm's performance. Based on the above, the hypothesis is proposed as:

H3：R&D investment has a negative moderating effect on the correlation between the internal compensation gap and the firm's financial performance.

4. Model Design

4.1 Sample Selection and Data Source

My preliminary sample starts from the 269 Sci-tech innovation listed companies from July 22, 2019, to May 7, 2021. The data were processed as follows based on the primarily selected samples: (1) Eliminate the samples with missing main financial data and ensure the number of deleted samples is relatively small, which will not have a substantial impact on the empirical results; (2) Control the influence of outliers on the regression coefficients in case of the deviations in the regression results, winsorize all continuous variables at the 1% and 99% quantiles; (3) Normalize the data before performing multiple regression to eliminating the influence of dimensionality and range difference between variables on data analysis results. In the end, 807 valid observations were obtained. This paper uses a multiple regression model for testing and uses substitution variables for robustness testing and analysis. The data used in this paper were gathered from the wind database. Data management and analysis were performed using Excel2010 and Stata14.0.

4.2 Variable Definition and Measurement Standards

4.2.1 R&D investment intensity

Generally speaking, the innovation activities of enterprises divided into two parts: First is the R&D investment, which includes recruitment of R&D talents, equipment procurement, paying for R&D services, and even the patents purchase; Second part is R&D output, which embodies the capitalized R&D expenditures, the number of patents applied by enterprises (especially the number of invention patents), and the benefits of the enterprise's core technology products. However, it takes a long time for companies to transform R&D investment into R&D output successfully. Since the average time to market of Sci-tech innovation board companies is relatively short, less than three years on average, and the current R&D investment conversion efficiency is limited, this article focuses on the R&D investment intensity of Sci-tech innovation board companies.

In addition, from the research purpose, this paper studies whether the R&D

investment of Sci-tech innovation board companies will increase or inhibit the fairness of the enterprise's internal resource allocation. Although, more intuitively, the increase in R&D investment results from the technological competition in the current era. Although under this background, the rise in R&D investment may increase the inner compensation gap, this paper further studies the economic consequences of R&D investment on enterprises and the moderating effect of R&D investment between the internal compensation gap and the firm's financial performance.

R&D investment intensity is one of the primary measurement variables studied in this article. R&D investment intensity (rdi) refers to how much of the company's operating income is invested in R&D activities. It is measured by the proportion of R&D investment in operating income. The formula is as follows:

$$\text{R\&D intensity} = \frac{R\&D\ expenditures}{Total\ Revenues}$$

This article uses the proportion of R&D capital investment (rda) to replace it in the robustness test. The ratio of R&D capital investment is calculated using the following formula:

$$\text{R\&D capital propotion} = \frac{R\&D\ expenditures}{Total\ Assets}$$

In summary, the variable design related to R&D activities in this article is shown in the following table:

Table 4.1 Definition of variables related to R&D

Generic designation	Variable name	Symbol
R&D and Innovation	R&D intensity	rdi
	R&D Capital Investment Ratio	rda

4.2.2 Internal Compensation Gap

The corporate pay gap can be divided into the external compensation gap and the internal compensation gap. The external salary gap refers to the gap between inside and outside the enterprise on employees' salaries of a certain rank and job position. The external factors of the enterprise include industry, region, etc. Internal compensation gap refers to the wage gap between employees in different places and different

departments within the company. This paper focuses on the inner compensation gap categorized into the compensation gap between executives and employees and the internal compensation gap between R&D department employees and other ordinary employees (see Figure 3.2 for details). Companies structure a salary gap, on the one hand, to motivate employees to improve their performance to obtain higher salaries, and promote the joint development of individuals and the company, on the other hand, create a competitive atmosphere, which is conducive to the company's selection and retention of talents. However, the pay gap may also harm the company. Excessive pay gaps will damage the employees' enthusiasm at the bottom, undermine the unity and cooperation within the company, and extreme competition will cause the company to fall into political struggles, bring unnecessary internal friction, and lead to talents. The loss is ultimately not conducive to the long-term development of the enterprise.

Usually, company employee compensation mainly consists of monetary compensation incentives (especially wages and bonuses) and equity compensation incentives. For corporate members, wages are fixed and have little to do with personal performance; bonuses are floating and linked to individual performance, and corporate members must reach a certain goal before getting corresponding rewards. Many companies do not make a strict distinction between the monetary and equity remuneration components. Long-term equity incentives are deferred, and they usually take several years to cash out. Due to the non-accessibility of data and the current lack of equity incentives in most Chinese companies, this article only studies monetary compensation incentives without considering long-term incentive compensation for executives.

At present, when domestic and foreign scholars measure the pay gap, they use indicators such as absolute pay gap, relative pay gap, and pay gap variation coefficient. This article compares the commonly used absolute pay gap and relative pay gap methods. Take the internal compensation gap between the executives and the employees as an example. The absolute compensation gap refers to the natural logarithm of the difference between the executives' average compensation and the employee's average

compensation. The relative pay gap refers to the ratio of the executives' pay to the employee's pay. Since the absolute salary gap of Sci-tech innovation board companies is often negative, we cannot take the natural logarithm directly. Therefore, this paper finally adopts the method of the relative pay gap.

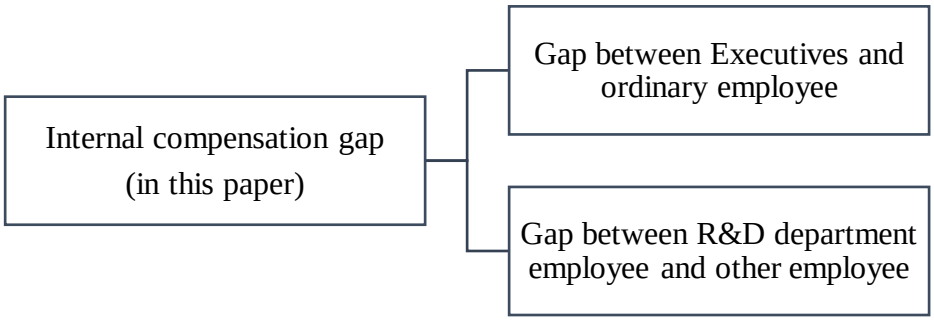

Figure 4.1 Specific composition of internal compensation gap

(1) Comparable compensation gap between executives and employees is represented by the symbol msr. This indicator is measured by the relative ratio of the annual average salary of executives to the average salary of employees. The specific calculation formula of msr is as follows:

$$\text{msr} = \frac{\text{The average compensation of executives}}{\text{The average compensation of ordinary employees}}$$

where,

$$\text{Executives' Avg. compensation} = \frac{Management\ compensation}{Number\ of\ executives}$$

$$\text{Ordinary employees' Avg. wage} = \frac{Total\ compensation - Management\ compensation}{Number\ of\ employees - Number\ of\ executives}$$

(2) Comparable compensation gap between R&D employees and other ordinary employees is represented by the symbol rsr. This indicator is measured by the relative ratio of the average annual salary of executives to the average salary of employees. The specific calculation formula of rsr is as follows:

$$\text{msr} = \frac{\text{The average compensation of R\&D employees}}{\text{The average compensation of other ordinary employees}}$$

where,

$$\text{R\&D employees}' \text{ Avg. compensation} = \frac{Total\ compensation\ of\ R\&D\ department}{Number\ of\ R\&D\ employees}$$

$$\text{Other employees}' \text{ Avg. compensation} = \frac{Total\ compensation - Management\ compensation - R\&D\ compensation}{Number\ of\ employees - Number\ of\ executives - Number\ of\ R\&D\ employees}$$

Table 4.2 Definitions of the variables related to the Internal compensation gap

Generic designation	Variable name	Symbol
Pay_gaps	The compensation gap between executive officers and staff	msr
	The compensation gap between R&D staff and other staff	rsr

4.2.3 Financial performance

According to the research purpose, this paper examines the impact of the internal compensation gap on the performance, the effect of R&D investment on the firm's performance, and the moderating effect of R&D investment on the correlation between the inner compensation gap and economic consequences. The measurement of the firm's financial performance typically embodies the return on net assets (ROE), the return on total assets (ROA), TobinQ (TobinQ), earnings per share (EPS), etc. In general studies, one or more of the above indicators will be selected. In addition, they will use the principal component analysis method to calculate the comprehensive evaluation level of a firm's financial performance.

This article uses the most representative ROE and ROA indicators, and at the same time, uses the return on human investment (ROP) to measure the value that human resources bring to the enterprise.

(1) Return on Equity (ROE) is the percentage of net profit to average net assets, reflecting the return on investment of the company's owner's equity. The specific formula is:

$$\text{ROE} = \frac{\text{Net Income}}{\text{Average Net Assets}}$$

（2）Return on Assets (ROA) is the percentage of the total assets of the company's operating income that can be distributed by investors and creditors during the reporting period, reflecting the comprehensive effect of asset utilization. This indicator excludes the impact of financial leverage on the rate of return. The specific formula:

$$\text{ROA} = \frac{\text{EBIT}}{\text{Average Total Assets}}$$

（3）Human capital investment rate of return (ROP) reflects the level of corporate value compared to employee value. This indicator is suitable for companies whose main cost is human resources input, such as the software service industry. According to the purpose of the research, the return on human resources investment can directly reflect the impact of the company's compensation mechanism on the firm's financial performance. Specific formula:

$$\text{ROP} = \frac{\text{EBIT}}{\text{Total Compensation}}$$

Where:

$$\text{EBIT} = \text{Total profit} + \text{Financial expense},$$

$$\begin{aligned}\text{Total salary} = {} & \text{cash paid to employees} \\ & + \text{salary payable at the end of the period} \\ & - \text{salary payable at the beginning of the period.}\end{aligned}$$

Table 4.3 Definition of variables related to corporate performance

Generic designation	Variable name	Symbol
Perfoms	Return on Equity	roe
	Return on Assets	roa
	Return on Human capital investment	rop

4.2.4 Control variables

Control variables include internal and external factors that may affect R&D investment, Internal compensation gap, and firm's financial performance.

(1) Control variables reflecting the operating conditions of the enterprise

a.Asset-Liability ratio (LEV)

This paper selects the equity multiplier of listed companies on the Sci-tech innovation board to measure the company's leverage ratio and financial risk level during the reporting period. The specific calculation formula is:

$$\text{LEV} = \text{Total liabilities/Total assets.}$$

b.Firm size（Scale）

The measurement index of firm size is the natural logarithm of the company's total assets at the end of each year. The larger the value, the larger the firm size. Firm size is also closely related to the R&D investment and performance of the enterprise. The scale of enterprise operation can bring a certain competitive advantage to the enterprise. Therefore, this article takes the scale of the enterprise as one of the control variables.

(2) Control variables reflecting preferential policies

To encourage enterprises to increase investment in R&D and innovation, the Ministry of Finance and the State Administration of Taxation issued the Notice on Increasing the Pre-tax Deduction Ratio of Research and Development Expenses (Caishui [2018] No. 99) in 2018, which revised the increase in R&D expenses. The deduction policy has increased the deduction ratio from 50% to 70%, and the beneficiaries have been expanded to all Chinese companies. The government's preferential policies have promoted companies' R&D investment and also significantly improved their financial performance. (Cheng, 2021). Government policy guidance will allow companies to increase R&D investment and affect the allocation of internal resources. Therefore, this article takes corporate tax returns and tax relief, and government subsidies as control variables.

(3) CEO-chairman duality

CEO-chairman duality means the chairman serves as CEO in the listed companies, which will affect the promotion opportunity of other non-CEO executive officers and

change the incentive effect of the internal compensation gap. When the two positions are combined, the CEO has greater power and can interfere in various decisions of the board of directors. When it comes to the change of CEO, the board of directors is the main decision-maker. However, because the CEO is also the chairman of the board of directors, coupled with the decentralization of ownership, it directly leads to the transfer of actual control to the CEO, resulting in the dictatorial rule, making it difficult for the CEO to resign even if CEO's performance is poor. In this case, non-CEO executives hope to promote R&D to improve the firm's financial performance, thereby significantly reducing the possibility of being promoted to CEO. The abuse of power will undoubtedly weaken the incentive effect of the salary gap and affect executives' enthusiasm to promote R&D. This paper chooses the combination of two positions as a nominal variable to measure whether the chairman and CEO of the company are the same people. If they are, the value is 1, and if they are not, the value is 0.

(4) Nature of property rights

The nature of property rights also has a significant impact on R&D investment, corporate pay gap, and corporate performance. The property rights of listed companies on the Sci-tech innovation board are divided into several sectors: private enterprises, public enterprises, central state-owned enterprises, local state-owned enterprises, foreign-funded enterprises, collective enterprises, and other enterprises. The property rights in this paper split into state-owned enterprises and non-state-owned enterprises. The incentive effect of the salary gap on the financial performance of state-owned enterprises is significantly different from that of non-state-owned enterprises. Liu Guoyin and Shao Xikang (2019) found that the nature of state-owned property rights would weaken the positive correlation between the internal compensation gap of executives and the company's R&D investment intensity. Kang et al. (2018) believe that R&D investment has a promoting effect on corporate financial performance. The impact of R&D investment on private enterprises is more significant than on state-owned enterprises. Guo's (2016) research on state-owned listed companies found a

positive correlation between the internal compensation gap of executives and corporate financial performance. Yao et al. (2020) believe that the supervision and restraint of state-owned enterprises are not sound enough, and the excessive compensation of senior executives has become a typical manifestation of the agency problem of state-owned enterprises. Therefore, this paper controls the property rights of state-owned enterprises and non-state-owned enterprises. If the listed company on the Sci-tech innovation board is a state-owned enterprise, the value is 1. Otherwise, the value is 0.

(5) The control variable reflecting the regional differences-the level of regional economic development

Guo (2016) studies the area difference's impact on the compensation gap in state-owned enterprises. The findings are that eastern China has a higher coefficient of the influence of the salary gap on corporate performance than the western regions where economic development is slightly underdeveloped. Chen et al. (2009) found that salary control is widespread in state-owned enterprises, and the degree of salary control is also affected by regional differences. In his study, the variables are the regional wealth gap, unemployment rate, and foreign investment. Fu and Wu (2006) found that regional growth differences affect the efficiency of technological innovation. This article considers the different levels of economic development in the locations where listed companies on the Sci-tech innovation board are located. It comprehensively uses qualitative analysis and quantitative analysis to make statistics on the differences in regional economic development. According to the method of Shan (2008), Zhang et al. (2018), Total Factor Productivity (TFP) is selected as a measure of the quality of regional economic development. Considering the availability of data, this paper selects the data from 2000 to 2017. The sample includes 30 provinces, autonomous regions, and municipalities in mainland China except for Tibet (Because Tibet has many missing observations). The data are from the China Statistical Yearbook and the statistical yearbooks of each province. The specific calculation processing of data is as follows:

(1) Regarding output indicator (Y): Regional GDP is an important indicator to

measure the results of regional economic production activities. This paper selects the GDP of each province from 2000 to 2017 as the regional output index. This paper takes 2000 as the base period and uses the CPI index of each province to convert the regional GDP from 2001 to 2017.

(2) Regarding the input factors (K, L): this paper selects the population of urban employment in each province from 2000 to 2017 as the labor input index (L). Then, it selects the gross regional fixed assets to calculate the capital input index (K). Capital input is calculated based on the method of permanent inventory. This paper takes 2000 as the base period and uses the Fixed Asset Investment Price Index to adjust the Gross Fixed Capital Formation from 2001 to 2017. When estimating the capital stock of each province in the base period, the depreciation rate is 10.96 % (Shan, 2008), and the capital stock in the base period is divided by the sum of the depreciation rate and the five-year average growth rate of Fixed Asset Investment near the base period. Based on the data envelopment analysis method of Rolf et al. (1994), this paper uses the DEA-Malmquist index method to calculate the Malmquist TFP of each province from 2000 to 2017. The results are shown in Table 4-4.

Table 4-4 Malmquist Index Summary Of Province Means

No.	Province	effch	techch	pech	sech	tfpch
1	Beijing	1.01	1.042	1.009	1.001	1.052
2	Tianjin	0.965	1.012	0.97	0.995	0.977
3	Hebei	0.976	1.038	0.979	0.997	1.014
4	Shanxi(山西)	0.968	0.987	0.98	0.988	0.956
5	Liaoning	0.954	0.971	0.961	0.993	0.926
6	Jilin	0.943	0.968	0.945	0.998	0.913
7	Heilongjiang	0.958	0.997	0.971	0.986	0.954
8	Shanghai	1.011	1.041	1.01	1.001	1.052
9	Jiangsu	1.004	1.048	1.001	1.003	1.053
10	Fujian	1	1.073	1	1	1.073

11	Jiangxi	0.98	0.997	0.999	0.981	0.977
12	Shandong	0.993	1.038	0.993	0.999	1.031
13	Henan	0.975	0.987	0.981	0.994	0.963
14	Hubei	1.01	1.003	1.024	0.986	1.013
15	Hunan	0.995	1.002	1.007	0.988	0.997
16	Guangdong	1	1.015	1	1	1.015
17	Guangxi	0.959	0.986	0.96	0.998	0.945
18	Hainan	0.985	1.002	0.961	1.026	0.987
19	Chongqing	0.996	0.993	0.996	1.001	0.99
20	Sichuan	0.987	0.988	1.002	0.985	0.976
21	Guizhou	1.007	0.994	1.009	0.998	1.002
22	Yunnan	0.963	1	0.964	1	0.963
23	Shanxi(陕西)	0.993	0.986	0.997	0.996	0.978
24	Gansu	0.973	0.997	0.974	0.999	0.971
25	Qinghai	0.987	1.006	0.944	1.045	0.992
26	InnerMongolia	0.942	0.98	0.944	0.998	0.923
27	Ningxia	1.066	1.072	1.008	1.057	1.142
28	Zhejiang	0.988	1.045	0.993	0.995	1.033
29	Xinjiang	0.979	0.99	0.978	1.001	0.97
30	Anhui	0.983	0.993	0.993	0.989	0.976
	mean	0.985	1.008	0.985	1	0.993
	median	0.986	0.9985	0.993	0.998	0.983

For the entire study period, the average total factor productivity change is -0.7%. This is due to a decrease in the efficiency changes to the extent of 1.5% and the pure efficiency change to the extent of 1.5%, but the scale efficiency change remained stagnant.

This article compares the regional economic level with the median. If the total factor productivity level of the area is higher than the median value, it is recorded as

"1". Otherwise, it is recorded as "0". The statistical results obtained are as follows:

Table 4.5 Comparison of Regional Economic Development Levels

No.	Provinces	Economic Performance Evaluation	No.	Provinces	Economic Performance Evaluation
1	Beijing	1	16	Guangdong	1
2	Tianjin	0	17	Guangxi	0
3	Hebei	1	18	Hainan	1
4	Shanxi(山西)	0	19	Chongqing	1
5	Liaoning	0	20	Sichuan	0
6	Jilin	0	21	Guizhou	1
7	Heilongjiang	0	22	Yunnan	0
8	Shanghai	1	23	Shanxi(陕西)	0
9	Jiangsu	1	24	Gansu	0
10	Fujian	1	25	Qinghai	1
11	Jiangxi	0	26	InnerMongolia	0
12	Shandong	1	27	Ningxia	1
13	Henan	0	28	Zhejiang	1
14	Hubei	1	29	Xinjiang	0
15	Hunan	1	30	Anhui	0

(6) Control variables reflecting industry differences

The research on the salary gap and the degree of industry competition shows that the impacts on the salary gap vary from the different industries. Xiao (2015) studied the pay gap between monopoly and competitive industries and found that the industry's monopoly would weaken the role of the pay gap in promoting a firm's financial performance. Ke and Chen (2015) used trend research to study the employee pay gap caused by region, industry, and ownership factors. The impact of industry differences on the pay gap has always existed. Dong (2019) divided the industries into labor-intensive industries, capital-intensive industries, and technology-intensive industries according to the intensity of production factors. The research found that venture capital in different industries chooses different corporate governance models to promote enterprises' technological innovation.

Based on the above, this paper considers the dual impact of industry compensation level and industry competition. First, it selects the proportion of the annual average

salary of employees in the industry to the total annual average salary of employees in the overall market to measure the competitiveness of employees in the industry. Second, the proportion of the annual average salary of executives in the industry to the total annual average salary of executives in the overall market is selected to measure the competitiveness of executives in the industry. Finally, select the proportion of the annual number of companies in the industry to measure the intensity of competition in the industry.

Table 4-6 Description of control variables related to industry differences

Parameter	Description
Competitiveness of industry employee salary (Indstf)	It is measured by the industry's annual average employee compensation ratio to the overall average employee compensation in the market. Take the median value of the ratio and judge whether the average salary percentage of employees in the industry is higher than the median value. If it is, the value is "1", indicating that the company's industry pays employees better. Otherwise, the value is "0", Which shows that the industry in which the company is located does not give employees better remuneration.
Competitiveness of industry executive compensation (Indmnt)	The industry's annual average remuneration measures the industry's annual average remuneration of executives as a percentage of the overall market's average remuneration. First, take the median value of the ratio and judge whether the average salary percentage of the industry executives is higher than the median value. If so, the value is "1", indicating that the company's industry can provide better remuneration packages for executives; otherwise, the value is "0". The industry in which the company is located does not provide better remuneration for senior management.
Annual number of companies in the industry (Indcp)	Measured by the ratio of A-share listed companies in a specific industry to the total number of listed companies in the overall market each year. First, take the median value of the ratio. If the industry's number is

higher than the median value, the value is "1", indicating that the industry is highly competitive. Otherwise, the value is "0", indicating that the degree of industry competition is not high.

This article uses the statistical data of industry salary in the wind database. In addition, this paper refers to the China Securities Regulatory Commission's new industry standards, divides the Sci-tech innovation board listed companies into 19 industries, and further subdivides them into 81 sub-industries. The statistical results are as follows:

Figure 4.2 Statistics on the intensity of industry competition in the A-share market

The above picture is a comprehensive ranking of the fierce competition in the industry. The top three industries with fierce competition in the A-share market are manufacturing, information transmission, software, information technology services, Wholesale, and retail.

Figure 4.3 Ranking of employees' salary competitiveness in the industry

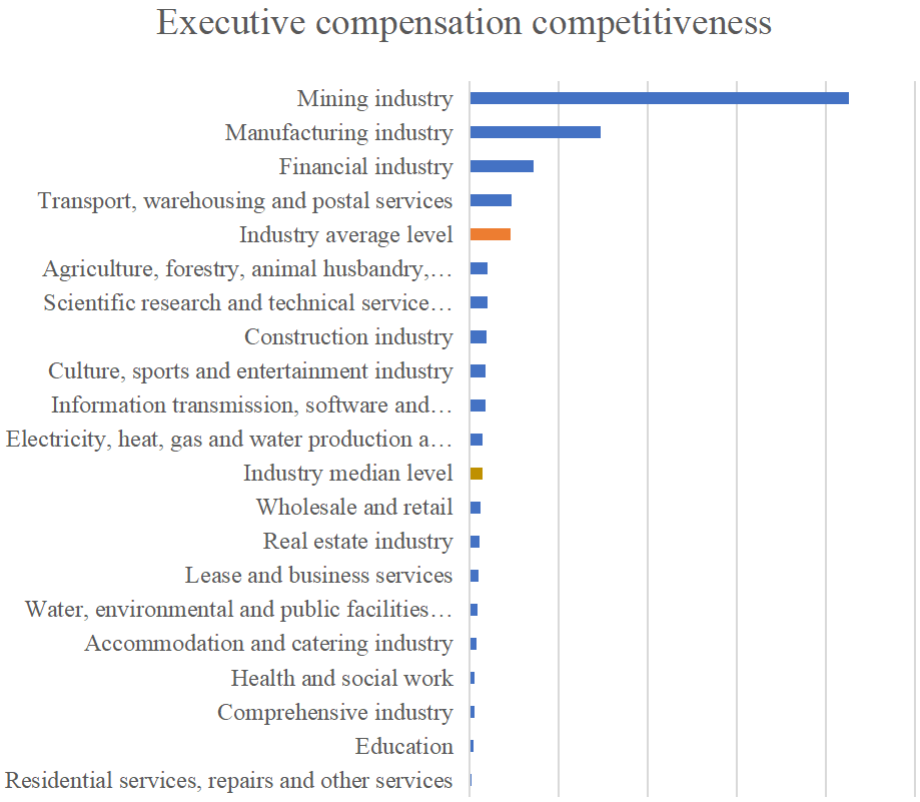

Figure 4.4 Ranking of industry executive compensation competitiveness

The industry with a higher average salary of employees is also in the

manufacturing industry, but the industry with higher executive salaries is the mining industry. This finding also fully shows that the industry is very different in terms of salary gaps. Thus, although the manufacturing industry is an industry with very fierce market competition, it is also a very competitive industry.

Table 4.2 Design of control variables

Generic designation	Variable name	Symbol	Calculation
Enterprise operation status	Asset-Liability ratio	lev	Total liabilities/total assets
	Firm size	scale	Ln (total assets)
Preferential policies	Tax return and relief	txre	Tax return and relief
	Government subsidies	subp	government subsidy
The concentration of CEO power	CEO-chairman duality	ceo_dual	The chairman and CEO are the same people, take 1, otherwise take 0
Differences in property rights	Nature of property rights	soe	1 for state-owned enterprises and 0 for non-state-owned enterprises
regional difference	Regional economic development	region	The total factor productivity measures the comprehensive level of regional economic development. If the regional value is higher than the median value, take 1. Otherwise, take 0
Industry differences	The degree of industry competition	indcp	The number of companies in the industry/ The number of companies in the A-share market, higher than the median, take 1. Otherwise, take 0
	Industry employee compensation level	indstf	Industry per capita salary level/A-share market per capita salary level, higher than the median value, take 1. Otherwise, take 0
	Remuneration level of industry executives	indmnt	Industry executive compensation level/A-share market executive compensation level, higher than the median value, take 1. Otherwise, take 0

4.2 Modeling

In order to verify Hypothesis 1, Hypothesis 2.a, Hypothesis 2.b, Hypothesis 3, this

paper constructs models 4.1-4.3:

$$\text{Pay\_gaps} = \beta \times \text{rdi} + \alpha \times \text{controls} + \varepsilon \quad (4.1)$$

$$\text{Performs} = \beta \times \text{Pay\_gaps} + \alpha \times \text{controls} + \varepsilon \quad (4.2.a)$$

$$\text{Performs} = \beta \times \text{rdi} + \alpha \times \text{controls} + \varepsilon \quad (4.2.b)$$

$$\text{Performs} = \beta \times \text{Pay\_gaps} + \gamma \times \text{rdi} + \delta \times \text{Pay\_gaps} \times \text{rdi} + \alpha \times \text{controls} + \varepsilon \quad (4.3)$$

Model 4.1 examines the impact of R&D investment intensity (rdi) on the internal compensation gap (pay_gaps). Model 4.2.a and Model 4.2.b examine the impact of the internal compensation gap and R&D investment intensity on corporate performance. Finally, model 4.3 examines the moderating effect of R&D investment intensity on the relationship between the internal compensation gap and corporate performance. In the above models, the explanatory variables are uniformly used to lag the value of one period to prevent endogenous problems. The explanatory variable and the control variable adopt the current value.

Among them, “pay_gaps” embodies the compensation gap between the executives and employees (msr) and the compensation gap between R&D employees and other ordinary employees (rsr), see Table 4.1 in 4.2.2 for details.

The variable “performs” includes “roe”, “roa”, “rop”, see Table 4.3 in 4.2.3 for details. “rdi” stands for R&D investment intensity. “controls” means all control variables; see Table 4.2 in 4.2.4 for more information.

5. Empirical Results Analysis

5.1 Descriptive Statistical Analysis

(1) Distribution of variables in model 4.1

Table 5.1 is the descriptive statistical results after winsorizing the data in model 4.1.

Table 5.1 Descriptive statistics of Model 4.1 main variables

Variable	Obs	Mean	Std.Dev.	Min	Max
msr	452	9.322	5.157	2.525	35.620
rsr	372	1.308	0.603	0.023	4.220
rdi	536	1.682	12.190	0.029	108.900
rda	538	0.069	0.066	0.013	0.478
lev	538	0.333	0.183	0.037	0.854
scale	538	11.390	0.960	9.658	14.900
txre	538	0.023	0.031	0.000	0.178
subp	538	0.004	0.016	0.000	0.122
ceo dual	538	0.556	0.497	0	1
soe	538	0.052	0.222	0	1
region	538	0.862	0.345	0	1
indcp	538	0.976	0.154	0	1
indstf	538	0.628	0.484	0	1
indmnt	538	0.613	0.487	0	1

According to the data in the table, in the internal compensation gap of a company, the average salary of executives is 9.322 times that of ordinary employees, and the highest is even 35 times, indicating that there is a big difference in the salary gap between executives and employees. The average salary of R&D personnel is 1.3 times that of ordinary employees, and the highest is four times. The results illustrate a huge gap between executives and employees. Employees need to experience fierce competition to become executives. The salary of employees in the R&D department is relatively high. It demonstrates that employees who are creative or master important technology can enjoy preferential treatment through engagement in R&D activities,

In terms of enterprise innovation, the company's R&D intensity is around 1.682, with a maximum value of 108.9, indicating that R&D expenditures are far higher than the company's operating income. As a whole, the average R&D expenditure as a

proportion of total assets is around 6.9%. It shows that in the market, the intermediate R&D investment level of Sci-tech innovation board companies is relatively high, but this is an enormous burden on the company's profitability.

Among the control variables, the average Asset-Liability ratio of enterprises is about 33%, with an interval between 3% and 85%. Firm size is measured by the logarithm of total assets, which is challenging to compare intuitively. Still, seen from the standard deviation of 0.960, there is not much difference between individuals, which has a specific relationship with China's capital requirements for companies to go public. The values of the two variables, tax deductions and refunds and government subsidies, are relatively small, and it is not intuitive to see any impact.

In the control variables of 0-1 distribution, it can be seen that nearly 55.6 % of the enterprises with CEO-chairman duality. State-owned enterprises accounted for 5.2 percent, a relatively small proportion. The high level of economic development at the company's location accounted for 86.2%, indicating that the company's growth is inseparable from regional development. The high level of the regional economy can bring more abundant resources to the company. At the same time, the development of the regional economy also requires the company's economic contribution. The high degree of competition in the industry in which the company is located accounts for 97.6%, indicating that Sci-tech innovation board companies face more intense industry competition, so companies must pay more attention to innovation activities to create competitiveness for companies. The remuneration of executives in the industry accounted for 62.8 %. The remuneration of employees in the industry accounted for 61.3 %, indicating that Sci-tech innovation board members are likely to be tempted by higher external remuneration. To retain high net worth talents, making some appropriate arrangements on the salary incentive mechanism is necessary.

(1) Distribution of variables in models 4.2 and 4.3

Table 5.2 is the basic distribution of the main variables in models 4.2 and 4.3

Table 5.2 Descriptive statistics of models 4.2 and 4.3

Variable	Obs	Mean	Std.Dev.	Min	Max

roe	535	0.151	0.165	-0.633	0.823
roa	538	0.113	0.116	-0.399	0.556
rop	538	1.281	1.355	-3.543	5.649
msr	403	8.852	5.085	2.249	30.980
rsr	325	1.232	0.581	-0.687	3.053
rdi	536	1.682	12.190	0.029	108.900
rda	538	0.069	0.066	0.013	0.478
lev	538	0.333	0.183	0.037	0.854
scale	538	11.390	0.960	9.658	14.900
txre	538	0.023	0.031	0.000	0.178
subp	538	0.004	0.016	0.000	0.122
ceo dual	538	0.556	0.497	0	1
soe	538	0.052	0.222	0	1
region	538	0.862	0.345	0	1
indcp	538	0.976	0.154	0	1
indstf	538	0.628	0.484	0	1
indmnt	538	0.613	0.487	0	1

This paper uses the one-period lagged data of the explained variables. The explained variables and explanatory variables are based on two years' data rather than three years, so the total number of samples is 538 rather than 807 (807 is the total number of all samples for three years). Due to the lack of some data, part of the total number of samples less than 538.

In this table, return on equity (ROE), return on total assets (ROA), and return on human investment (ROP) reflect the company’s operational capabilities and performance levels. According to the data in the table, the average ROE of the sample companies is 15%, and the maximum and minimum values are 82.3% and -63.3%, respectively, which is quite different. The average ROA is around 11.3%, and the maximum and minimum values are 55.6% and -39.9%, respectively. The average ROP

is 1.281, but the span between the maximum and minimum is large. The results reflect that listed companies' financial performance on the Sci-tech innovation board in China is very different and fluctuates wildly.

Because the internal compensation gap variable in Model 4.1 uses the data of one period lagging, compared with this table, the salary gap data in the lagging period is larger than the current value. Thus, the study confirms that enterprises tend to widen the compensation gap between the executives and employees and the compensation gap between the R&D department employees and other employees.

In this table, the variable of Internal compensation gap is multiplied by the variable of R&D investment to obtain a new variable, which is used to explain the variable of the moderating effect of R&D investment. In addition, the distribution of the remaining variables is consistent with that of Model 4.1.

5.2 Correlation Analysis

Before the regression analysis, this paper tests the correlation between the variables. The results are shown in Table 5.3-5.5. And the absolute value of the correlation coefficient between the main variables does not exceed 0.8, indicating that there is no multicollinearity in the model, and multiple regression analysis can be carried out.

(1) The evidence from the observation shows that the correlation between R&D investment intensity (rdi) and the indicators of internal compensation gap is positive, especially the correlation between R&D staff and ordinary staff pay gap (rsr) is significantly positive. But the proportion of R&D investment expenditures on the total asset is negatively corresponding to the compensation gap between the executive and staff.

(2) This experiment did not detect the evidence of the very significant correlation between the internal compensation gap and a firm's financial performance, except for the positive correlation between return on human capital (rop) and the compensation gap between R&D employees and other employees (rsr).

(3) There is a significant negative correlation between innovation R&D investment and a firm's financial performance in the short term (the average listed companies in the sector are less than three years). Thus, the findings preliminary confirms hypothesis 2.b.

In summary, the results of the Pearson correlation analysis are not consistent with the assumptions of this article, except for the correlation between the R&D intensity and the financial performance. But the correlation analysis has its limitations, and the correlation analysis results can only initially show the relationship between the variables. Therefore, the correlation between the various variables needs to be further explored through the regression model.

Table 5.3 Correlation Analysis of Model 4.1

	msr	rsr	rdi	rda	txre	subp	lev	scale	ceo dual	soe	region	indcp	indstf	indmnt
msr	1													
rsr	0.252***	1												
rdi	0.081*	0.233***	1											
rda	-0.105**	0.199***	0.469***	1										
txre	0.114**	-0.013	0.063	0.035	1									
subp	0.235***	-0.092*	0.018	-0.240***	0.209***	1								
lev	0.010	0.081	0.320***	0.220***	0.013	-0.027	1							
scale	0.049	0.182***	0.510***	0.273***	0.033	-0.039	0.131***	1						
ceo dual	-0.046	-0.030	-0.076*	-0.018	-0.120***	-0.117***	0.025	-0.002	1					
soe	-0.088*	-0.118**	-0.031	-0.072*	0.146***	0.228***	-0.099**	0.000	-0.245***	1				
region	-0.079*	0.079	0.002	0.089**	-0.095**	-0.032	-0.041	-0.112***	0.034	-0.101**	1			
indcp	-0.031	0.118**	0.020	0.027	0.090**	0.013	0.045	0.038	0.030	0.037	0.007	1		
indstf	-0.166***	-0.023	-0.167***	0.050	-0.042	-0.062	0.091**	-0.091**	-0.007	-0.028	0.050	0.004	1	
indmnt	-0.057	-0.045	-0.016	0.005	-0.183***	-0.033	0.015	-0.005	0.028	-0.055	0.060	-0.026	0.321***	1

Note : *, * *, * * * are significant at 10 %, 5 %, 1 % significance level respectively.

Table 5.4 Correlation Analysis of Model 4.2 and Model 4.3

	roe	roa	rop	msr	rsr	rdi	rda	lev	scale	txre	subp
roe	1										
roa	0.879***	1									
rop	0.592***	0.694***	1								
msr	0.056	0.023	0.063	1							
rsr	-0.050	-0.026	0.110**	0.217***	1						
rdi	-0.448***	-0.450***	-0.418***	0.039	0.032	1					
rda	-0.281***	-0.239***	-0.431***	-0.091*	0.077	0.469***	1				
lev	0.062	-0.183***	-0.203***	0.146***	-0.037	0.063	0.035	1			
scale	-0.249***	-0.370***	-0.113***	0.193***	-0.078	0.018	-0.240***	0.209***	1		
txre	-0.128***	-0.117***	-0.164***	-0.023	-0.054	0.320***	0.220***	0.013	-0.027	1	
subp	-0.236***	-0.235***	-0.223***	0.034	0.088	0.510***	0.273***	0.033	-0.039	0.131***	1
ceo dual	0.029	0.081*	0.088**	-0.023	0.014	-0.076*	-0.018	-0.120***	-0.117***	0.025	-0.002
soe	-0.029	-0.064	-0.063	-0.074	-0.141**	-0.031	-0.072*	0.146***	0.228***	-0.099**	0.000
region	0.039	0.053	-0.022	-0.060	0.135**	0.002	0.089**	-0.095**	-0.032	-0.041	-0.112***
indcp	0.024	0.001	-0.094**	-0.059	0.105*	0.020	0.027	0.090**	0.013	0.045	0.038
indstf	0.040	0.011	-0.040	-0.204***	0.027	-0.167***	0.050	-0.042	-0.062	0.091**	-0.091**
indmnt	-0.022	-0.012	-0.021	-0.050	0.046	-0.016	0.005	-0.183***	-0.033	0.015	-0.005

Note : *, * *, * * * are significant at 10 %, 5 %, 1 % significance level respectively.

Table 5.4 Correlation Analysis of Model 4.2 and Model 4.3 (Continued)

	ceo dual	soe	region	indcp	indstf	indmnt
ceo dual	1					
soe	-0.245***	1				
region	0.034	-0.101**	1			
indcp	0.030	0.037	0.007	1		
indstf	-0.007	-0.028	0.050	0.004	1	
indmnt	0.028	-0.055	0.060	-0.026	0.321***	1

Note : *, * *, * * * are significant at 10 %, 5 %, 1 % significance level respectively.

5.3 Multiple Regression Analysis

After standardizing the data, this article uses Multiple regression to verify the assumptions in Chapter 3. The verification results are shown in Table 5-1, Table 5-2, and Table 5-3.

Table 5-1 Multiple regression results of innovation input and internal salary gap

	(1)	(2)
Variables	**msr**	**rsr**
rdi	0.053	0.151
	(0.97)	(0.91)
lev	0.055	-0.009
	(1.03)	(-0.16)
scale	0.242***	-0.081
	(3.14)	(-1.41)
txre	0.002	-0.001
	(0.04)	(-0.01)
subp	0.003	0.081
	(0.06)	(0.59)
ceo_dual	-0.102	-0.101
	(-1.07)	(-1.01)
soe	-0.768***	-0.465*
	(-3.38)	(-1.96)
region	-0.218*	0.211
	(-1.65)	(1.41)
indcp	-0.185	0.693**
	(-1.29)	(2.33)
indstf	-0.296***	0.060
	(-2.99)	(0.61)
indmnt	-0.002	-0.097
	(-0.02)	(-0.97)
Constant	0.659***	-0.766**
	(3.45)	(-2.37)
Observations	451	371
R-squared	0.115	0.100
adj_R2	0.0931	0.0726
F	3.624	2.287

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5-1 is the regression result of R&D investment intensity on the company's

internal salary gap. The compensation gap within the enterprise includes the compensation gap between the executive officers and staff and the compensation gap between R&D staff and other Staff. This paper measures the impact of R&D investment intensity on the two internal salary gap indicators. It can be seen from Table 5-1 that R&D investment intensity has a positive impact on the compensation gap. No significant evidence was found on the correlation between the one-period-lagged internal compensation gap and the current R&D intensity. The findings are contrary to hypothesis 1. A possible explanation for this might be: 1) the Sci-tech companies listed for no longer than three years, many of the mechanisms in the companies are full of change and uncertainty. 2) In order to adapt to the new market rules, enterprises are constantly exploring and adjusting the internal system.

In the regression results of the control variables, the enterprise's Asset-Liability ratio has no significant effect on internal compensation disparity. Firm size has a significant positive correlation with the compensation gap between executives and staff. But it negatively correlates with the compensation gap between R&D staff and other Staff without significance. This result may be explained by the fact that the enterprise manages more employees in general with a larger firm scale. The more detailed the division of employee ranks and positions in large enterprises, the greater the salary gap between senior managers and ordinary employees.

Neither Tax return and relief nor Government subsidies have a significant impact on the compensation gap. And from the perspective of the concentration of management power, no significant correlation was observed between the CEO-chairman duality and the internal compensation gap. The combination of chairman and general manager means that there are no principal-agent problems. If the chairman is the CEO, they will consider maximizing the corporate interests prior to the self-interests. The ownership concentration possibly significantly affects the compensation gap between the CEO and other executives rather than on the other compensation gaps.

From the perspective of the nature of property rights, state-owned enterprises are more inclined to narrow the salary gap between executives and employees than the

salary gap between the R&D employees and other employees. On the one hand, the national salary limit order restricts the executive compensation of state-owned enterprises in recent years. On the other hand, state-owned enterprises are more inclined to keep enterprises stable in harmony than non-state-owned enterprises. As stated by the theory of behavior, narrowing the salary gap is beneficial to increase team cohesion and reduce employees' dissatisfaction at the bottom of the salary inequity.

From the analysis of regional economic development, the developed regional economy has a 0.1 level of significant impact on the compensation gap between the executives and staff. Though it positively impacts the compensation gap between R&D staff and other staff, the finding is not significant. It indicates that enterprises tend to narrow the compensation gap in the more developed region.

As for the industry differences, the results reveal that the higher degree of industry competition will significantly promote the compensation gap between the R&D employee-employee. However, the competition degree impacts negatively on the executive-staff compensation gap without significance. This result is in reflection of both Tournament theory and Behavioral theory. The widening of the salary gap between adjacent levels seems to be more conducive to motivating employees to improve their performance for promotion. Usually, the gap between the top executives and ordinary employees may be widely divided into many levels. To enhance cohesion, the company should limit the exceptional salary of the executives and narrow the salary gap between executives and ordinary employees, especially the bottom employees. Increasing the remuneration of the bottom employees is conducive to the unity of the company. The measures concur with the behavior theory. The findings may suggest that companies are more inclined to widen the pay gap between adjacent levels in the context of fierce industry competition but narrow the cross-level pay gap.

In terms of industry remuneration differences, if the external salary of the employees is relatively high, it is significantly not conducive for companies to increase the salary gap between executives and employees. There is no significant evidence showing that the executives' external salary has a relatively negative correlation with

the compensation gap.

Table 5-2 Multiple regression results of the internal compensation gap of the enterprise and the performance of the enterprise

	(3)	(4)	(5)		(6)	(7)	(8)
Variables	**roe**	**roa**	**rop**	**Variables**	**roe**	**roa**	**rop**
msr	0.080**	0.094***	0.083	rsr	-0.041	-0.028	0.136*
	(2.22)	(2.75)	(1.63)		(-0.47)	(-0.33)	(1.66)
lev	0.126*	-0.091*	-0.203***	lev	0.086	-0.072	-0.232***
	(1.85)	(-1.69)	(-3.46)		(1.34)	(-1.24)	(-3.53)
scale	-0.237***	-0.324***	-0.085*	scale	-0.195***	-0.255***	-0.025
	(-5.59)	(-7.68)	(-1.66)		(-3.91)	(-5.11)	(-0.46)
txre	0.017	0.025	-0.028	txre	-0.118	-0.111	-0.102
	(0.22)	(0.39)	(-0.44)		(-1.21)	(-1.23)	(-1.28)
subp	-0.230**	-0.242**	-0.212**	subp	-0.191**	-0.213***	-0.230***
	(-2.19)	(-2.59)	(-2.37)		(-2.40)	(-2.94)	(-2.78)
ceo_dual	-0.052	-0.023	0.005	ceo_dual	0.007	-0.002	0.050
	(-0.65)	(-0.29)	(0.05)		(0.07)	(-0.02)	(0.43)
soe	0.043	0.127	-0.123	soe	0.033	0.061	-0.046
	(0.28)	(0.96)	(-0.75)		(0.19)	(0.40)	(-0.25)
region	0.142	0.129	-0.143	region	-0.040	-0.030	-0.180
	(1.43)	(1.35)	(-1.04)		(-0.33)	(-0.26)	(-1.19)
indcp	0.215**	0.186	-0.487	indcp	0.194	0.216	-0.184
	(2.07)	(1.57)	(-1.22)		(1.07)	(1.12)	(-0.43)
indstf	-0.099	-0.137	-0.181	indstf	0.049	0.007	-0.099
	(-0.73)	(-1.07)	(-1.30)		(0.36)	(0.05)	(-0.65)
indmnt	0.007	-0.075	-0.145	indmnt	-0.027	-0.086	-0.222
	(0.06)	(-0.71)	(-1.16)		(-0.25)	(-0.78)	(-1.62)
Constant	-0.251*	-0.149	0.887**	Constant	-0.298	-0.230	0.478
	(-1.93)	(-1.04)	(2.10)		(-1.51)	(-1.09)	(1.09)
Observations	401	403	403	Observations	323	325	325
R-squared	0.138	0.211	0.121	R-squared	0.160	0.201	0.161
adj_R2	0.113	0.189	0.0959	adj_R2	0.130	0.173	0.132
F	5.662	9.006	4.475	F	3.029	5.775	5.299

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The regression results in Table 5-2 show that the compensation gap between the executive officer and staff has a significant positive impact on ROE and ROA and no significant effect on ROP. The results prove Hypothesis 2.a. The compensation gap

between R&D staff and other Staff has a significant positive effect on ROP and no significant effect on ROE or ROA. The results partially demonstrate Hypothesis 2.a. It can therefore assume that if the Sci-tech companies widen the compensation gap between executive officers and employees, it can motivate employees and promote financial performance in compliance with the tournament theory. Widening the salary gap between R&D employees and ordinary employees can bring higher returns on human capital.

The Asset-Liability ratio has a significant positive effect on ROE at a 0.1 level, while it has a significant negative impact on ROA and ROP. Firm size shows a significant inhibitory effect on ROE and ROA. No significant evidence indicates the correlation between the tax return and relief and the financial performance in the models. But the government subsidies have a significant negative impact on the financial performance of the companies. Neither CEO duality, property rights, nor regional development difference significantly impacts financial performance.

Regarding industry differences, in the model containing the executive-staff compensation gap, the higher level of industry competition has a significant positive impact on ROE. The high external compensation of the employees or the executives has no significant effect on the financial performance.

Table 5-3 Multiple regression results of innovation investment and corporate performance

	(9)	(10)	(11)
Variables	**roe**	**roa**	**rop**
rdi	-0.435***	-0.429***	-0.387***
	(-5.35)	(-7.07)	(-9.86)
lev	0.161***	-0.075*	-0.147***
	(2.86)	(-1.71)	(-3.35)
scale	-0.286***	-0.364***	-0.080**
	(-7.20)	(-9.58)	(-2.02)
txre	0.001	0.016	-0.038
	(0.02)	(0.28)	(-0.75)
subp	-0.037	-0.041	-0.036
	(-0.68)	(-0.91)	(-0.81)
ceo_dual	-0.055	-0.014	0.046
	(-0.78)	(-0.20)	(0.60)

soe	-0.057	0.056	-0.190
	(-0.47)	(0.50)	(-1.55)
region	0.146*	0.131*	-0.101
	(1.88)	(1.78)	(-0.95)
indcp	0.179	0.158	-0.425
	(1.49)	(1.19)	(-1.20)
indstf	-0.156	-0.225**	-0.258**
	(-1.50)	(-2.36)	(-2.55)
indmnt	0.019	-0.033	-0.047
	(0.22)	(-0.41)	(-0.52)
Constant	-0.166	-0.085	0.691*
	(-1.14)	(-0.55)	(1.88)
Observations	533	536	536
R-squared	0.302	0.369	0.240
adj_R2	0.287	0.356	0.224
F	11.62	23.04	20.36

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5-3 is the regression result of R&D investment intensity on company performance. Financial performance includes ROE, ROA, and ROP. This article measures the impact of R&D investment intensity on the three financial performance indicators. It can be seen from Table 5-3 that R&D investment intensity has a significant negative effect on financial performance, and hypothesis 2.b has been verified.

We now turn to the control variables' effect: Asset-Liability ratio has a significant positive effect on ROE. But the Asset-Liability ratio has a significant negative impact on ROA and ROP to the extent of 0.01-0.1. These findings show that the Asset-Liability ratio can partially improve the profitability of enterprises. Firm size has significant negative effects on all the performance indicators. The bigger the enterprise-scale, the more complicated the corporate governance. Management costs inhibit financial performance to a certain extent. In terms of preferential policies, there is no significant relationship between the companies' tax returns and relief and financial performance. The enterprise obtains government subsidies, which are not significantly related to financial performance. The CEO duality and the property rights have no significant impact on the performance. The level of regional economic development has a weak

and significant positive impact on enterprises' return on ROE and ROA. Regarding the industry difference, the high external employees' compensation level has a significant negative impact on the ROE and ROP.

Table 5-4 Moderating effect of R&D investment intensity

	(12)	(13)	(14)		(15)	(16)	(17)
Variables	roe	roa	rop	Variables	roe	roa	rop
msr	0.079**	0.093***	0.083*	rsr	-0.005	0.008	0.188**
	(2.31)	(2.86)	(1.68)		(-0.07)	(0.11)	(2.51)
rdi	0.510*	0.429***	0.538	rdi	-0.512***	-0.484***	-0.366***
	(1.68)	(2.90)	(0.88)		(-7.68)	(-7.94)	(-6.77)
msr*rdi	-0.740***	-0.649***	-0.673	rsr*rdi	-0.011	-0.011	-0.074
	(-3.46)	(-5.59)	(-1.53)		(-0.14)	(-0.16)	(-1.25)
lev	0.195***	-0.026	-0.147***	lev	0.157***	-0.002	-0.163***
	(4.02)	(-0.76)	(-2.98)		(3.86)	(-0.05)	(-3.08)
scale	-0.258***	-0.343***	-0.102**	scale	-0.233***	-0.292***	-0.057
	(-6.89)	(-9.07)	(-2.06)		(-6.12)	(-7.51)	(-1.13)
txre	0.077	0.079*	0.020	txre	0.023	0.022	-0.005
	(1.58)	(1.69)	(0.32)		(0.58)	(0.56)	(-0.07)
subp	0.046	0.009	0.007	subp	0.030	-0.005	-0.043
	(0.98)	(0.21)	(0.13)		(0.60)	(-0.11)	(-0.86)
ceo_dual	-0.067	-0.036	-0.006	ceo_dual	-0.040	-0.046	0.014
	(-0.89)	(-0.49)	(-0.06)		(-0.50)	(-0.53)	(0.13)
soe	0.075	0.155	-0.096	soe	0.033	0.061	-0.046
	(0.51)	(1.19)	(-0.60)		(0.19)	(0.41)	(-0.26)
region	0.285***	0.258***	-0.030	region	0.118	0.120	-0.047
	(3.18)	(2.95)	(-0.23)		(1.32)	(1.30)	(-0.34)
indcp	0.178*	0.153	-0.516	indcp	0.077	0.103	-0.293
	(1.86)	(1.40)	(-1.36)		(0.43)	(0.53)	(-0.73)
indstf	-0.250**	-0.277**	-0.303**	indstf	-0.148	-0.182*	-0.263*
	(-2.14)	(-2.46)	(-2.27)		(-1.42)	(-1.67)	(-1.89)
indmnt	0.129	0.038	-0.048	indmnt	0.063	0.002	-0.136
	(1.38)	(0.42)	(-0.41)		(0.73)	(0.02)	(-1.09)
Constant	-0.253*	-0.154	0.896**	Constant	-0.210	-0.145	0.556
	(-1.96)	(-1.13)	(2.20)		(-1.05)	(-0.67)	(1.37)
Observations	400	402	402	Observations	322	324	324
R-squared	0.276	0.320	0.176	R-squared	0.384	0.377	0.253
adj_R2	0.252	0.297	0.148	adj_R2	0.358	0.350	0.222
F	22.67	152.1	8.204	F	9.618	16.02	47.25

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The regression results in Table 5-4 show that corporate R&D investment intensity has a negative moderating effect on the correlation between the compensation gap and the financial performance indicators, which verifies Hypothesis 3. The negative moderating effect of R&D intensity is significant on the correlation between the executive-staff gap and ROE or ROA. In the model of the executive-staff compensation gap and financial performance, R&D intensity has a significant positive coefficient, which is unexpected. On the contrary, in the model of the R&D staff and other staff compensation gap and financial performance, R&D intensity is negatively related to the financial performance at a 0.01 significance level.

Regarding the control variables of the model, the Asset-Liability ratio has shown significant positive effects on ROE, but negative on ROA and ROP. The firm size has a significant inhibitory effect on ROE and ROA. In the model containing the executive-staff compensation gap, the tax return and relief showed a weakly significant positive effect on ROA. No considerable evidence suggests the correlation between government subsidies and financial performance. Neither CEO duality nor property rights have a significant impact on the performance. In the model with the compensation gap between executives and staff, there is a significant positive impact of the high regional development level on ROE and ROA. It can be suggested that the performance of the companies might depend on the total factor productivity level of the specific region.

In the model containing the executive-staff compensation gap, the degree of industry competition has a positive impact on ROE at a 0.1 level of significance, and the industry employee compensation has a negative impact on financial performance at an extent of 0.05 significance level. While in the model containing the compensation gap between R&D staff and other staff, there is a lower significant level of the negative impact of the external employee compensation on the performance of the enterprise. Besides, the industry executive compensation has no significant impact on financial performance.

To summarize how the R&D intensity, internal compensation gap, and financial

performance of a company affect each other:

First, R&D intensity has no significant effect on the inner compensation gap, including the compensation gap between executives and staff, and the compensation gap between R&D staff and other staff. Surprisingly, the findings are contrary to Hypothesis 1. The findings are unexpected and suggest that the current Sci-tech companies don't have a clear compensation gap preference.

Second, there is a significant positive correlation between ROE/ROA and the compensation gap between executives and staff, and a significant positive correlation between ROP and the compensation gap between R&D staff and other staff. The results validate Hypothesis 2.a. In comparison, there is no significant evidence proving the correlation between the ROP and the executive-staff compensation gap and the correlation between ROE/ROA and the compensation gap between R&D staff and other staff. In the comparison, the executive-staff compensation gap seems more substantial to the performance than the compensation gap of the adjacent level between R&D staff and other staff. The results in this sector indicate that the practice of widening the compensation gap, especially the executive-staff compensation gap, can improve the performance of the Sci-tech companies. On the other hand, R&D intensity has a significant adverse effect on financial performance. The possible reason is the high R&D investment in the short term can not bring out a positive return to the enterprises but the expenditures on R&D projects increase the financial load for the enterprise.

Third, R&D investment intensity has a significant negative moderating effect on the correlation between the executive-staff compensation gap and ROE/ROA, which verifies Hypothesis 3. In the interactive model of the executive-staff compensation gap and the financial performance, the R&D intensity tends to improve the performance, which is unanticipated and contrary to the findings in the interactive model of the R&D staff and other staff compensation gap and the financial performance. It suggests that the widened compensation gap of the cross-level between the executives and the staff might possibly increase the financial performance of the firm, but the increased R&D intensity might weaken the positive effect. The R&D intensity also negatively

moderates the correlation between the financial performance and the compensation gap between R&D staff and other staff, but the significance level is not high. The significance level of R&D intensity's moderating effects varies from the different subjects.

5.4 Robustness Test

To verify the robustness of the research results above and make the research conclusions more convincing, this paper uses multiple financial performance indicators to compare the effects of R&D investment intensity and internal compensation gap on financial performance. In addition, this paper also replaces the explanatory variable "R&D investment intensity" (rdi) with "R&D expenditure in total assets" (rda) for robustness testing. The model results after replacing the variables are as follows:

Table 5-5 Multiple regression results of innovation input and internal compensation gap of enterprises

	(18)	(19)
Variables	**msr**	**rsr**
rda	-0.093**	0.109
	(-2.08)	(0.85)
lev	0.068	-0.019
	(1.30)	(-0.35)
scale	0.222***	-0.060
	(2.84)	(-1.00)
txre	0.028	0.024
	(0.53)	(0.25)
subp	0.065	0.131
	(1.07)	(1.22)
ceo_dual	-0.121	-0.144
	(-1.27)	(-1.36)
soe	-0.784***	-0.512**
	(-3.45)	(-2.14)
region	-0.164	0.222
	(-1.26)	(1.51)
indcp	-0.178	0.701**
	(-1.17)	(2.35)
indstf	-0.291***	-0.021
	(-2.96)	(-0.18)
indmnt	-0.010	-0.124
	(-0.10)	(-1.22)

Constant	0.614***	-0.674**
	(3.08)	(-2.02)
Observations	452	372
R-squared	0.120	0.093
adj_R2	0.0980	0.0652
F	4.088	2.346

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The regression results in Table 5-5 are not completely consistent with those in Table 5-1. There is significant evidence at a 0.05 level of the negative correlation between the R&D expenditure proportion and the executive-staff compensation gap, but the coefficient number is very small.

Table 5-6 Multiple regression results of innovation investment and corporate performance

	(20)	(21)	(22)
Variables	**roe**	**roa**	**rop**
rda	-0.327***	-0.289***	-0.425***
	(-3.83)	(-3.53)	(-8.27)
lev	0.154***	-0.084*	-0.142***
	(2.77)	(-1.84)	(-3.33)
scale	-0.365***	-0.434***	-0.183***
	(-8.73)	(-10.50)	(-4.66)
txre	-0.049	-0.040	-0.059
	(-0.71)	(-0.62)	(-1.15)
subp	-0.151***	-0.163***	-0.104*
	(-2.60)	(-3.03)	(-1.93)
ceo_dual	-0.003	0.041	0.079
	(-0.04)	(0.53)	(1.03)
soe	0.013	0.126	-0.137
	(0.11)	(1.13)	(-1.17)
region	0.148*	0.121	-0.051
	(1.80)	(1.55)	(-0.49)
indcp	0.200	0.178	-0.400
	(1.52)	(1.35)	(-1.10)
indstf	0.067	-0.010	-0.052
	(0.62)	(-0.10)	(-0.53)
indmnt	-0.031	-0.080	-0.093
	(-0.33)	(-0.92)	(-1.06)

Constant	-0.347**	-0.251	0.487
	(-2.10)	(-1.54)	(1.32)
Observations	535	538	538
R-squared	0.239	0.290	0.279
adj_R2	0.223	0.276	0.264
F	13.49	17.65	18.36

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The regression results in Table 5-6 are almost consistent with those in Table 5-3. The increase in the proportion of R&D investment in total assets has a significant negative impact on all three financial performance indicators. In terms of control variables, Government subsidies have a significant negative impact on corporate performance. The significance level is inconsistent with the conclusions in Table 5-3. Though the high external employees' compensation level negatively corresponds to ROE and ROP, the results are not that significant, which is inconsistent with the conclusions in Table 5-3.

Table 5-7 Moderating effect of R&D investment intensity

	(23)	(24)	(25)		(26)	(27)	(28)
Variables	**roe**	**roa**	**rop**	**Variables**	**roe**	**roa**	**rop**
msr	0.120	0.109	0.113	rsr	0.011	0.033	0.195**
	(1.32)	(1.35)	(1.35)		(0.13)	(0.37)	(2.18)
rda	-0.179	-0.216	-0.366***	rda	-0.279	-0.232	-0.399***
	(-0.86)	(-1.12)	(-2.75)		(-1.35)	(-1.13)	(-3.10)
msr*rda	-0.116	-0.059	-0.112	rsr*rda	-0.090	-0.116	-0.098
	(-0.56)	(-0.33)	(-0.91)		(-0.42)	(-0.54)	(-0.75)
lev	0.156***	-0.066	-0.158***	lev	0.144***	-0.016	-0.154***
	(2.84)	(-1.58)	(-3.32)		(3.31)	(-0.42)	(-3.02)
scale	-0.290***	-0.373***	-0.170***	scale	-0.274***	-0.327***	-0.134***
	(-7.23)	(-9.33)	(-3.52)		(-6.54)	(-7.61)	(-2.69)
txre	0.068	0.071	0.052	txre	-0.055	-0.055	-0.012
	(1.13)	(1.30)	(0.90)		(-0.89)	(-0.92)	(-0.18)
subp	-0.145**	-0.166**	-0.080	subp	-0.114**	-0.138***	-0.128*
	(-2.05)	(-2.41)	(-1.14)		(-2.09)	(-2.61)	(-1.82)
ceo_dual	-0.054	-0.022	0.006	ceo_dual	-0.011	-0.017	0.028
	(-0.69)	(-0.29)	(0.06)		(-0.13)	(-0.18)	(0.26)
soe	0.069	0.149	-0.083	soe	0.047	0.078	-0.026

	(0.46)	(1.13)	(-0.52)		(0.29)	(0.55)	(-0.15)
region	0.217**	0.199**	-0.022	region	0.095	0.093	0.007
	(2.28)	(2.20)	(-0.18)		(0.97)	(0.95)	(0.05)
indcp	0.247**	0.218**	-0.431	indcp	0.099	0.128	-0.313
	(2.59)	(2.34)	(-1.17)		(0.53)	(0.68)	(-0.82)
indstf	-0.104	-0.137	-0.183	indstf	0.061	0.014	-0.080
	(-0.84)	(-1.17)	(-1.43)		(0.48)	(0.11)	(-0.61)
indmnt	0.064	-0.025	-0.058	indmnt	0.005	-0.053	-0.184
	(0.64)	(-0.26)	(-0.51)		(0.05)	(-0.55)	(-1.56)
Constant	-0.386***	-0.285**	0.653*	Constant	-0.327	-0.255	0.436
	(-2.93)	(-2.24)	(1.68)		(-1.55)	(-1.18)	(1.13)
Observations	401	403	403	Observations	323	325	325
R-squared	0.205	0.267	0.255	R-squared	0.294	0.302	0.324
adj_R2	0.178	0.243	0.230	adj_R2	0.264	0.273	0.296
F	9.314	10.24	18.33	F	8.383	12.49	13.75

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The regression model results in Table 5-7 are not completely consistent with the regression model results in Table 5-4. The proportion of R&D investment in total assets has a negative moderating impact on the correlation between each performance indicator and the compensation gap. The results are similar to the early findings of R&D intensity but not that significant. In contrast, the proportion of R&D investment in total assets shows a significant negative moderating effect on the correlation between the financial performance and the compensation gap between executive and staff. Regarding the control variables, the subsidies have a negative impact on the performance at a significance level from 0.01 to 0.1.

Based on the above, the robustness test results show that:

First, there is a weak impact of enterprise R&D expenditures on the compensation gap. The outcome is contrary to the previous literature. Further research is required to undertake.

Second, the proportion of R&D investment to the total assets has a significant negative impact on each performance indicator, which is the same as the conclusions of R&D intensity.

Third, R&D investment proportion has a negative moderating impact on the

correlation between the compensation gap and the performance, consistent with the previous findings but not as significant as the moderating effect of the R&D intensity. Therefore, the test results are mostly consistent with the previous findings, and the research conclusions of this article are robust.

6 Conclusions and Recommendations

6.1 Conclusions

Based on the 2018-2020 data of listed companies on the China Science and Technology Innovation Board, this paper analyzes the impact of enterprise innovation, internal compensation gap, and financial performance. After regression analysis and robustness testing, the conclusions are as follows:

(1) Contrary to the expectations, the R&D intensity has no significant impact on the compensation gap in the Sci-tech innovation listed companies. Both H1.a and H1.b are rejected. The possible explanation is that the compensation system in Sci-tech companies is quite unclear under a period of economic restructuring, especially the reform of the capital market in China. The enterprise should orient the internal system to the changing policy environment and the needs of the present regulatory system.

(2) The internal compensation gap has a positive impact on the performance of Sci-tech companies. But the significant levels are different. The compensation gap of cross-level between the executives and the staff is shown to have a significantly positive impact on ROE/ROA, and the compensation gap of the adjacent level between the R&D staff and other staff has a significantly positive impact on ROP. The effect of the internal compensation gap of Sci-tech innovation board companies on financial performance varies greatly from the subjects. Overall, the conclusions indicate that the enlarged compensation gap for Sci-tech companies will improve the performance, in line with the tournament theory, which confirms the H2.a.

Conversely, the R&D intensity of Sci-tech innovation board companies has a significant negative impact on financial performance. The findings prove H2.b.

(3) The R&D intensity of Sci-tech innovation board companies has negative moderating effects on the economic consequences of the compensation gap, which complies with Hypothesis 3. But the results are not significant in the robust test with the R&D investment proportion as the substitute variable of R&D intensity. The findings suggest that with the broadening internal compensation gap, the enterprise might improve its performance. However, the negative moderating effect of the R&D

intensity will impair the positive effect of the compensation gap on the performance. The possible explanation for the findings is that high R&D intensity puts the companies at a high risk of R&D failures with possible huge financial loss. As well as the R&D investment return is uncertain in the short term. Before the success of the R&D project, the R&D employees will be blamed for several times R&D failures. Suppose the enterprise chooses to enlarge the compensation gap. In that case, it will hurt the innovation initiative of the R&D employees after experiencing several failures, finally result in a negative impact on the performance. Therefore, with the high R&D intensity, it is not suitable for companies to continue to expand the salary gap, which cannot continuously motivate employees to improve their performance. However, companies should narrow the pay gap and permit or tolerate several failures of the innovation.

(4) Regarding the effects of control variables, no significant evidence shows the correlation between the Asset-Liability ratio and the internal compensation gap. The Asset-Liability ratio usually has a significant positive effect on ROE, but negative on ROA and ROP. Firm size has a significant positive impact on the compensation gap between executives and staff. The possible explanations may be the larger the enterprise size, the higher the company's requirements for executive management capabilities and the company tend to give the management higher promotion incentives. Firm size displays a negative impact on financial performance at different significance levels. The possible explanation should be that corporate management costs rise with the expansion of enterprise size.

Regarding preferential policies, tax returns and relief have no substantial impact on the compensation gap or the performance. The impact of tax return and relief on corporate performance is controversial in different models, which requires further research to understand. However, some of the previous research conclusions show that government preferential tax policies can significantly promote corporate performance (Miao, 2017; Song and Yang, 2021; Yang and Hu, 2021). The impact of government subsidies on the compensation gap is positive but not significant. It indicates that government subsidies flow into the company, which increases the company's

promotion incentives and widens the salary gap between the ranks to a certain extent. Since the government subsidies can make up for the R&D fund shortage, it will probably improve the financial performance. By contrast, the evidence from the Sci-tech innovation companies shows that the government subsidies on the performance are negative at various significance levels, which is inconsistent with the previous studies.

From the perspective of the concentration of CEO power, if the chairman and the CEO are the same people, there are no principal-agent problems, and the management power is relatively concentrated. The findings show that CEO-chairman duality has a negative but not significant impact on the compensation gap. Its impact on the financial performance is controversial but also not that significant. The possible explanation for the negative impacts can indicate that the CEO's more concentrated power will result in 'only one man's words count.' Few constraints are imposed on the CEO. The enterprise will pay dearly for the bad decision attributed to mistakes or even irrationality. As the previous studies unveiled, the situation seems to be more common in high-tech companies (Shi, 2018; Zhao and Wang, 2020).

From the perspective of property rights, state-owned enterprises are significantly inclined to narrow the internal compensation gap compared to non-state-owned enterprises. The possible reason would be the government regulation on the constraints of the compensation gap (Lian, 2019). However, the nature of property rights has no significant impact on corporate performance.

From the perspective of regional economic development degree, the findings show that in the developed region, firms might be inclined to narrow the executive-staff compensation gap at a 0.1 significance level. In a few models, the regional total factor productivity change has a significant positive impact on ROE and ROA. However, the regional total factor productivity change might adversely affect ROP, although the results are not that significant. In the developed regions, the commodity price level is high, and the cost of employees might be higher than in the non-developed regions. The enterprises might pay more to recruit new employees, and the compensation gap becomes narrowed. The employees might have higher motivation to pursue high

salaries and improve their performance.

From the perspective of industry differences, the industry competition degree puts a negative but not significant impact on the executive-staff compensation gap, while a positive impact at a 0.05 significant level on the compensation gap between R&D staff and other staff. In the competitive industry, employees become sensitive to the competition as well as the compensation gap. In the face of fierce competition in the external environment, narrowing the pay gap between executives and employees might be conducive to corporate teamwork. As for the Sci-tech companies, they might offer high pay to tempt the talented R&D personnel and retain brains. Thus, the compensation gap between R&D staff and other staff becomes broadened.

The industry competition degree has a positive impact on ROE and ROA at various significance levels. The possible reasons may be the Sci-tech companies have more advantages in the industry competition. However, the findings indicate that the industry competition degree might negate the return on human capital (ROP). The possible explanation for the results might be the increasing competition among the companies leads to the talent war, which raises the price of human capital. Therefore, the degree of industry competition might impair the human capital return to a certain extent.

The higher level of industry employee compensation has a significant adverse effect on the compensation gap between executive officers and ordinary employees. And it has no difference in the compensation gap between the R&D staff and other staff. The reasons might be the increasing recruitment costs for the Sci-tech enterprises due to the high employee salary in the industry. Based on the behavior theory, the employees will compare the gap between their compensation and others. The employees might feel unsatisfied if their compensation is at the lower class in the industry. In this case, the enterprise needs to improve the bottom employees' compensation at least close to the median level of the industry, which might shrink the gap between the executives and ordinary workers and might burden the financial performance. But the effect of high industry employee compensation on performance is still a matter of some controversy. In most models, the high external employee treatment has a negative impact on the

financial performance at a significance level from 0.01 to 0.05. In a few models, the high industry employee treatment has a positive but not significant impact on the financial performance. Therefore, the correlation between external employee treatment and firm performance needs further researches to understand.

The higher level of industry executive compensation has no significant effect on the compensation gap and the corporate performance.

Some of the reasons for the conflict between the conclusions of this paper and the research hypothesis may be:

First, the company's listing year is relatively short, and the current paper only collects three years of market data. Therefore, the time constraints only allow testing the one-period-lagged effect. In the previous studies, some scholars use the example of ten years of market data and test the effect for two or more periods lagged to understand the long-term influence both of the R&D investment and the compensation gap. The limitation of the sample might result in a vague correlation between the internal compensation gap and the R&D intensity.

Second, the Sci-tech innovation board market regulatory rules have become strict and are still being improved. Companies are still adjusting their internal systems to adapt to the new regulatory rules. Moreover, the complexity of the market increases these years, such as the COVID-19 and the sino-us trade friction, resulting in the volatility of the enterprises' performance.

6.2 Recommendations

For investors who prefer short-term investment, a company with high R&D intensity is not a good choice. In a short time, high innovation investment burdens the firm's performance and increases the operational risks. It cannot bring a positive return right away. If the investors decide to invest in the early stage of the enterprise, they need to psychologically prepare for long-term running and take the high risk of R&D failures. In terms of corporate governance, investors can pay attention to the Sci-tech enterprises with a relatively high compensation gap between executives and employees. Because the findings suggest that enterprises appropriately widening the pay gap can

improve corporate performance. It is worth noting that under the excessive R&D investment, the Sci-tech companies widen the pay gap between R&D employees and employees, which cannot improve corporate performance. Investors should be alert to corporate behaviors of over-investment and inefficient investment in case of the transmission of the interest.

For business managers, the Sci-tech innovation companies shoulder the mission of national innovation strategy and face more fierce global market competition. Therefore, innovation activities are essential for companies. Enterprise innovation can create core competitiveness for enterprises and ensure sustainable development. The key to innovation is to integrate human capital with corporate resources. Therefore, companies need to establish appropriate monitoring and incentive mechanisms to encourage management and employees to engage in innovative activities. Companies should consider fairness and efficiency when setting the pay gap. Based on the principal-agent theory, companies should create a fair, competitive environment, clarify promotion standards, and appropriately widen the internal compensation gap. The arrangement of the company's personnel remuneration will affect the employee's enthusiasm and further impact the corporate performance and innovation. The outcomes show that the enlarged executive-staff compensation gap can positively impact ROE and ROA. And the broadened compensation gap between the R&D staff and other staff has a significant impact on the return on human capital. The evidence supports the tournament-performance view in the Sci-tech innovation companies. However, the negative moderating effect of R&D intensity will impair the tournament effect of the internal compensation gap on financial performance. Therefore, managers should consider avoiding over-investment. In addition, companies should design the compensation system by reference to the outside compensation level in the industry. Strive for government subsidies and accreditation, which can positively improve the firm’s performance. If the industrial compensation is high, companies should improve the treatment of the bottom employees and narrow the compensation gap in case that the employees feel dissatisfied with the current salary.

For government agencies, tax relief and tax returns have no significant influence on the firm's performance. Some findings show that the subsidies can substantially inhibit the Sci-tech companies' performance. But there are still some disputes over the impact. The possible explanation for the results is that government has specific requirements for subsidies. Although government subsidies can mitigate the fund shortage of the firm, the policy burden does not bring a positive incentive effect to enterprises but may make the enterprise performance worse. Therefore, government subsidies do not significantly promote the performance of Sci-tech innovation companies. To avoid the practice of defrauding preferential treatment, relevant government departments should investigate and continuously monitor the situation of enterprises. It is necessary to ensure that various subsidy policies and preferential tax policies can accurately deliver to the enterprises with actual needs. Furthermore, the government should improve the capital market system to ease the financing difficulties of enterprises with high R&D intensity. In addition, the government should improve relevant laws, regulations, and systems as soon as possible, provide support and guidance for corporate innovation activities, and strengthen the protection of corporate intellectual property rights. In terms of corporate pay gap supervision, the government should also strengthen the supervision of executive compensation to prevent executives from using their power to transfer benefits.

6.3 Research Limitations and Prospects

This article has certain limitations.

(1) Since the listed companies on the Science and Technology Innovation Board have relatively short listing years and limited sample data, this paper can only deal with explanatory variables with a one-period lag and does not deal with the second and third lags. Therefore, this paper cannot make an in-depth discussion on the long-term impact of the R&D investment intensity and impact of the compensation gap within the Sci-tech innovation companies. Instead, this paper can only look at the impact of R&D investment intensity and the compensation gap in the short term.

(2) Enterprise innovation is a relatively complicated process. As for the

measurement index of enterprise innovation, this article only considers the aspect of R&D investment and does not consider R&D output, which is not comprehensive enough. Due to the relatively short time to market for Sci-tech innovation companies and limited sample data, the efficiency of the current R&D investment successfully converted into output needs to be tested for a longer time. Future research on sci-tech innovation board companies can consider the number of new products, the scale of capitalized R&D expenditures (intangible assets), and core technologies to measure corporate innovation output.

(3) In the study of the internal salary gap, due to the limited number of companies implementing equity incentive plans in the Chinese market, this article did not consider the shareholding plans of corporate members in the research. Therefore, this paper only considers monetary compensation. I hope that in the future, when data is available, a more comprehensive study can be carried out in conjunction with the scale of participation of corporate members in the shareholding plan.

(4) In terms of sample selection, this article only studies the characteristics of companies listed on the Sci-tech Innovation Board without comparing the Sci-Tech Innovation Board horizontally with other trading sectors. The research conclusions of this paper are mainly around the Sci-tech innovation companies, not suitable for all companies in the market. With the advancement of China's capital market registration system reform and the experience of the sci-tech innovation board, the GEM registration system has launched, and more listed companies have appeared. Further studies can be undertaken. I hope to be able to analyze the comparison of the technological innovation enterprises in different trading markets.

BIBLIOGRAPHY

Adams, J. S. 1965. Inequity In Social Exchange[J], 2: 267-299.

Allan, S., & Gilbert, P. 1995. A social comparison scale: Psychometric properties and relationship to psychopathology[J], 19: 293-299.

Ao, Jiaxin. 2020. Managerial Incentives and Corporate Performance - A Study based on the R&D and Internal Control[D]: Lanzhou University.

Balkin D B., Markman G D., & Gomez-Mejia L R. 2000. Is CEO pay in high technology firm related to innovation[J]. ACADEMY OF MANAGEMENT JOURNAL, 43(6): 1118-1129.

Balafoutas, L., Kerschbamer, R., & Sutter, M. 2012. Distributional preferences and competitive behavior[J]. JOURNAL OF ECONOMIC BEHAVIOR & ORGANIZATION

Berle, A., & Means, G. 1932. The Modern Corporation and Private Property.. Commerce Clearing House.

Bloom, M. 1999. The performance effects of pay dispersion on individuals and organizations[J] [Article], 42(1): 25-40.

Brown, J. R., Fazzari, S. M., & Petersen, B. C. 2009. Financing innovation and growth: Cash flow, external equity, and the 1990s r&d boom[J] [Article], 64(1): 151-185.

Carland, J. C., & Carland, J. W. 2009. Innovation: The soul of entrepreneurship[J], 33(1): 173-184.

Chan, H. L., Kawada, B., Shin, T., & Wang, J. 2020. CEO-employee pay gap and firm R&D efficiency[J] [Article], 19(2): 271-287.

Clark, J. B. 1901. Wages and Interest as Determined by Marginal Productivity[J]. JOURNAL OF POLITICAL ECONOMY, 10(1)

Cowherd, D. M., & I., L. D. 1992. Product Quality and Pay Equity Between Lower-Level Employees and Top Management: An Investigation of Distributive Justice Theory.[J]. ADMINISTRATIVE SCIENCE QUARTERLY, 37: 302-320.

Cui, V., Ding, W. W., & Yanadori, Y. 2019. Exploration versus exploitation

in technology firms: The role of compensation structure for R&D workforce[J]. RESEARCH POLICY, 48(6)

Davis, L. E., North, D. C., Fusfeld, D. R., Hessian, C. H., Dillard, D., & Kanel, D. 1971. Institutional Change and American Economic Growth: A First Step Towards a Theory of Institutional Innovation[J]. University Press,

DeVaro, J. 2006. Strategic promotion tournaments and worker performance[J] [Article], 27(8): 721-740.

Ding, Juan. 2002. Evolution of Innovation Theory[J]. Modern Economic Research(06): 27-29.

Drucker, P. F. 1998. The future that has already happened.[J]. Futurist

Duffhues, P., & Kabir, R. 2008. Is the pay-performance relationship always positive?. Evidence from the Netherlands[J] [Article], 18(1): 45-60.

Feng, F. Z., & Westerfield, M. M. 2020. Dynamic resource allocation with hidden volatility[J]. JOURNAL OF FINANCIAL ECONOMICS(prepublish)

Ferris, G. R., & Kacmar, K. M. 1992. Perceptions of Organizational Politics[J], 18(1): 93-116.

Festinger, L. 1954. A Theory of Social Comparison Processes[J], 7(2): 117-140.

Freeman, C. 1995. The national system of innovation in historical perspective.[J]. CAMBRIDGE JOURNAL OF ECONOMICS(1): 5-24.

Goethals, G. R., & Darley, J. M. 1987. Social Comparison Theory: Self-Evaluation and Group Life. In B. Mullen & G. R. Goethals (Eds.), Theories of Group Behavior[M] (21-47). Springer New York (Reprinted.

Grund, C., & Westergård-Nielsen, N. C. 2005. The Dispersion of Employees' Wage Increases and Firm Performance[J]. Bonn Econ Discussion Papers

Han, F. 2017. Tournament Incentives vs. Equity Incentives of CFOs: The Effect on Firms' Risk Taking and Earnings Management[D]. Ann Arbor: University of North Texas.

Hazarika, N. 2021. R&D intensity and its curvilinear relationship with firm

profitability: Perspective from the alternative energy sector[J] [Article], 13(9)

Holmstrom, B., & Tirole, J. 1989. The theory of the firm. In R. Schmalensee & R. Willig (Eds.), Handbook of Industrial Organization[M] (1, pp. 61-133). Elsevier (Reprinted.

Homans, G. C. 1961. Social behavior: Its elementary forms. Harcourt, Brace.

Hsin-Han Shen, C., & Zhang, H. 2018. Tournament incentives and firm innovation[J] [Article], 22(4): 1515-1548.

Hua, Y., & Jing, X. 2019. Executive - employee pay gap, R&D intensity and firm performance − Empirical evidence from Shanghai and Shenzhen A-share listed companies in the new generation of information technology industry[J]. The Chinese Certified Public Accountant(12): 40-44.

Jensen, M., & Meckling. W. H. 1976. Theory Of The Firm Managerial Behavior, Agency Costs And Ownership[J]. JOURNAL OF FINANCIAL ECONOMICS, 3: 305-360.

Justin Manly, Konstantinos Apostolatos, Ramón Baeza, Matthias Krühler, Rahool Panandiker, Michael Ringel, & Johann D. Harnoss. 2021, 2021-04-15. The Readiness Gap Most Innovative Companies 2021 Retreved June 6th, 2021 from https://www.bcg.com/publications/2021/overcoming-the-readiness-gap

Kamien, M. I., & Schwartz, N. L. 1982. Market structure and innovation. Cambridge University Press.

Lazear E. P., & Rosen S. 1981. Rank-Order Tournaments as Optimum Labor Contracts. [J]. JOURNAL OF POLITICAL ECONOMY, 89(5): 841-864.

Lei, Huijuan. 2016. Equilibrium analysis of supply chain base on improve quality R&D effect uncertain and government R&D subsidy policy[D]: Hunan University.

Leung, T. Y., & Sharma, P. 2021. Differences in the impact of R&D intensity and R&D internationalization on firm performance – Mediating role of innovation performance[J] [Article], 131: 81-91.

Li Lu. 2017. Empirical Analysis of R&D Investment, Pay gap and Enterprise

Performance[D]: Dongbei University of Finance and Economics.

Li Wei. 2020. Research on the Relationship between Executive Pay Gap and Firm Performance in GEM Listed Companies - Based on the Mediating Effect of R&D [D]: 山东建筑大学.

Li, Z., Daspit, J. J., & Marler, L. E. 2021. Executive pay dispersion: Reconciling the differing effects of pay inequality and pay inequity on firm performance[J] [Article]

Li, Zhankui. 2017. An Study on the Relationship between Executive Incentive and Firm Performance-Based on the Mediating Effect of R&D Investment[J]. Communication of Finance and Accounting(35): 31-36.

Lundvall, B., Johnson, B., Andersen, E. S., & Dalum, B. 2002. National systems of production, innovation and competence building[J]. RESEARCH POLICY

Mansfield, E. 1981. How economists see R&D[J], 59(6): 98-106.

Marshall, A. 1890. Principles of Economics. Palgrave Macmillan, London.

Martin, J. 1979. Relative deprivation : a theory of distributive injustice for an era of shrinking resources (92). [Stanford]: Graduate School of Business, Stanford University. (Reprinted.

Moirangthem, N. S., & Nag, B. 2021. Value-added Activities of Venture Capitals in Entrepreneurial Finance: Evidence from the Growth of Flipkart[J] [Article]

Nemlioglu, I., & Mallick, S. 2021. Effective innovation via better management of firms: The role of leverage in times of crisis[J] [Article], 50(7)

Paul R. Milgrom, & John Roberts. 1988. An Economic Approach to Influence Activities in Organizations[J]. AMERICAN JOURNAL OF SOCIOLOGY, 94: 154-179.

Phyllis, A., Siegel, Donald, C., & Hambrick. 2006. Pay disparities within top management groups: Evidence of harmful effects on performance of high technology firms[J]. OPERATIONS RESEARCH

Rolf, F., Shawna, G., Mary, N., & Zhongyang, Z. 1994. Productivity Growth, Technical Progress, and Efficiency Change in Industrialized Countries[J]. The American Economic Review, 84(1)

Schumpeter, J. A. 1934. The Theory of Economic Development - An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle (R. Opie, Trans.). Harvard University Press.

Sun, B., Ruan, A., Peng, B., & Liu, S. 2020. Pay disparities within top management teams, marketization and firms' innovation: evidence from China[J] [Article]

Swift, T. 2008. Creative destruction in R&D: On the relationship between R&D expenditure volatility and firm performance[D]. Ann Arbor: Temple University.

Tang, J., Tang, Z., Zhu, R., & Li, X. 2021. Entrepreneurs' resource background, innovation, philanthropy and the exit of external Investment in Private Ventures in China[J] [Article], 38(2): 467-489.

Terwiesch, Christian, Ulrich, & Karl, T. 2009. Innovation Tournaments: Creating and Selecting Exceptional Opportunities.[J]. Harvard Business School Press Books

Unesco Institute For Statistics. 2021, 2021-06-06. Sicence, Technology and Innovation -Research and experimental development (fulll dataset) -GERD as a percentage of GDP Retreved 2021/06/06 from http://data.uis.unesco.org/

Walster, E., Traupmann, J., & Walster, G. W. 1978. Equity and extramarital sexuality[J], 7(2): 127-142.

Wenhong, Z., & Yuan, X. 2011. Study on Influencing Factors of Enterprise R&D and the Failure Cause[J]. Science & Technology Progress and Policy, 28(04): 70-74.

Woodruffe, C. 1999. Winning the talent war : a strategic approach to attracting, developing and retaining the best people. Chichester ; New York : John Wiley and Sons.

Zhang, C., & Ying, P. 2021. Research on the Correlation between R&D Investment of Listed Companies on the Science and Technology Innovation Board and Corporate Value[J]. Chinese Township Enterprise Accounting(03): 18-20.

Zhao, Q., & Wang, Y. 2019. Pay gap, inventor promotion and corporate technology innovation[J] [Article], 9(2): 154-182.

蔡雪飞. 2010. 高新技术企业高管团队内薪酬差距影响因素研究[D]: 浙江工商大学.

常锐. 2020. 高管激励、研发投入对企业成长性的影响研究[D]: 沈阳农业大学.

陈金. 2020. 高管激励、股权集中度与企业研发投入[D]: 重庆理工大学.

陈素琴, & 计维爱. 2020. 研发投入、高管内部薪酬差距与财务绩效——基于信息技术业上市公司的分析[J]. 开发研究(04): 152-160.

陈信元, 陈冬华, 万华林, & 梁上坤. 2009. 地区差异、薪酬管制与高管腐败[J]. 管理世界(11): 130-143.

陈恂. 2012. 高科技上市公司高管薪酬差距与公司业绩关系研究[D]: 西南财经大学.

程非儿. 2021. 研发费用加计扣除新政对企业绩效的影响研究——以乐普医疗为例[J]. 江苏商论(01): 91-96.

翟国宇, & 王妹. 2021. 研发投入、融资能力和企业绩效关系研究——以汽车制造业为例[J]. 生产力研究(01): 115-118.

丁华, 高静怡, 齐晓婷, & 张印. 2021. 制造业企业研发投入的财务、市场绩效回报——基于高管薪酬激励的面板门槛模型[J]. 会计之友(07): 115-125.

董屹宇. 2019. 风险资本、公司治理与企业技术创新[D]: 山西财经大学.

方靖美. 2021. 研发投入、产权性质与企业绩效——以江苏省上市公司为例[J]. 北方经贸(05): 136-139.

傅晓霞, & 吴利学. 2006. 技术效率、资本深化与地区差异——基于随机前沿模型的中国地区收敛分析[J]. 经济研究(10): 52-61.

郭红秋. 2016. 国有上市公司内部薪酬差距对企业绩效的影响研究[D]:

首都经济贸易大学.

郭淑娟, 路雅茜, & 常京萍. 2019. 高管海外背景、薪酬差距与企业技术创新投入——基于PSM的实证分析[J]. 华东经济管理, 33(07): 138-148.

冯团英. 2011. 高层管理者薪酬差距与公司绩效[D]: 南京财经大学.

黄丹钰. 2010. 高新技术公司高管薪酬激励与企业绩效实证分析[D]: 江西财经大学.

黄国良, & 杨光. 2018. 高管内部薪酬差距、内部控制与研发投入[J]. 中国注册会计师(06): 56-60.

黄雪晴. 2018. 高管内、外部薪酬差距与企业研发投入[D]: 东北财经大学.

贾玉辉, & 宁金辉. 2021. IPO热潮下科创板拟上市企业绩效评价研究[J]. 经济体制改革(02): 102-108.

蒋馨笛. 2018. 高管“晋升锦标赛”激励了企业研发投入吗？[D]: 西南财经大学.

康华, 程成, & 朱文璟. 2020. 高管内部薪酬差距、经营风险与企业研发投入[J]. 预测, 39(01): 51-58.

康华, 扈文秀, 吴祖光, & 赵欣. 2016. 晋升激励、成长性与创业板上市公司研发投入[J]. 科研管理, 37(10): 51-59.

柯希嘉, & 陈焱晗. 2015. 地区、行业和所有制性质对职工平均薪酬差距的影响——基于中国上市公司数据的趋势研究[J]. 中国劳动关系学院学报, 29(02): 81-85.

黎雨韵. 2019. 高管薪酬差距会影响公司研发投入吗?——以医药制造业上市公司为例[J]. 财会通讯(18): 74-77.

李莉, 崔静, & 陈娜菲. 2021. 汽车制造企业政府补助、研发投入与财务绩效[J]. 湖南财政经济学院学报, 37(01): 120-128.

李璐. 2017. 研发投入、薪酬差距与企业业绩[D]: 东北财经大学.

李友俊, 史清清, & 巩艳芬. 2021. 高管薪酬激励、研发投入与企业绩效影响研究[J]. 商业经济(01): 108-111.

李智宇. 2017. 高管团队激励与研发投入[D]: 厦门大学.

连怡臻. 2019. 高管薪酬限制政策对国有企业绩效的影响研究[D]: 西安建筑科技大学.

刘辉, & 范林榜. 2021. 科技创新与企业绩效的“门槛效应”研究——基于供应链视角对我国制造型企业的面板数据分析[J]. 物流科技, 44(01): 128-134.

刘建伟. 2019. 研发投入、薪酬差距对企业财务绩效的影响研究[D]: 天津财经大学.

刘丽辉, 吕文海, & 曹宇翔. 2021. 人力资本、研发投入对企业财务绩效的协同影响——以广东省科技型企业为例[J]. 佛山科学技术学院学报(社会科学版), 39(02): 32-41.

刘骏, 张蕾, 陈梅, & 何琳珠. 2020. 高层次创新人才薪酬与企业盈利关系研究——以科技型中小企业为例[J]. 科技进步与对策, 37(14): 135-140.

刘银国, & 邵西康. 2019. 产权性质、高管内部薪酬差距与研发投入[J]. 郑州航空工业管理学院学报, 37(02): 44-56.

陆翠丽. 2017. 高管薪酬差距对企业研发投入的影响研究[D]: 广西大学.

穆尼娜·吐尔托合提. 2017. 高管团队规模、晋升激励与上市公司研发投入[D]: 新疆财经大学.

牛秀丽, & 吕彩萍. 2019. 高管薪酬差距与研发投入强度——基于信息技术行业上市公司的经验研究[J]. 云南农业大学学报(社会科学), 13(03): 47-55.

冉秋红, & 刘萍芬. 2015. 高管薪酬差距、产品市场竞争与企业研发投入——基于2007—2014年非金融类上市公司的实证研究[J]. 珞珈管理评论(02): 124-139.

任鸽, & 孙慧. 2019. 政府补助如何影响企业研发投入？——高管垂直薪酬差距的中介作用和董事会规模的调节作用[J]. 研究与发展管理, 31(06): 70-79.

单豪杰. 2008. 中国资本存量K的再估算:1952～2006年[J]. 数量经济技术经济研究, 25(10): 17-31.

石慧. 2018. 我国科技型中小企业公司治理与综合财务绩效关系研究[D]:

山东大学.

石美琪, & 谢瑞峰. 2021. 基于中小板数据的研发投入与企业绩效相关性分析[J]. 商业会计(02): 91-94.

宋薇. 2021. 关键高管薪酬差距、研发投入与企业绩效[J]. 财会通讯(04): 50-53.

唐文秀, 周兵, & 徐辉. 2018. 产品市场竞争、研发投入与财务绩效——基于产权异质性的比较视角[J]. 华东经济管理, 32(07): 110-119.

王爱莲, & 张梦玉. 2021. 现金持有、研发投入与企业绩效——基于中国创业板上市公司的实证分析[J]. 西安石油大学学报(社会科学版), 30(01): 25-30.

王莉莉, 韩道琴, & 张宸恺. 2021. 中小板公司股权集中度、研发投入与公司绩效[J]. 会计之友(03): 117-123.

王璞. 2008. 高新技术公司高管层薪酬激励与公司绩效[D]: 成都理工大学.

王亦娴. 2017. 管理层激励、决策权威与企业研发投入关系研究[D]: 江南大学.

夏雨, & 葛玉辉. 2021. 研发投入、CEO权力强度及经济政策不确定性对企业绩效影响的组态路径研究[J]. 科技与管理, 23(01): 18-25.

肖娟. 2015. 薪酬差距对企业绩效影响的差异分析——基于垄断行业与竞争行业的视角[J]. 国际商务财会(07): 82-90.

杨冬梅, 万道侠, & 郭俊艳. 2021. 企业科技研发投入与企业绩效——兼论政府创新政策的调节效应[J]. 山东社会科学(05): 129-135.

杨茜. 2014. 高新技术企业高管团队薪酬差距对企业绩效影响研究[D]: 山东大学.

姚建峰, 喻凡, & 甘家武. 2020. 国有企业高管薪酬管制与委托代理问题[J]. 西部论坛, 30(05): 113-124.

张璐. 2019. 高新技术企业内部薪酬差距对创新的影响[D]: 中南财经政法大学.

张楠. 2017. 高新技术企业内部薪酬差距对绩效的影响[D]: 河南大学.

张月友, 董启昌, & 倪敏. 2018. 服务业发展与“结构性减速”辨析——兼论建设高质量发展的现代化经济体系[J]. 经济学动态(02): 23-35.

张正堂. 2008. 企业内部薪酬差距对组织未来绩效影响的实证研究[J]. 会计研究(09): 81-87.

赵弘扬, & 王珊珊. 2020. 高科技企业CEO两职合一对企业绩效的影响研究[J]. 企业改革与管理(08): 13-14.

赵奇锋, & 王永中. 2019. 薪酬差距、发明家晋升与企业技术创新[J]. 世界经济, 42(07): 94-119.

赵亭. 2017. 高管团队异质性、薪酬差距与研发投入[D]: 东北财经大学.

郑操. 2009. 高新技术企业知识型员工薪酬激励研究[D]: 哈尔滨工程大学.

郑海元, & 李琨. 2021. 研发投入、高管团队异质性与企业绩效[J]. 财会通讯(08): 27-31.

郑玉玉, & 赵祺. 2021. 数智化背景下R&D投入与企业绩效关系研究——基于软件和信息技术业A股上市公司数据[J]. 武汉商学院学报, 35(02): 38-42.

钟凤英, & 郭澳. 2021. 高管团队垂直对特征差异、研发投入与企业绩效[J]. 商业经济(03): 170-173.

钟熙, 宋铁波, & 陈伟宏. 2019. 高管团队薪酬差距、董事会监督能力与企业研发投入[J]. 证券市场导报(07): 32-41.

仲东亭, & 任浩. 2021. 高新技术企业绩效影响因素实证分析——基于上海全样本数据[J]. 中国科技论坛(05): 90-98.

周子薇. 2019. 管理者权力视角下高管薪酬差距对企业研发投入的影响研究[D]: 云南财经大学.

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Summary

1. Research background

Under the national innovation development strategy requirements, the Science and Technology Innovation Board officially opened in July 2019. The positioning of the Sci-tech innovation board is a specialized capital market plate, which serves the technology innovation enterprises that conform to the national strategy, breakthrough the essential core technology, and have high market recognition. By serving the integration of technology and capital, Sci-tech Innovation Board promotes economic transformation and high-quality development. Innovation has gradually become a key factor for the sustainable development of enterprises. In the long run, the enterprise will earn considerable profits from the competitive advantage built by the successful R&D project. But in the current, enterprises' overinvestment in R&D activities will bring high operational risk to enterprises. The high intensity of R&D investment has dual effects on the sustainable development of enterprises.

Within the enterprise, the continuous innovation R&D activities depend on excellent top managers and top researchers. Enterprises tend to give promotion incentives and higher salaries to employees with outstanding performance. Senior managers and core technicians can enjoy several times higher salaries than ordinary employees. From the tournament theory, widening the pay gap can make employees get higher promotion incentives, thus promoting enterprise performance. But from the perspective of behavior theory, if the pay gap is too large, it will cause dissatisfaction of the bottom employees and destroy the unity of the enterprise. Too much internal compensation may also harm the development of enterprises. Therefore, the widening of the internal pay gap has two sides to enterprise performance.

2. Research Purpose

This paper studies how the internal pay gap will change under the precursor of R&D investment enhancement of Sci-tech innovation listed companies and what kind of economic consequences this change will bring to enterprises? These are the core purpose of this paper.

3. Innovation Points

(1). Based on this research purpose, this paper begins to collect data and review the literature on the internal pay gap, innovation, and financial performance.

In terms of the internal pay gap, scholars mainly focus on the CEO-executive pay gap, pay gap between executives, pay gap between executives and employees. Few studies consider the pay gap between employees because Sci-tech enterprises have talent intensive and high R&D intensity characteristics. This paper includes the salary gap between R&D staff and general staff in the variable range.

(2). In terms of research ideas, most studies explain the impact of the internal pay gap on R&D investment. Few studies take innovation as a research premise to study the effect of R&D investment on internal pay incentives. The idea of this paper is relatively novel.

(3). In the sample selection, this paper selects the scientific innovation board company for research. There are many pieces of research on the internal pay gap, R&D investment, and corporate performance of Chinese listed companies. However, the research literature on the inner pay gap of listed enterprises on the science and technology innovation board is relatively few. Therefore, the research of this paper has a specific value and can fill the blank in the research field.

4. Research significance

Theoretically, this paper expands the relevant literature on the compensation contract theory of Sci-tech innovation listed companies. This paper introduces the salary gap between R&D employees and ordinary employees into the variable of internal salary gap.

This study enriches the dimensions of the study. Previous studies focused on the impact of the pay gap on R&D investment. The research idea of this paper is the impact of R&D investment on the change of salary gap. At the same time, this paper takes R&D investment as a moderating variable to further study the moderating effect of R&D investment on the correlation between internal pay gap and enterprise performance.

In a practical sense, the conclusion of this paper can give investors, enterprise managers, and government departments some suggestions and reference experience.

5. Research methods

① Normative analysis. This paper summarizes the relevant research results and practical experience on the pay gap, R&D investment, and enterprise performance through a literature review. It clarifies the relationship among them to determine the research objectives. At the same time, the literature review also paves the way for the theoretical basis of this hypothesis. This paper puts forward five hypotheses:

H1a: The R&D intensity positively correlates to the Internal compensation gap.

H1b: The R&D intensity negatively impacts the Internal compensation gap.

H2a: The internal compensation gap positively impacts financial performance.

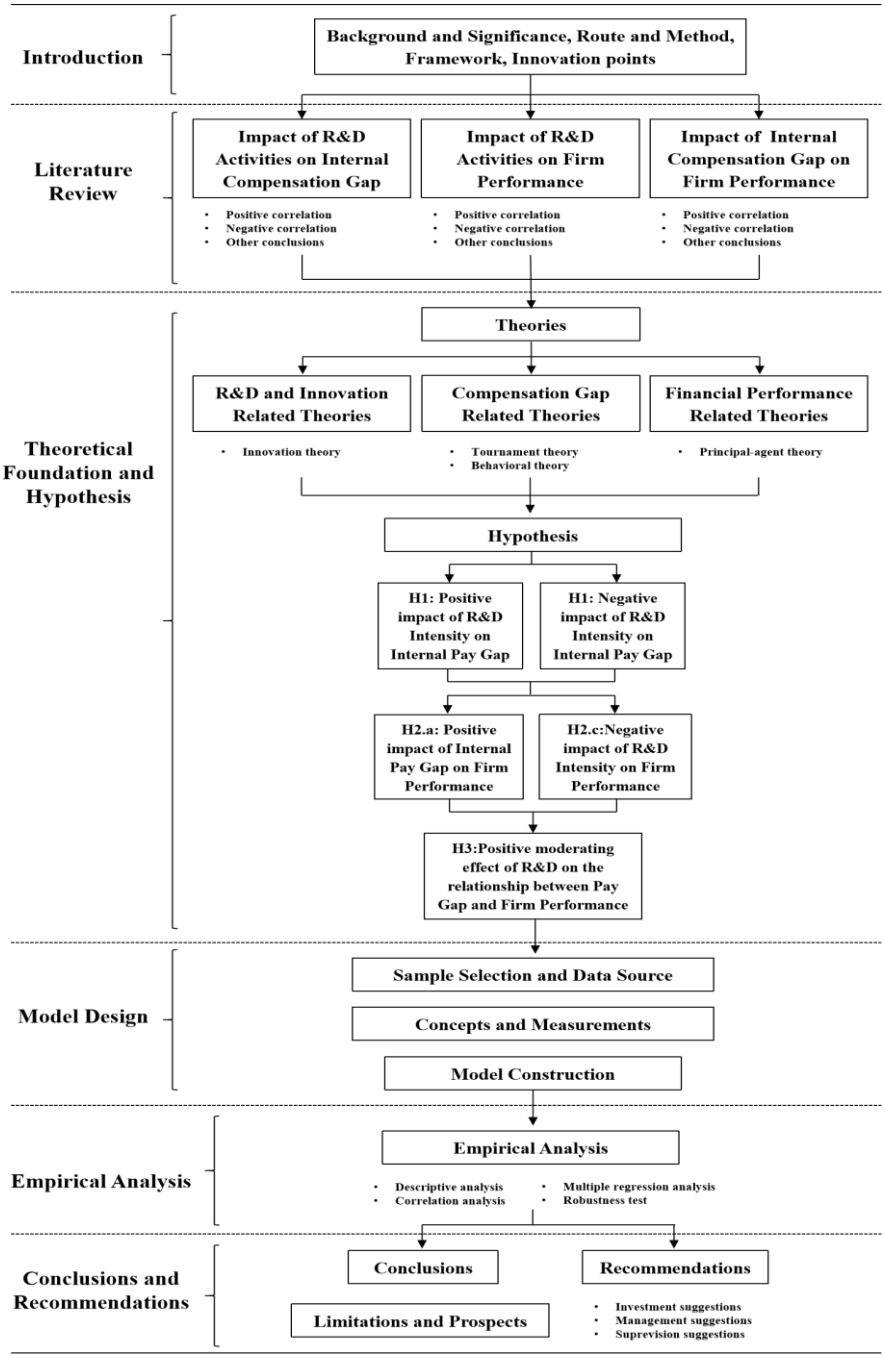
H2b: The R&D intensity inhibits financial performance in the short term.

H3: R&D intensity has a negative moderating effect on the relationship between the inner compensation gap and corporate performance.

② Empirical analysis. In this paper, the Sci-tech innovation listed companies by May 7, 2021, are taken as the research sample. This paper uses descriptive statistics, correlation analysis, multiple regression analysis, and robustness tests to analyze the data. Firstly, this paper selects the appropriate explanatory variables, explained variables, and control variables based on the hypothesis and constructs the research model based on the previous research methods and theories. Secondly, this paper preprocesses the data. Before the descriptive statistics of the data, this paper first winsorizes the data (before and after 1% outliers are removed). Before multiple regression analysis, this paper standardized the data. To standardize the data can control the eigenvalue of the data in a specific range. Finally, this paper uses the method of replacing variables to test the robustness of the research conclusions. Excel and Stata do all the work of data analysis and regression test in this paper.

6. Research framework

This paper divided into six chapters:



7. Literature review

This paper summarizes the literature review from three research directions: (1) the correlation between innovation and the internal pay gap, the correlation between innovation and performance, and the correlation between inner pay gap and firm's performance.

(1) The correlation between enterprise innovation and the pay gap

There are many controversies about the research conclusion of this literature. Some scholars' research conclusions prove a positive correlation between the two, which

verifies the tournament theory: the larger the pay gap, the better the innovation performance. However, some scholars' research conclusions prove a negative correlation between the two, consistent with the equity theory: the more significant the pay gap, the less R&D investment. Some scholars also found that there is a threshold effect between enterprise innovation and the pay gap. In the beginning, the widening of the enterprise pay gap will promote R&D investment, but when the crack reaches a peak, R&D investment will decrease. The more interesting conclusion is: there is a significant negative correlation between promotion incentive and R&D investment, while there is a positive correlation between promotion incentive and R&D investment. The conclusion shows that different subjects are affected differently. Many other factors influence the findings above, such as the nature of property rights, the degree of power concentration of executives, and top management team characteristics. Inspired by previous studies, this paper will also take some factors inside and outside the enterprise as control variables.

(2) The correlation between enterprise innovation and enterprise performance

There are also many controversies in this aspect. Some scholars' research conclusions prove that there is a positive correlation between R&D investment and financial performance. However, some scholars hold the opposite view: there is a negative correlation between R&D investment and corporate financial performance. Other scholars believe that the positive impact of R&D investment on corporate financial performance is lagging. R&D investment is not conducive to the short-term economic performance of enterprises but can bring considerable financial performance in the future.

(3) The correlation between internal pay gap and performance

Similarly, there are many controversies in this aspect. Some scholars have concluded that there is a positive correlation between R&D investment and firm performance. The widening of the salary gap can significantly promote financial performance, and some scholars have proposed that the pay gap has a positive moderating effect between R&D investment and firm performance. But there is also some evidence that the executive power is too large, and the pay gap does not positively impact corporate

performance. And the widening of the pay gap is not conducive to enterprise unity, which verifies the behavior theory. Some scholars believe that tournament performance is specific to specific industries. For example, in non-technology companies, the widening pay gap will promote enterprise performance, but not necessarily in technology companies.

In summary, no matter in which research direction, the research conclusions are controversial. This paper needs to sort out the research theory.

8.Theory Foundation

（1）Innovation Theory

Schumpeter put forward in his works that innovation refers to introducing a new "combination" of production factors and production conditions into the production system. He regards enterprises as the main body of creation. He believes that innovation includes five situations: introducing a new product, introducing a new production method, opening up a new market, obtaining a new supply of raw materials or semi-finished products, and a new form of organization. After Schumpeter, innovation theory divided into two schools: one's representatives are Kamien and Schwartz (1982); the other are Kamien and Schwartz (1982); Mansfield (1981) led the school of technological innovation, and Davis et al. (1971) represented the school of institutional innovation.

Many factors affect enterprise innovation activities. From the internal point of view, it includes the enterprise's culture, management, technology, talents, and assets. The external point of view provides market, policy, law, economy, and other environmental factors. The causes of R&D failure include insufficient resources, poor team cooperation, dereliction of duty of senior managers, difficulty in technology development, and changes in the external environment (Wenhong and yuan, 2011).

（2）Tournament Theory

According to the traditional economic theory, the salary level is determined by the marginal output, but in fact, the salary gap in enterprises is not entirely determined by the marginal productivity of labor. Tournament theory holds that compensation is related to the rank of employees' marginal output, not to the specific marginal output

of employees. Tournament theory links the salary level of employees with the promotion. Suppose the promotion of employees can bring about a substantial increase in wages. In that case, it will stimulate the enthusiasm and enthusiasm of employees to work hard and then improve the company's performance.

（3）Behavioral theory

The behavioral theory includes relative development theory, organizational politics theory, allocation preferences theory, and equity theory

According to relative deprivation theory, if a person gets far less than he deserves, he will have a sense of exploitation (Martin, 1979). It is easy for employees to judge the salary gap between themselves and others from what they get rather than what they contribute. Therefore, the gap of employees' ability is difficult to be reflected directly from the salary gap, and there is a gap in everyone's input. So even if employees get promotions and higher salaries because of excellent production efficiency, it will also lead to dissatisfaction in the hearts of other employees.

According to the theory of organizational politics, members of an enterprise will try their best to influence the behavior of decision-makers for their interests - "political conspiracy" (Paul R. Milgrom and John Roberts, 1988). Under a vast salary gap, the enterprise members will be more inclined to engage in self-interest "political conspiracy" activities, resulting in higher level of effort. The increase in income is not enough to make up for the increase of cost caused by the enterprise destruction of enterprise cooperation.

Allocation preferences theory believes that the salary of enterprise members is set in the interaction between the salary maker and the receiver. If the enterprise unilaterally stipulates the compensation, ignoring employees' dissatisfaction, it will significantly reduce the rationality of the salary system.

Equity theory is a critical theory to explain the sense of fairness (Adams, 1965; Homans, 1961)。 Suppose employees find that their income and expenditure ratio is lower than that of others, or the current income and expenditure ratio is lower than that of the past. In that case, they will feel pain because of unfairness, which reduces their work enthusiasm.

（4）Principal-agent theory

American economist Berle and means (1932) propose the Principal-agent theory in their study of how to separate the ownership and control of a company. Because the ownership and management rights are separated in the principal-agent relationship, the goals of the principal and the agent are inconsistent. The core of the principal-agent problem is: how to design a reasonable compensation scheme for the shareholders as the principal to make the operators as the agent willing to make the most outstanding efforts for the goals and profits of the principal at the minimum cost. Salary incentive is one of the methods to reduce agency costs (Holmstrom and Tirole, 1989). Incentive mechanisms can solve the conflict of interest between principal and agent more effectively than supervision mechanisms.

9. Hypothesis

According to the actual situation of the listed companies of Chuang Chuang plate and the summary of previous studies, this paper puts forward four hypotheses.

From the perspective of reducing the supervision cost. Compared with other industries, the Sci-tech companies are in the industry with the characterization of the high R&D intensity. There are more technological R&D projects with high technological complexity. The companies face a more complex outside environment. Thus, the R&D project management of Sci-tech companies is more difficult with the high cost of supervision. Due to the high risk of the firm's R&D activities, the management will invest in projects with low risk and low income in order to avoid risks, refuse to invest in projects with high risk and high income, and lack the drivers to participate in the R&D activities (Hitt et al., 1997). Enterprises need to set up a suitable salary incentive mechanism to reduce the cost of supervision and management. Based on the tournament theory, with the increase of the R&D intensity, the difficulty of project management increases, and the compensation gap is appropriately widened, which can prevent the slack and short-sighted behavior of the executives or the core technical personnel. However, according to the behavioral theory, accompanied by the rise of the R&D intensity and the technical complexity, the employees' marginal production is more challenging to measure. Suppose the enterprises widen the

compensation gap. It would come up with more political conspiracy behavior of the team members, possibly disrupting the team's cooperation.

From the perspective of motivating employees. The knowledge workers are capable of using their knowledge to carry out innovative work and provide the basis for innovation (Woodruffe, 1999). Intellectual capital is essential to enterprise innovation (Lao et al., 2021; Shuyang et al., 2021). Talents are the main driving force for the sustainable development of enterprises (Liu, 2021). Lack of compensation incentives for knowledge workers will lead to talent drain. Employees who master core technology or business secrets leave will leak core technology or business secrets. Especially when the executives or R&D employees jump to competitors, enterprises will face more fierce competition. If the core employees resign, enterprises cannot make up for the vacancies in core positions quickly. It will affect the regular operation of enterprises. Once knowledge workers leave, such as senior executives leave, a group of employees may follow, which has a domino effect on the loss of enterprises. Enterprises must invest time and energy in recruiting and training new employees, and the productivity of new employees cannot meet their needs immediately (Zheng 2009). Therefore, due to the huge loss of the executives and the R&D staff, enterprises need to settle down a reasonable pay gap to meet the salary expectations of knowledge workers and improve their performance.

On the one hand, some studies support high-technology companies preferring tournament incentives (Cui et al., 2019; Liu et al., 2020; Zhao and Wang, 2019). But on the other hand, Grund and Westergård-Nielsen (2005) , Phyllis et al. (2006) did not approve of the view of the tournament, even some domestic scholars demonstrated that in China, the high-tech companies more stress on the internal group work than the traditional companies. Due to the high complementarity of the management team, the compensation gap between the executives is relatively small (Feng, 2011; Lu, 2017). The research on high-tech background companies has the great controversy over the correlation between the R&D intensity and the pay gap.Therefore, this paper puts forward the hypothesis:

H1a: The R&D intensity has a positive effect on the internal compensation gap.

H1b: The R&D intensity has a negative effect on the internal compensation gap.

This paper carried out simple statistics and preliminary judgment on the existing data of the Sci-tech companies' internal compensation gap. The data initially identified the tendency of the tournament-performance in the Sci-tech companies: the internal compensation gap and the performance change in the same direction. In the current, most studies on the mechanical effect of China high-tech companies' internal compensation gap and firm's performance support the view of tournament theory(Cai, 2010; Chen, 2012; Huang, 2010; Yang, 2014; Zhang, 2019). Therefore, widening the internal compensation gap enables the executives and R&D employees to enhance their work initiative, strive for a ladder-like increase in the compensation, and win a sense of honor in the competition. Based on this, this paper puts forward the hypothesis:

H2.a: Internal compensation gap is positively correlated with a firm's financial performance.

In the past three years, the Sci-tech companies' R&D investment showed a gradual upward trend. Some research indicated that the Sci-tech enterprises' innovation investment positively correlates with the firm's financial performance (Li, 2020). But the technical innovation project usually needs to last a long time, the conversion of the R&D is risky. In the short period, enterprises would not obtain considerable profits from the innovation activities, which means the positive return of R&D investment is lagged(Zhang and Ying, 2021; Li, 2017; Yang et al., 2021; Zheng and Zhao, 2021). And the effect of the two or more periods lagged is more significant. Although the average time to market is only 2~3 years for the most Sci-tech listed companies, the Sci-tech enterprises have a relatively high level of R&D investment, which might be unfavorable to the firm's financial performance. To summarize, the paper assumes that:

H2.b: The R&D investment intensity is negatively correlated with the firm's financial performance.

In the early days of the R&D project, companies need to experiment many times and may face failures. Before the success of the R&D project, the managers will be

questioned for the unwise decision, and also, the R&D employees should be responsible for the consequences of the failure. According to the traditional salary incentives, employee compensation links with the individual performance, the enterprises would punish the R&D employees and the managers who failed in the innovation by the reduction of the rank and benefits. As stated by the tournament theory, the winner of the past game cannot do it once for all. If the previous winner loses the game, the treatment and ranking would dramatically decline due to the huge pay gap, which is psychologically unacceptable. The more times the R&D fails, the greater the blow to the managers and the R&D employees. Based on the principal-agent theory, ownership is apart from the operating rights. Therefore, the managers will make more conservative investment decisions and choose to reduce the innovation activities to avoid R&D failures. The action will subsequently harm the shareholder's interests and discourage the long-term development and expansion of the enterprises. Consequently, the high-tech enterprises invest more in R&D projects, and the executives and the R&D employees will face a higher risk of R&D failure. The larger internal compensation gap will hit the initiative of the executives and the R&D employees, which is not conducive to the improvement of enterprise performance. Zhang (2008) studied the examples of China-listed companies. With the increase in the technical complexity of the enterprises' R&D activities, employees emphasize the equality of the treatment and request the employer to decline the compensation gap. Similarly, Zhang's (2017) research findings also proved that the technical complexity of innovation activities would impair the positive effect of the internal pay gap on the firm's performance. Based on the above, the hypothesis is proposed as:

H3: R&D investment negatively moderates the relationship between the internal compensation gap and a firm's financial performance.

10.Model Construction

$$\text{pay\_gaps} = \beta \times \text{rdi} + \alpha \times \text{controls} + \varepsilon \quad (4.1)$$

$$\text{performs} = \beta \times \text{rdi} + \alpha \times \text{controls} + \varepsilon \quad (4.2.a)$$

$$performs = \beta \times pay\_gaps + \alpha \times controls + \varepsilon \quad (4.2.b)$$

$$performs = \beta \times pay\_gaps + \gamma \times pay\_gaps \times rdi + \alpha \times controls + \varepsilon \quad (4.3)$$

Model 4.1 examines the impact of R&D investment intensity (rdi) on the internal compensation gap (pay_gaps). Model 4.2.a and Model 4.2.b examine the impact of the internal compensation gap and R&D investment intensity on corporate performance. Finally, model 4.3 examines the moderating effect of R&D investment intensity on the relationship between the internal compensation gap and corporate performance. In the above models, the explanatory variables are uniformly used to lag the value of one period to prevent endogenous problems. The explanatory variable and the control variable adopt the current value. In the above models, the value of the explanatory variables are uniformly lagged for one period to prevent endogenous problems. The explanatory variable and the control variable adopt the current value.

11.Conclusions

(1) Contrary to the expectations, the R&D intensity has no significant impact on the compensation gap in the Sci-tech innovation listed companies. Both H1.a and H1.b are rejected. The possible explanation is that the compensation system in Sci-tech companies is quite unclear under a period of economic restructuring, especially the reform of the capital market in China. The enterprise should orient the internal system to the changing policy environment and the needs of the present regulatory system.

(2) The internal compensation gap has a positive impact on the performance of Sci-tech companies. But the significant levels are different. The compensation gap of cross-level between the executives and the staff is shown to have a significantly positive impact on ROE/ROA, and the compensation gap of the adjacent level between the R&D staff and other staff has a significantly positive impact on ROP. The effect of the internal compensation gap of Sci-tech innovation board companies on financial performance varies greatly from the subjects. Overall, the conclusions indicate that the enlarged compensation gap for Sci-tech companies will improve the performance, in line with the tournament theory, which confirms the H2.a.

Conversely, the R&D intensity of Sci-tech innovation board companies has a significant negative impact on financial performance. The findings prove H2.b.

(3) The R&D intensity of Sci-tech innovation board companies has negative moderating effects on the economic consequences of the compensation gap, which complies with Hypothesis 3. But the results are not significant in the robust test with the R&D investment proportion as the substitute variable of R&D intensity. The findings suggest that with the broadening internal compensation gap, the enterprise might improve its performance. However, the negative moderating effect of the R&D intensity will impair the positive effect of the compensation gap on the performance. The possible explanation for the findings is that high R&D intensity puts the companies at a high risk of R&D failures with possible huge financial loss. As well as the R&D investment return is uncertain in the short term. Before the success of the R&D project, the R&D employees will be blamed for several times R&D failures. Suppose the enterprise chooses to enlarge the compensation gap. In that case, it will hurt the innovation initiative of the R&D employees after experiencing several failures, finally result in a negative impact on the performance. Therefore, with the high R&D intensity, it is not suitable for companies to continue to expand the salary gap, which cannot continuously motivate employees to improve their performance. However, companies should narrow the pay gap and permit or tolerate several failures of the innovation.

13.Recommendation

For investors who prefer short-term investment, a company with high R&D intensity is not a good choice. If the investors decide to invest in the early stage of the enterprise, they need to psychologically prepare for long-term running and take the high risk of R&D failures. In terms of corporate governance, investors can pay attention to the Sci-tech enterprises with a relatively high compensation gap between executives and employees. Because the findings suggest that enterprises appropriately widening the pay gap can improve corporate performance. Investors should be alert to corporate behaviors of over-investment and inefficient investment in case of the transmission of the interest.

For business managers, the Sci-tech innovation companies shoulder the mission of national innovation strategy and face more fierce global market competition.

Therefore, innovation activities are essential for companies. Enterprise innovation can create core competitiveness for enterprises and ensure sustainable development. The key to innovation is to integrate human capital with corporate resources. Therefore, companies need to establish appropriate monitoring and incentive mechanisms to encourage management and employees to engage in innovative activities. Based on the principal-agent theory, companies should create a fair, competitive environment, clarify promotion standards, and appropriately widen the internal compensation gap. The evidence supports the tournament-performance view in the Sci-tech innovation companies. However, the negative moderating effect of R&D intensity will impair the tournament effect of the internal compensation gap on financial performance. Therefore, managers should consider avoiding over-investment.

For government agencies, tax relief and tax returns have no significant influence on the firm's performance. The possible explanation for the results is that government has specific requirements for subsidies. Although government subsidies can mitigate the fund shortage of the firm, the policy burden does not bring a positive incentive effect to enterprises but may make the enterprise performance worse. To avoid the practice of defrauding preferential treatment, relevant government departments should investigate and continuously monitor the situation of enterprises. Still, it is necessary to ensure that various subsidy policies and preferential tax policies can accurately deliver to the enterprises with actual needs. Furthermore, the government should improve the capital market system to ease the financing difficulties of enterprises with high R&D intensity. In addition, the government should improve relevant laws, regulations, and systems as soon as possible, provide support and guidance for corporate innovation activities, and strengthen the protection of corporate intellectual property rights. In terms of corporate pay gap supervision, the government should also strengthen the supervision of executive compensation to prevent executives from using their power to transfer benefits.

14.Research Limitations and Prospects

This paper has certain limitations.

(1) Since the listed companies on the Science and Technology Innovation Board have

relatively short listing years and limited sample data, this paper can only deal with explanatory variables with a one-period lag and does not deal with the second and third lags. Therefore, this paper cannot make an in-depth discussion on the long-term impact of the R&D investment intensity and impact of the compensation gap within the Sci-tech innovation companies. Instead, this paper can only look at the impact of R&D investment intensity and the compensation gap in the short term.

(2) Enterprise innovation is a relatively complicated process. As for the measurement index of enterprise innovation, this article only considers the aspect of R&D investment and does not consider R&D output, which is not comprehensive enough. Due to the relatively short time to market for Sci-tech innovation companies and limited sample data, the efficiency of the current R&D investment successfully converted into output needs to be tested for a longer time. Future research on sci-tech innovation board companies can consider the number of new products, the scale of capitalized R&D expenditures (intangible assets), and core technologies to measure corporate innovation output.

(3) In the study of the internal salary gap, due to the limited number of companies implementing equity incentive plans in the Chinese market, this article did not consider the shareholding plans of corporate members in the research. Therefore, this paper only considers monetary compensation. I hope that in the future, when data is available, a more comprehensive study can be carried out in conjunction with the scale of participation of corporate members in the shareholding plan.

(4) In terms of sample selection, this article only studies the characteristics of companies listed on the Sci-tech Innovation Board without comparing the Sci-Tech Innovation Board horizontally with other trading sectors. The research conclusions of this paper are mainly around the Sci-tech innovation companies, not suitable for all companies in the market. With the advancement of China's capital market registration system reform and the experience of the sci-tech innovation board, the GEM registration system has launched, and more listed companies have appeared. Further studies can be undertaken. I hope to be able to analyze the comparison of the technological innovation enterprises in different trading markets.