

The Mediating Role of CEO Power Intensity in the Relationship between CEO Source and Innovation Investment of Private Enterprises

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Abstract: Based on the perspective of Guanxi and differential pattern theory, this paper divides the sources of CEO into family CEOs, acquaintances CEOs, and outsiders CEOs, and empirically analyzes the impact of CEO sources on innovation investment of private enterprises in the Shanghai and Shenzhen A-share listed companies from 2007 to 2018. Research has shown that the sources of CEO has a significant negative impact on the level of innovation investment in enterprises, and the strength of CEO power has a significant positive impact on the level of innovation investment in enterprises. The CEO power intensity plays a mediating role in CEO sources and innovation investment of enterprises, while equity incentives play a positive moderating role in the sources of CEO and CEO power intensity.

1. Introduction

After decades of rapid growth, the Chinese economy has now entered a new era of high-quality development driven by scientific and technological innovation. With the development of China's economy and the intensification of market competition, enterprise innovation has become a necessary means for Chinese enterprises to achieve long-term success and sustainable development. The government and enterprises have adopted a series of measures to encourage and support innovation, while a number of new enterprises and startups have emerged, injecting new vitality into China's innovation development. At the same time, China's private enterprises have gradually become the main force supporting the rapid growth of the national economy, and their contribution to the society is increasing day by day. The fact of development tells us that private enterprises have become the most economic potential and the most dynamic economic form in China, and have become an important driving force for China's economic development, so we focus on the innovation of private enterprises. The CEO plays a crucial role in the decision-making of an enterprise, and the CEO's innovation awareness largely determines the formulation of organizational innovation decisions. Some scholars have focused on exploring the impact of the characteristics of corporate CEOs on innovation, while CEO sources has little impact on innovation investment. Therefore, this paper explores the impact on innovation investment from the perspective of CEO sources. This study investigates private listed companies as research samples to analyze the relationship between CEO sources and innovation investment, providing theoretical basis for the development of private

enterprises and promoting their development.

The term "difference order pattern" was proposed by Mr. Fei Xiaotong to describe the interpersonal pattern of closeness, which is like a continuous halo on the water surface. It extends from itself, circle by circle, and divides closeness by distance. Liu Xiaoxia et al. divided the actual controller and CEO into family members (personal or blood related relationships), acquaintances (geographical, business, academic relationships), and outsiders (non family acquaintances) based on their relationship [1]. Emphasizing interpersonal relationships, advocating for the importance of relationships, and following the pattern of differences are the basic principles and important characteristics of handling relationships in Chinese social interactions. This criterion and characteristic have been fully demonstrated in private enterprises. When family members of a business serve as CEOs, they prioritize the interests of the family and demonstrate a high degree of altruism and loyalty, making them trustworthy "butlers"; When the principal's acquaintances such as classmates, fellow townspeople, and colleagues serve as CEOs, they not only focus on their relationship with the principal, but also on their own interests. Although trustworthy, the principal still needs to remain vigilant; When external professional managers serve as CEOs, they often exhibit self-interest and have low credibility, requiring supervision. Zou Likai and Wang Bo found that intergenerational inheritance is one of the important factors affecting the innovation of family businesses [2], Therefore, the individual differences in CEO succession are an important research field for company innovation. Sun Weizhang et al. found that internal succession of CEOs can improve the innovation level of enterprises [3]. For enterprises in China that are currently undergoing or are about to inherit and replace, choosing a successor for family business operations or a professional manager is a problem that every business owner must face.

Existing research has studied the influencing factors of enterprise innovation from both macro and micro perspectives, and has achieved certain results. From a macro perspective, it includes external factors such as tax policies [4,5], market environment [6-8], government subsidies [9-11], and so on. From a micro perspective, including enterprise scale [12,13], equity structure [14], social networks and social capital [15-17]. In addition, executive characteristics also have an indispensable impact on corporate innovation, such as the greater the power of executives with research and development backgrounds in the management team, the higher the innovation investment [18]; Executives with financial backgrounds may suppress corporate innovation and innovation by increasing financial investment and reducing physical investment [19]; Executives with overseas study experience are more likely to accept new ideas, take on new risks, and innovate [20]. CEOs with military experience can better cope with crises, have a stronger sense of responsibility, and make long-term innovation plans for the enterprise [21]. At the same time, the psychological characteristics of executives can also affect the innovation level of the enterprise. For example, overconfidence among executives makes them more inclined to invest in high-risk and high capacity projects, thereby improving the innovation level of the enterprise [22].

Based on the differential pattern theory and butler theory, this article categorizes the sources of CEO into family CEOs, acquaintances CEOs, and outsiders CEOs based on the close relationship between the CEO and the actual controller. Power intensity is used as the mediating variable, and equity incentives are used as the moderating variable to explore the impact of CEO sources on innovation investment in private enterprises. By studying the relationship between the sources of CEO differentiation and innovation investment in private enterprises, the relevant theories of CEO and innovation in private enterprises have been enriched.

2. Theoretical Basis and Research Hypotheses

2.1. CEO Sources and Innovation Investment

The agency theory is based on a series of assumptions about the behavior of managers, believing that people are rational egoists who strive to maximize their personal interests and avoid punishment as much as possible. For a long time, agency theory has also been regarded as one of the most important governance theories by the vast majority of Chinese companies. However, these views are not conclusive even in the West. With the rapid development of China's economy and the basic abundance of materials, people have begun to pursue spiritual satisfaction. The butler theory starts from organizational psychology and organizational sociology, believing that managers gain internal satisfaction by completing challenging tasks, taking responsibility, and gaining recognition from leaders and colleagues, which is a form of non-material motivation. Therefore, combining the roles of the board of directors and CEO, as well as adding internal and affiliated directors, is beneficial for managers to fully leverage their stewardship skills in an environment of mutual trust.

From the perspective of butler theory, when the CEO is served by acquaintances, the level of trust between shareholders and managers is higher. Trust, as a non-material incentive, encourages managers to actively undertake challenging and risky innovation projects, seek breakthrough development, and repay the trust of shareholders. Chen Siying found that high trust is conducive to sharing more knowledge, forming a win-win situation for cooperation, and promoting knowledge innovation. Thus further enhancing the overall innovation level of the enterprise [23]. The purpose of innovation is actually to enhance the core competitiveness of the enterprise and pursue long-term benefits. When the CEO is appointed by acquaintances, the interests of managers and shareholders tend to align, and they pay more attention to the long-term development of the enterprise and the formation of competitiveness. Therefore, this article proposes the following assumptions.

H1: The closer CEO sources, the stronger innovation investment.

2.2. The Mediating Role of Power Intensity

In "Rural China," the pattern is defined as a network relationship centered around the patriarchal group and centered around kinship, it is a pattern. The pattern mainly emphasizes two aspects, one is the relationship, which is pushed outward based on the principle of from near to far and from close to sparse. The second is to emphasize the strict hierarchical order between individuals, which can be divided into brothers, spouses, and friends. In the management team of an enterprise, the smaller the difference pattern between management teams, the closer the relationship, the more concentrated the power, the relative concentration of power, and the greater the power in decision-making. The larger the hierarchical pattern between management teams, the more distant their relationships become. Due to the defensive mentality among managers, power is relatively dispersed. The theory of organizational management and motivation indicates that granting the CEO sufficient power to make decisions can better motivate the CEO to serve the company, stimulate the CEO's creativity and motivation. These CEOs who are granted full power are more inclined to increase R&D investment for the following reasons: firstly, CEOs with greater power are more able to bear risks, and they tend to pay more attention to the positive benefits brought by innovative R&D rather than the high risks brought by R&D investment [24]; Secondly, the greater the power of the CEO, the weaker the influence of the board of directors and major shareholders in the process of formulating and implementing strategies. They can choose the innovation strategy of the enterprise according to their own wishes [25]; Thirdly, the CEO is granted sufficient power to effectively achieve unified leadership of the enterprise, better allocate resources, improve decision-making efficiency, make decisions quickly in the constantly changing competitive environment, and formulate reasonable

R&D investment plans for the enterprise [26]

The greater the power of a CEO, the greater their freedom to allocate resources in the enterprise, and the ability to weaken the constraints and supervision of the board of directors. On the contrary, the more the power of the CEO is balanced, the less likely the enterprise is to experience extreme values in its operations. When the CEO makes innovative choices, they may be hindered by the conservative ideas of other executives, resulting in more robust development decisions; The CEO with high power owns shares in the enterprise, and the interests of the CEO are closely related to the interests of the enterprise. As a shareholder of a company, the CEO will pay more attention to the formation of the company's core competitiveness, attach importance to the long-term development of the company, and avoid short-term behavior. At the same time, CEOs with high power have a stronger sense of belonging, identify with the value of the enterprise, and want to seek breakthroughs for the development of the enterprise; CEOs with high power are not always risk averse. Due to their recognition of their own abilities, status, and existing achievements, they are no longer satisfied with a conservative and stable development model, and are more inclined to make innovative choices with certain risks. Therefore, this article proposes the following hypothesis:

H2: The more distant CEO sources, the lower power intensity.

H3: Power intensity plays a mediating role between CEO sources and innovation investment.

2.3. The Regulatory Effect of Equity Incentives

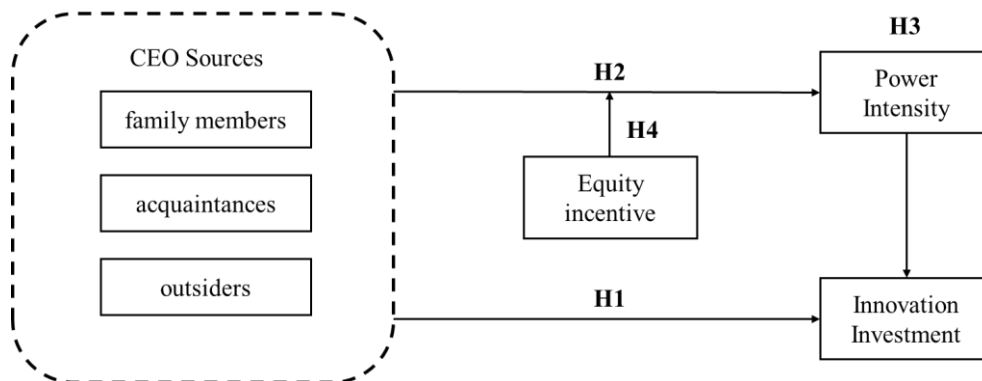


Figure 1: The Theoretical Model

Equity incentive is currently a commonly used measure to motivate employees in enterprises. By using equity incentive to connect employees with the enterprise, it enhances employees' sense of ownership and balances the rights and obligations in the development process of the enterprise. Equity incentives are beneficial for narrowing the internal power gap among employees, thereby facilitating innovation in enterprises [27]. With the improvement of China's capital market and the improvement of institutional safeguards related to equity incentives, more and more enterprises are choosing equity incentives as a medium to long-term incentive tool to reduce agency costs and align the long-term interests of employees and enterprises, thereby reducing management costs and shortening the gap between external employees, which is conducive to the volatilization of power utility [28]. In order to achieve consistency in the goals of executives and shareholders and share risks, it is necessary to grant equity to executives. In order to obtain more surplus value, executives who have received equity incentive will increase their R&D risk bearing capacity, and tend to reduce the available redundancy retention level and use it to increase the R&D investment of enterprises. In this situation, granting executives residual claim rights will help promote their use of available redundancy to enhance support for R&D investment [29]. In modern corporate governance structures, the use of equity incentives can effectively shorten the distance between managers. The implementation of equity

incentive plans has become the main reason for the widening of the internal salary gap among executives. The widening of the internal salary gap helps to form an incentive effect. Both external CEOs and family CEOs are affected by equity incentives, indirectly narrowing the source of differences and regulating the impact of CEO sources on power. Therefore, this article proposes the following assumptions.

H4: Equity incentives can positively regulate the impact of CEO sources on power.

In summary, the theoretical model studied in this article is shown in Figure 1.

3. Research Design and Data Description

3.1. Samples and Data Sources

This article takes private enterprise listed companies in the Shanghai and Shenzhen A-shares from 2007 to 2018 as the research object. Data was manually collected and classified from different sources of CEOs through Baidu, annual reports of various companies, and Guotai An database. Data on intermediary variables, moderating variables, control variables, and dependent variables were all obtained through Guotai A database. In order to obtain reliable conclusions, we screened the data as follows: (1) Exclude data samples with ST, * ST markers. (2) Exclude data samples that are not fully disclosed from CSMAR. (3) The continuous variables in the data were subjected to tail reduction at a level of 1% to 95%. We ultimately obtained 11669 annual observation samples from 1560 enterprises over the past 12 years.

3.2. Variable Selection and Definition

3.2.1. Explanatory Variable: Innovation Investment (RD)

Considering the significant differences in the total innovation investment of enterprises of different scales, this article draws on the method of Xiong Kaijun [30] and adopts the total innovation investment/total assets of enterprises to measure the level of innovation investment.

3.2.2. Explanatory Variable: CEO Sources (CEOres)

The explanatory variable of this paper is CEO sources. Drawing on the method of Liu Xiaoxia et al [31], the CEO represents the manager and the owner represents the actual controller. CEO sources is divided into family members (including those who serve as both), acquaintances, and outsiders based on their relationship with the owner, from close to distant, and assigned values of 1, 2, and 3 to each of the three relationships.

3.2.3. Mediating Variable: CEO Power (CEOpower)

This paper uses CEO power intensity as a mediating variable and draws on Finkelstein's (1998) [32] power model for measurement. Finkelstein believes that dealing with internal and external uncertainty is the main task of the CEO, which means that the power foundation is based on the ability to handle uncertainty. Therefore, he specifically divided CEO power into four dimensions, namely organizational, expert, ownership, and reputation power. This article draws inspiration from Finkelstein's approach and divides it into four dimensions. Two dummy variables are selected from each dimension to measure the corresponding power intensity, and the average value is ultimately taken to measure the size of CEO power, as shown in Table 1.

Table 1: CEO Power Dimension Indicators

Power dimension	Explanation
Organizational power	Whether to concurrently serve as the chairman
	Whether he or she is an internal director
Expert power	Whether he or she has a senior title
	Whether the length of service exceeds the industry median
Ownership power	Whether he or she has equity
	Whether institutional investors are below the industry median
Reputation power	Whether he or she have a master degree or above
	Whether to work part-time outside the company

3.2.4. Adjusting Variable: Equity Incentive (Mshare)

This article uses equity incentives as a moderating variable, drawing on the method of Wen Wen et al [33], and measures the level of equity incentives by dividing the number of shares held by a company's CEO in the current year by the total number of shares held by the company. The higher the CEO's shareholding ratio, the greater the company's equity incentives to the CEO. We use $CEOres * Mshare$ as an interaction term to examine the moderating effect of equity incentives on the source of CEO differentiation and CEO power.

3.2.5. Control Variables

This paper draws on existing literature on innovation investment research and controls for the basic characteristics of companies such as enterprise size and the impact of individual CEOs, as shown in the table 2.

This paper takes innovation investment as the explanatory variable, CEO sources as the explanatory variable, equity incentive as the moderating variable, CEO power as the intermediary variable, corporate basic characteristics and CEO personal characteristics as the control variable, control time, industry, and regional effects, and establishes the following multivariate regression model, where e is a random Error term.

$$RD = \beta_0 + \beta_1 CEOres + \beta_2 CEOpower + \beta_3 Mshare + \beta_4 CEOres * Mshare + \beta_i Controls + e \quad (1)$$

4. Empirical Analysis

4.1. Descriptive Statistics

Descriptive statistical analysis of the main variables using stata14 is shown in Table 3. The mean of the dependent variable RD is 0.0176, the maximum value is 0.0526, the minimum value is 0, and the standard deviation is 0.015. The mean of the explanatory variable CEOres is 1.74, and the standard error is 0.708. The mean of the intermediate variable CEOpower is 0.5566, and the standard error is 0.0018. From an overall perspective, the innovation investment level of private enterprise listed companies in China is not high, and the gap between different enterprises is relatively small.

Table 2: Control Variable Names and Descriptions

Variable	Symbol	Description
Enterprise scale	Epsize	The natural log of total assets
Asset-liability ratio	Lev	Total liabilities/total assets
Return on Equity	Roe	Net profit/total assets
Fixed Asset Ratio	Far	Ratio of ending fixed assets to ending total assets
Ownership concentration	Stol	Shareholding ratio of the largest shareholder
Board size	Bs	Number of board members
Government subsidy	Sub	Government subsidies/total assets related to research and development
CEO's Characteristics	Gender	1 for males and 0 for females
	Age	Age value
	Edu	1 for high school and below, 2 for junior college, and 3 for master's and above
Degree of market competition	Market	The Herfindahl index
Year	Year	Year dummy variable
Industry	Ind	Industry dummy variable
Region	Area	Regional dummy variable

Table 3: Descriptive Statistics of Variables

Variable	Obs	Mean	Std.Dev.	Min	Max
RD	11669	0.0176	0.015	0	0.0526
CEOres	11669	1.74	0.708	1	3
CEOpower	11669	0.5649	0.0019	0	1
Gender	11669	0.928	0.258	0	1
Age	11669	47.59	7.122	25	77
Edu	11669	2.455	0.591	1	3
Epsize	11669	7.831	0.958	5.861	9.745
Sub	11669	15400000	19700000	0	75500000
Stol	11669	0.324	0.129	0.085	0.582
Market	11669	0.0757	0.0627	0.0148	0.248
Bs	11669	8.327	1.504	3	18
Lev	11669	0.369	0.19	0.0395	0.715
Roe	11669	0.0435	0.0479	-0.172	0.127
Far	11669	0.189	0.125	0.00266	0.454
Mshare	11669	0.0268	0.0695	0	0.262

4.2. Correlation Analysis

Since CEO sources is categorical variable, we adopted spearman correlation test to preliminarily explore the relationship between variables, and found that each variable has a significant correlation with innovation input, indicating that these variables have a greater explanation for innovation input changes, as shown in Table 4 ~ 5.

Among these variables, the explanatory variable of CEO sources is negatively correlated with the relationship between CEO power and innovation investment in private enterprises, and the

relationship between CEO power and innovation investment in private enterprises is positively correlated, which preliminarily validates our research hypothesis. Enterprise size, asset liability ratio, fixed asset ratio, board size, equity concentration ratio, and market competition are all negatively correlated with innovation investment, while other variables are positively correlated with innovation investment. By observing the coefficients between the variables, which are less than 0.7, we can basically eliminate the multicollinearity problem of the variables in the model.

Table 4: Correlation analysis results

Variate	RD	CEOres	CEOpower	gender	age	edu
RD	1					
CEOres	-0.19 ***	1				
CEOpower	0.207 ***	-0.456 ***	1			
gender	0.055 ***	-0.005	0.044 ***	1		
age	0.027 ***	-0.154 ***	0.187 ***	0.019 **	1	
edu	0.059 ***	0.005	0.23 ***	-0.014	-0.094 ***	1
Epsize	-0.125 ***	0.154 ***	-0.039 ***	0.006	0.072 ***	0.033 ***
Lev	-0.278 ***	0.188 ***	-0.12 ***	-0.002	-0.013	0.026 ***
Roe	0.202 ***	-0.098 ***	0.054 ***	-0.012	-0.038 ***	0.029 ***
far	-0.008	0.039 ***	-0.03 ***	0.021 **	0.066 ***	-0.102 ***
Bs	-0.06 ***	0.072 ***	-0.05 ***	0.05 ***	-0.007	-0.009
Stol	-0.046 ***	-0.039 ***	-0.13 ***	-0.041 ***	-0.027 ***	-0.04 ***
Sub	0.187 ***	0.003	0.046 ***	0.038 ***	0.026 ***	0.08 ***
Market	-0.272 ***	0.025 ***	-0.098 ***	-0.04 ***	-0.077 ***	-0.074 ***
Mshare	0.169 ***	-0.217 ***	0.275 ***	0.022 **	0.037 ***	-0.009

Table 5: Correlation analysis results

Variate	Epsize	Lev	Roe	far	Bs	Stol	Sub	Market	Mshare
Epsize	1								
Lev	0.48 ***	1							
Roe	-0.049 ***	-0.361 ***	1						
far	-0.042 ***	0.078 ***	-0.12 ***	1					
Bs	0.131 ***	0.077 ***	0.059 ***	0.07 ***	1				
Stol	0.024 ***	-0.003	0.135 ***	0.012	-0.079 ***	1			
Sub	0.438 ***	0.153 ***	0.102 ***	0.057 ***	0.066 ***	0.002	1		
Market	0.004	0.122 ***	-0.07 ***	0.05 ***	0.028 ***	0.087 ***	-0.08 ***	1	
Mshare	-0.074 ***	-0.133 ***	0.107 ***	-0.043 ***	-0.009	-0.049 ***	0.03 ***	-0.046 ***	1

4.3. Regression Test and Its Results

The models in Table 6 all controlled for other necessary control variables, as well as the impact of industry, year, and regional factors on the regression. The regression model (1) is the result of regressing CEO sources and innovation investment. The regression results indicate that as the relationship between CEOs and actual controllers becomes more distant, the innovation investment level of the enterprise becomes lower, which proves hypothesis H1. Regression model (2) is the result of regressing CEO sources and CEO power. The regression results indicate that the more distant the relationship between the CEO and the actual controller, the smaller the CEO power, which proves hypothesis H2. Regression model (3) is a test of the mesomeric effect of CEO power. At the same time, CEO sources and CEO power are introduced to explore the impact on innovation input. The P value of CEO power is less than 0.01, which is highly positive correlation, and the mesomeric effect is significant. The conclusion is the same as that of regression model (2), and the impact of CEO sources on innovation input is the same as that of regression model (1), which proves the hypothesis H3. In order to further examine the impact of CEO sources on corporate innovation investment, we introduced equity incentives and their interaction terms for regression. The results are shown in models (4) and (5), and it can be found that compared to CEOs, when CEOs are relatives, power is lower when CEOs are acquaintances, and lower when CEOs are outsiders. Observing the coefficient direction and significance of the interaction term $CEOres * Mshare$, it can be seen that there is a significant positive correlation at the 1% level, indicating that equity incentives can weaken the negative impact of CEO sources (from close to sparse) on CEO power, supporting hypothesis H4 in this article.

Table 6: Hypothesis Test Regression Results

Variate	(1)	(2)	(3)	(4)	(5)
	RD	CEOpower	RD	CEOpower	CEOpower
CEOres2	-0.00183***	-0.152***	-0.00108***	-0.138***	-0.142***
CEOres3	-0.00374***	-0.225***	-0.00264***	-0.210***	-0.215***
Gender	0.00234***	0.0252***	0.00222***	0.0249***	0.0253***
Age	-0.0000413**	0.00349***	-0.0000583***	0.00350***	0.00352***
Edu	0.00164***	0.0822***	0.00124***	0.0823***	0.0825***
Epsize	-0.00453***	0.00242	-0.00454***	0.00394*	0.00406*
Sub	1.77e-10***	-2.16e-10**	1.78e-10***	-2.34e-10**	-2.35e-10**
Stol	-0.00521***	-0.202***	-0.00423***	-0.198***	-0.196***
Market	-0.0273***	-0.101***	-0.0268***	-0.101***	-0.104***
Bs	0.000131	-0.000715	0.000135*	-0.000426	-0.000418
Lev	-0.00687***	-0.0428***	-0.00666***	-0.0390***	-0.0378***
Roe	0.0394***	0.115***	0.0389***	0.107***	0.105***
Far	-0.00260***	0.0260**	-0.00272***	0.0305**	0.0301**
CEOpower			0.00487***		
Mshare				0.332***	0.0801
CEOres*Mshare					0.216***
_Cons	0.0386***	0.296***	0.0372***	0.257***	0.255***
R ²	0.287	0.3103	0.29	0.3217	0.3227
Adj R ²	0.2854	0.3087	0.2883	0.32	0.321
N	11669	11669	11669	11669	11669
Year	Control	Control	Control	Control	Control
Ind	Control	Control	Control	Control	Control
Area	Control	Control	Control	Control	Control

Note: The significance is *p<0.1, **p<0.05,***p<0.01.

4.4. Robustness Test

Table 7: Robustness Test Results

Variate	(6)	(7)	(8)	(9)	(10)
	Rd	CEOpower	Rd	CEOpower	CEOpower
CEOres2	-0.00509***	-0.193***	-0.00447***	-0.199***	-0.201***
CEOres3	-0.00844***	-0.257***	-0.00762***	-0.263***	-0.266***
Control variable	Control	Control	Control	Control	Control
CEOpower			0.00321***		
Mshare				-0.143***	-0.295***
CEOres*Mshare					0.130*
_Cons	0.104***	-0.335***	0.105***	-0.318***	-0.319***
R ²	0.3398	0.3177	0.3403	0.3186	0.3188
Adj R ²	0.3382	0.3161	0.3387	0.317	0.3171
N	11669	11669	11669	11669	11669
Year	Control	Control	Control	Control	Control
Ind	Control	Control	Control	Control	Control
Area	Control	Control	Control	Control	Control

Note: The significance is *p<0.1, **p<0.05,***p<0.01.

Because there is no accurate and unified measurement method for innovation input and CEO power, considering the measurement error, in order to make the results more robust, this paper adopts the

method of replacing variables to test the robustness of the model. This article draws on the method of Ding Hongyan et al [34] and uses principal component analysis to process eight indicators from the four dimensions of measuring CEO power. By selecting three principal components with eigenvalues greater than 1, the comprehensive score of CEO power is re measured. Drawing on the method of Sun Weizhang et al [35], the measurement indicator of innovation investment is replaced by R&D investment/total operating income, Models (5) to (8) are the models obtained by replacing the dependent and intermediate variables, and the regression results are shown in the table 7.

Model (6) examines the relationship between the replaced innovation input and the source of CEO, model (7) examines the relationship between the replaced CEO power and the source of CEO, model (8) examines the mesomeric effect of the replaced CEO power, model (9) and model (10) test the moderating effect of equity incentive after replacement of innovation input and CEO power measure. The conclusion drawn based on the regression results is consistent with the previous text, it shows that the empirical results are robust.

5. Research Conclusion and Enlightenment

This paper empirically finds that the more distant the relationship between the CEO and the actual controller is, the lower the CEO power intensity and the level of enterprise innovation investment. Moreover, the CEO power intensity plays a mediating role in CEO sources and enterprise innovation investment, while equity incentives play a positive moderating role in CEO sources and CEO power intensity. Based on the research findings of this article, suggestions are proposed as follows:

Establish more effective systems to prevent actual controllers from excessive control over the enterprise, thereby ensuring that the CEO has sufficient power to drive innovation investment in the enterprise, adjust the relationship between CEO sources and power intensity through equity incentives, and achieve better corporate governance effects. Develop appropriate equity incentive plans to motivate the CEO to make greater contributions in innovation, and when formulating equity incentive plans, consideration should be given to the impact of different sources of differentiation on the incentive effect of CEOs. For example, for externally hired CEOs, it is necessary to increase the intensity of equity incentives to compensate for the negative impact of their insufficient sense of identification and belonging to the enterprise.

Strengthen supervision and evaluation of corporate governance to ensure the effectiveness and implementation of the system. Supervisory agencies can promote the healthy operation of enterprises through regular evaluation and transparent information disclosure, while cultivating and selecting high-quality CEO talents to enhance their leadership and innovation capabilities. When selecting and evaluating CEOs, multiple factors such as their personal qualities, professional abilities, and business performance should be comprehensively considered to ensure the long-term development and stability of the enterprise.

Overall, the innovation investment of enterprises is a complex system engineering that needs to be promoted and implemented from multiple perspectives. By establishing effective governance systems, strengthening equity incentives, enhancing CEO power and innovation motivation, strengthening supervision and evaluation, and cultivating high-quality CEO talents, efforts can be made to promote enterprise innovation investment, achieve sustainable development, and achieve long-term profitability.

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Private Enterprises".

References

- [1] Liu Xiaoxia, Liu Meng, Yang Lin. Relationship familiarity and risk bearing level of private enterprises. *Research Management*, 2020, 41 (11): 268-278. DOI: 10.19571/j.cnki.1000-2995.2020.11.025
- [2] Zou Likai, Wang Bo, Liang Qiang. A Study on the Differences in Successive CEO Status and Innovation Investment in Family Enterprises from the Perspective of Legitimacy. *Foreign Economics and Management*, 2019, 41 (03): 126-140. DOI: 10.16538/j.cnki.fm.2019.03.009
- [3] Sun Weizhang, Xue Zhizhong, Wang Yaping, et al. The Source of CEO Succession, Heterogeneity of Living Environment, and Enterprise Innovation Investment. *Science and Technology Management Research*, 2023,43 (05): 136-145
- [4] Zhang Jitong, Zhu Jialing. Research on the Impact of Tax Policies on Innovation Incentives in China's Manufacturing Industry. *Journal of Nanjing Audit University*, 2018,15 (06): 47-54
- [5] Zhao Shubo, Wang Xiuzhe, Cao Yue. Research on Tax Policies to Encourage Enterprise Innovation in China. *Tax Research*, 2019, No. 415 (08): 20-26. DOI: 10.19376/j.cnki.cn11-1011/f.2019.08.004
- [6] Aarstad Jarle, Kvitastein Olav Andreas. An unexpected external shock and enterprises' innovation performance. *Applied Economics Letters*, 2021,28 (14)
- [7] Zhou Zong'an, Xia Feifei, Zhou Jing. Banking Market Environment, Credit Constraints, and Small and Medium Enterprise Innovation. *Dongyue Cong*, 2017, 38 (08): 102-110. DOI: 10.15981/j.cnki.dongyueluncong.2017.08.015
- [8] Andreeva Tatiana, Garanina Tatiana, Sáenz Josune, Aramburu Nekane, Kianto Aino. Does country environment matter in the relationship between intellectual capital and innovation performance? *Journal of Business Research*, 2021,136
- [9] Li Dandan. Research on the Impact of Government R&D Subsidies on Enterprise Innovation Performance: From the Perspective of Enterprise Scale and Property Heterogeneity. *Journal of Economics*, 2022, 9 (01): 141-161. DOI: 10.16513/j.cnki.cje.20220126.001
- [10] Chen Xiaohe, Zhou Ke. Innovation Heterogeneity, Government Subsidies, and Innovative Development of Military Civil Integration Enterprises. *Journal of Beijing University of Technology (Social Sciences Edition)*, 2021, 23 (01): 117-126
- [11] Cheng Qiongwen, Ding Hongyi. Financial subsidies, policy combinations, and innovation output of resource-based enterprises: from the perspective of innovation output heterogeneity. *China Science and Technology Forum*, 2021, No.305 (09): 20-30+103. DOI: 10.13580/j.cnki.fstc.2021.09.004
- [12] Wang Xiaosong, Zhang Yu. Enterprise Scale and Innovation Efficiency: An Empirical Analysis Based on China's High tech Industry. *Journal of Social Sciences of Jilin University*, 2021, 61 (03): 129-141+236-237. DOI: 10.15939/j.jjsse.2021.03.j2
- [13] Stephen Kehinde Medase. Product innovation and employees' slack time. The moderating role of firm age & size. *Journal of Innovation&Knowledge*, 2020,5 (3):
- [14] Yang Qing, Gao Jiqiao. Does the dual ownership structure promote enterprise innovation— Data from Chinese companies listed in the United States. *Shanghai Finance*, 2021, No. 494 (09): 64-79. DOI: 10.13910/j.cnki.shjr.2021.09.006
- [15] Yeşil S, Doğan I F. Exploring the relationship between social capital, innovation capability and innovation. *Innovation*, 2019, 21 (4)
- [16] Marco Nunes, António Abreu. Managing Open Innovation Project Risks Based on a Social Network Analysis Perspective. *Sustainability*, 2020, 12 (8)
- [17] Iftekhar Hasan, Chun-Keung (Stan) Hoi, Qiang Wu,Hao Zhang. Is social capital associated with corporate innovation? Evidence from publicly listed firms in the U.S. *Journal of Corporate Finance*, 2020, 62
- [18] Zhang Dong, Hu Wenlong, Mao Xinshu. Research and development background, executive power, and corporate innovation. *China Industrial Economy*, 2021, No. 397 (04): 156-174. DOI: 10.19581/j.cnki.ciejournal.2021-04.007
- [19] Li Gang, Fang Kun, Xiao Tusheng. CEO Financial Background and Enterprise Innovation: Promoting or Suppressing? *Accounting and Economic Research*, 2021, 35 (05): 43-61. DOI: 10.16314/j.cnki.31-2074/f.2021.05.002
- [20] Huang Weili, Ma Guangqi. Overseas Returned Executives, Regional Differences, and Enterprise Innovation. *Scientific Research Management*, 2021, 42 (07): 200-208. DOI: 10.19571/j.cnki.1000-2995.2021-07.022
- [21] Lang Xiangxiang, You Dandan. Manager's Military Experience and Enterprise R&D Investment. *Scientific Research Management*, 2021, 42 (06): 166-175. DOI: 10.19571/j.cnki.1000-2995.2021-06.020
- [22] Hao Jing, He Feng, Wang Bowen. Executive overconfidence and technological innovation in listed companies: From the perspective of corporate financialization. *Systems Engineering Theory and Practice: 1-24 [2023-04-18]* <http://kns.cnki.net/kcms/detail/11.2267.n.20230105.0936.003.html>.

- [23] Chen Siying, Gu Xin, Wang Tao. *Analysis of Factors Influencing Mutual Trust between Organizations in Enterprise Innovation Networks*. *China Science and Technology Forum*, 2014, No. 217 (05): 16-19+26. DOI: 10.13580/j.cnki.fstc.2014.05.004
- [24] Li Haixia. *CEO Power, Risk Taking, and Corporate Growth: An Empirical Study Based on Listed Companies in China*. *Management Review*, 2017, 29 (10): 198-210. DOI: 10.14120/j.cnki.cn11-5057/f.2017.10.17
- [25] Sun Ye, Shao Fangjing, Yin Zhaotian. *Research on the Impact of Board Capital and CEO Power on Enterprise Technological Innovation*. *Hubei Social Sciences*, 2018, No. 374 (02): 98-104. DOI: 10.13660/j.cnki.42-1112/c.014499
- [26] Xu Mingxia. *Family businesses, CEO power, and innovation efficiency*. *Shanghai Finance*, 2018, No.458 (09): 65-79. DOI: 10.13910/j.cnki.shjr.2018.09009
- [27] Chen Pengcheng. *Internal Gap in Equity Incentive Level and Enterprise Innovation*. *Journal of Yunnan University of Finance and Economics*, 2020, 36 (12): 89-104. DOI: 10.16537/j.cnki.jynufe.000656
- [28] Ni Yan, Hu Yan. *The impact of equity incentive intensity on corporate performance: A case study of A-share listed companies*. *Jiangnan Forum*, 2021, No.514 (04): 17-27
- [29] Zhu Fangfang. *Available Redundancy and R&D Investment: Joint Adjustment of Equity Incentive and Bankruptcy Distance*. *Modern Finance and Economics (Journal of Tianjin University of Finance and Economics)*, 2019, 39 (02): 84-100. DOI: 10.19559/j.cnki.12-1387.2019.02.007
- [30] Xiong Kaijun. *How R&D subsidies and non R&D subsidies affect enterprise innovation investment*. *Scientific Research*, 2023, 41 (01): 181-192. DOI: 10.16192/j.cnki.1003-2053.2023.01.002
- [31] Liu Xiaoxia, Liu Meng, Yang Lin. *Relationship familiarity and risk bearing level of private enterprises*. *Research Management*, 2020, 41 (11): 268-278. DOI: 10.19571/j.cnki.1000-2995.2020.11.025
- [32] Finkelstein S, Boyd B K. *How much does the CEO matter? The role of managerial discretion in the setting of CEO compensation*. *Academy of Management journal*, 1998, 41(2): 179-199.
- [33] Wen Wen, Chen Yinmo, Zhang Xiaoliang, et al. *Can CEO Equity Incentives Promote Foreign Direct Investment by Enterprises: From the Perspective of Enterprise Heterogeneity*. *Journal of International Business (University of International Business and Economics)*, 2020, No.196 (05): 125-140. DOI: 10.13509/j.cnki.ib.2020.05.009
- [34] Ding Hongyan, Li Bingyu, He Xi. *CEO Power, Financing Constraints, and R&D Investment: Empirical Evidence Based on Listed Companies in China*. *Industrial Technology and Economics*, 2020,39 (06): 78-85
- [35] Sun Weizhang, Xue Zhizhong, Wang Yaping, et al. *The Source of CEO Succession, Heterogeneity of Living Environment, and Enterprise Innovation Investment*. *Science and Technology Management Research*, 2023,43 (05): 136-145