

Controlling Shareholder's Equity Pledge and Corporate R&D Investment

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Abstract—In recent years, the controlling shareholder pledge of listed companies has become a common phenomenon in China's capital market. This paper taking the non-financial enterprises listed on Shanghai and Shenzhen A-share markets as samples from 2013 to 2017, studies the influence of the controlling shareholders' equity pledge on the R&D investment level of enterprises, and adds earnings management as a moderating variable. The empirical research shows that the controlling shareholder's equity pledge behavior will significantly reduce the level of R&D investment; the higher the quality of earnings management as a regulatory variable, the greater the negative effect of the large shareholder equity pledge on the R&D investment level of the enterprise. The article, expanding the existing research perspective, is of great significance for controlling company risks and promoting the long-term development of listed companies.

Keywords—controlling shareholder; equity pledge; earnings management; R&D investment

I. INTRODUCTION

Equity pledge refers to the act of the pledgee applying for loans from a third party or financial institution with the shares held as the pledge. Compared with the financing methods such as private placement of new shares and bank loans, the equity pledge does not require strict and time-consuming approval procedures by the regulatory authorities, and large-scale financing can be obtained without diluting the equity. Since the controlling shareholder has mastered the company's major business decision-making direction, the financing demand is often relatively large. In order to prevent the control right from being diluted, it is generally not easy to choose to reduce the stock to obtain the required funds. Therefore, equity pledge has gradually become an ideal financing method for controlling shares. The company's R&D activities are highly uncertain, long-term cyclical and risky. When the controlling shareholder has equity pledge, the restrictions and pressures on the interest rate and repayment period will increase, which makes the controlling shareholder must focus on short-term performance rather than on corporate R&D activities that focus on improving the company's long-term core competencies. At the same time, some enterprises repeatedly pledged equity within the same year. In order to maintain the reputation of the enterprise, stabilize the company's stock price, and meet the conditions of equity pledge again, the enterprise is more inclined to put

the funds obtained from the loan into routine operation projects with lower risks and more stable returns; otherwise, once the liquidation line is triggered, the enterprise may suffer losses and will also cause adverse effects on the position of the controlling shareholders. Therefore, under the pressure of clear short-term repayment performance, it is impossible for enterprises to invest capital in the R&D activities with high risks, thus reducing the R&D investment level of enterprises.

The controlling shareholder obtains financing through pledge of equity, which enhances its motives for manipulating management's implementation of earnings management, and this behavior introduces the external governance role of the pledgee. In order to ensure the safety of loans, the pledgee will pay close attention to the quality of the pledges of listed companies and the quality of earnings management. Oswald and Zarowin (2005) used British companies as a sample to explore whether and how accounting treatments for costing and capitalized R&D expenditures affect corporate managers' R&D investment decisions. The results of the study show that when adopting cost-based R&D expenditure processing, management tends to manage real earnings through real trading activities, and that is, reducing R&D expenditures. When adopting capitalized accounting treatment, management tends to adjust R&D. Management tends to conduct accrual earnings management by adjusting the capitalization ratio of R&D investment. In addition, some scholars have explored whether R&D investment will be used as a tool for earnings management when it comes to management-level performance target pressure from a management perspective. Both Dechow and Slogan (1991) have observed that management has the motivation and performance to reduce R&D investment for short-term profitability performance in the final years of the term. Barker and Muller (2002) have confirmed that the shorter the CEO's term, the more likely it is to reduce R&D spending to achieve short-term performance during his tenure.

After discussion of the above issues, what effect will the controlling shareholder's pledge of equity have on the R&D investment level of the company? For those companies that have conducted earnings management after the equity pledge, what changes will be made to the R&D investment level? Based on the above considerations, it is of practical

significance and practical significance to explore the impact of controlling shareholders' equity pledge on enterprise R&D investment. Therefore, this paper will focus on the impact of controlling shareholders' equity pledge on the R&D investment level of enterprises and introduce earnings management as a moderator to discuss the relationship between them, which is helpful for investors, creditors and other enterprises to identify the risk and reduce the risk identification cost.

II. THEORETICAL ANALYSIS AND RESEARCH HYPOTHESIS

A. *The Relationship Between the Controlling Shareholder's Equity Pledge and the Enterprise's R&D Investment*

The controlling shareholder who aims at maximizing wealth as a decision-maker who controls the important business behavior of the company is usually risk-averse, while the R&D activity period is long and the risk is high, and its input level will directly affect the company's performance. If it fails, not only the listed company's stock volatility may face heavy losses, and controlling shareholders will also face the risk of transfer of control rights, so they are reluctant to invest funds in high-risk research and development projects. Secondly, the long-term characteristics of R&D activities are contrary to the goal of controlling shareholders who tend to short-term performance. Even if R&D success can help companies establish core competitiveness and enable them to gain a larger market share. However, compared with the stable status of controlling shareholders, they will consider the risk of control transfer after pledged equity in their management decisions and avoid high-risk and high-return projects when making investment decisions (Dou Masulis & Zein, 2015). Finally, equity pledge itself indicates that the controlling shareholder has capital needs and faces a large financing limit. At this time, the controlling shareholder's gaze will become shorter.

In summary, when there is equity pledge, the controlling shareholder pledge behavior will reduce the company's research and development activities, making the company's R&D investment level lower. Therefore, this paper believes that under the influence of risk appetite, the controlling shareholder's equity pledge will be more averse to risk, and the higher the pledge ratio, the deeper the risk of aversion, and thus reluctant to invest in high-risk R&D activities. The first hypothesis of this paper is proposed:

H1: All other things being equal, the controlling shareholder's equity pledge is significantly negatively correlated with the level of R&D investment.

B. *Relationship Between Controlling Shareholder Pledge, Earnings Management and Enterprise R&D Investment*

When an enterprise chooses equity pledge for financing, it is similar to other debt financing methods. Before financing, it needs to be evaluated by banks or other regulatory agencies. These institutions will identify and review their loan conditions according to their financial

status. Therefore, in order to obtain financing, the controlling shareholder has a strong capital incentive to manage earnings, which affects the risk judgment and loan decision of the pledgee, thereby reducing the cost of the debt contract. After the equity pledge, the pledgee will still pay close attention to the quality of the pledge of the enterprise and the quality of the earnings management to ensure the security of the loan. For the controlling shareholder, after the equity pledge is loaned, it is possible to continue the earnings management in order to maintain the refinancing ability of the creditor in the follow-up evaluation (Begley, 1990).

Because China's accounting treatment adopts the basis of accounting confirmation of accrual system, it can make the earnings management of the company by manipulating the ratio of income and expenses, and the ratio of the research and development expenditure to capitalization or expense, the measurement amount, and the disclosure information. There is no specific provision for content and confirmation time, and there is a large profit manipulation space.

Based on the above analysis, this paper proposes the following assumptions:

H2: Under the condition that other factors remain unchanged, the quality of corporate earnings management is significantly negatively correlated with the level of R&D investment.

H3: The higher the quality of corporate earnings management, the greater the negative impact of the controlling shareholder pledge behavior on the R&D investment level of the company.

III. RESEARCH DESIGN

A. *Sample Selection and Data Source*

This article takes 2013-2017 In Shanghai and Shenzhen A-share listed non-financial companies for the study, according to the research needs of existing practices and research needs in this article, excluding the ST, * ST companies, financial companies, and screening out extreme outliers, and observations of less than one year of listing. In order to avoid the influence of extreme values, Winsorize the upper and lower 1% of all continuous variables in this paper. The R&D investment data of this paper is manually compiled according to the annual report, and the rest of the data comes from the RESSET database. After screening, the 2007 sample observations were obtained. The information on the equity pledge is compiled according to the information disclosure of each listed company. The software used is Stata 12.0 and Excel 2016.

B. *Selection and Definition of Variables*

1) *The variable is interpreted:* The explanatory variable in this paper is the R&D investment level (RD). In order to avoid the scale effect, this paper uses the R&D investment intensity to measure the R&D investment level. The specific calculation is to add the total cost of research and development to the total cost of research and development, and then divide the company's operating income.

2) *Explaining the variables:* Pledge represents equity pledge and DA represents accrued earnings management. Since the equity pledge in this paper refers to the equity pledge taken by the controlling shareholders of the enterprise, it is assumed that the value of equity pledge taken by the controlling shareholders of the enterprise by the end of the year is set as 1, and vice versa. If the pledge is taken, it is also set as 0 if it is removed before the end of the year. Xia Lijun (2002) found that when income recognition is easy to be manipulated, the modified Jones model can eliminate this tendency. Therefore, it is considered that the

modified Jones model can effectively test the accrued earnings management behavior of listed companies in China. At present, most domestic research also uses the modified Jones model to measure the level of accrued earnings management. Therefore, this paper using the measurable accrual profit measure calculated by the modified Jones model of Dechow et al (1995).

3) *Control variables:* This paper draws on the previous research to select the company size (Size), asset-liability ratio (Lev) and so on as control variables. The relevant variables are selected and calculated as shown in "Table I":

TABLE I. MAIN VARIABLES CALCULATION AND DEFINITION

Variable name	Variable symbol	Variable description
Enterprise R&D investment level	RD	The ratio of the company's research and development expenditure to the current year's operating income
Controlling shareholder pledge	Pledge 1	Whether the controlling shareholder has equity pledge at the end of the year, and the value is 1 ; otherwise, it is 0.
Proportion of controlling shareholder pledge	Pledge 2	Proportion of controlling shareholder's equity pledge in the current year
Accrual earnings management	DA	Accrual surplus control level
Shareholding ratio of controlling shareholders	Block	Number of shares held by controlling shareholders / total number of shares
Business scale	Size	Natural logarithm of total assets at the end of the period
Company growth	Growth	Operating income growth rate
Assets and liabilities	Lev	Ratio of total book value of debt at the end of the year to total book value of assets
Roe	Roe	Average annual profit / shareholder equity ending and opening balance
Cash flow from operating activities	CF	Net cash flow from operating activities / total assets
Year dummy variable	Year	In order to control the influence of macro factors in different years, set time dummy variables according to the year.
Industry dummy variable	Ind	Set industry dummy variables according to different industries

C. Model Establishment

This paper uses Model 1 to examine the relationship between controlling shareholder pledge and corporate R&D investment:

$$RD_{i,t+1} = \beta + \beta_1 Pledge_{i,t} + \beta_2 Block + \beta_3 Size + \beta_4 Growth + \beta_5 Lev + \beta_6 Roe + \beta_7 Cf + Year + \varepsilon$$

Because the controlling shareholder's equity pledge affects the R&D activities of listed companies, it takes a certain amount of time. In order to reduce the endogenous effect, this paper constructs the econometric model with the data with a lag of one period. $RD_{i,t+1}$ is measured by the innovation investment variable RD of the listed company t+1 years, $Pledge_{i,t}$ is measured by the proportion of equity pledge of controlling shareholders in t year, and other control variables are measured by the value of t years. (See "Table I" for details) If the research hypothesis 1 is established, then the coefficient β_1 should be significantly negative.

Use Model 2 to examine the relationship between earnings management and corporate R&D investment:

$$RD_{i,t+1} = \beta + \beta_1 DA_{i,t} + \beta_2 Block + \beta_3 Size + \beta_4 Growth + \beta_5 Lev + \beta_6 Roe + \beta_7 Cf + Year + \varepsilon$$

If hypothesis 2 is established, then the coefficient β_2 should be significantly negative.

Use Model 3 to examine the regulatory role of earnings management in controlling the shareholder's equity pledge to corporate R&D investment:

$$RD_{i,t+1} = \beta + \beta_1 Pledge_{i,t} + \beta_2 Pledge_{i,t} * DA_{i,t} + \beta_3 Block + \beta_4 Size + \beta_5 Growth + \beta_6 Lev + \beta_7 Roe + \beta_8 Cf + Year + \varepsilon$$

Among them, $Pledge_{i,t} * DA_{i,t}$ representing the intersection of the controlling shareholder's equity pledge and the listed company's earnings management, the other control variables are consistent with Model. If the

assumption 3 is true, then the coefficient β_3 should be significantly negative.

IV. EMPIRICAL ANALYSIS

A. Descriptive Statistics

It can be seen from "Table II" that the minimum value of R&D investment index RD is 0, the maximum value is 0.627, the standard deviation is 0.047, and the average value is 0.052, which indicates that China's R&D investment level is generally not high, but it can be seen that some enterprises

have consciously put R&D expenditures as a significant expense for the company. The average shareholding ratio of the controlling shareholder's equity is 0.294, and the maximum value is 1. This indicates that most enterprises do not adopt the equity pledge financing method. In addition, due to the concentration of equity, there are problems of controlling shareholders' monopoly, and the proportion of equity pledge is as high as 100%. Descriptive statistics of other variables are within reasonable limits and are not much different from existing studies, so this article will not elaborate.

TABLE II. DESCRIPTIVE STATISTICS FOR THE SAMPLES

Variable name	Observations	Mean	Standard deviation	Minimum value	Maximum
RD	2007	0.052	0.047	0.000	0.627
Pledge1	2007	0.149	0.356	0.000	1.000
Pledge2	2007	0.294	0.173	0.000	1.000
DA	2007	0.028	0.520	-0.506	0.664
Block	2007	0.807	0.153	0.097	1.092
Size	2007	19.322	1.857	13.346	26.549
Growth	2007	0.453	0.348	-1.000	1.680
Lev	2007	0.440	0.370	0.103	0.848
Roe	2007	0.068	0.162	-2.721	2.551
Cf	2007	9.41E+07	8.21E+08	-1.34E+10	2.68E+10

B. Correlation Analysis

According to the data in "Table III", there is a significant negative correlation between the company's R&D investment and the controlling shareholder's pledge and pledge ratio, indicating that the controlling shareholder's equity pledge will inhibit the company's R&D investment without considering other factors. After adding the earnings

management variables, it can be seen that the negative relationship between equity pledge and corporate R&D investment is more significant. Therefore, the higher the level of corporate earnings management, the more it will enhance the negative impact of controlling shareholders' equity pledge on the R&D investment level of enterprises. Hypothesis 3 is true.

TABLE III. CORRELATION ANALYSIS

	RD	Pledge2	Ple2*DA	Block	Size	Growth	Lev	Roe	Cf
RD	1								
Pledge2	-0.0589	1							
Ple2*DA	-0.0835	0.2805*	1						
Block	-0.1004*	-0.4408*	-0.1389*	1					
Size	-0.2167*	0.2331*	0.0511*	-0.2780*	1				
Growth	-0.0224	0.2321*	0.0696*	-0.1184*	-0.0533*	1			
Lev	-0.2325*	0.0163	0.0485*	0.1969*	-0.0862*	0.0084	1		
Roe	-0.0401*	-0.3232*	-0.0258	0.4478*	0.0024	0.0050	-0.0006	1	
Cf	-0.0636*	-0.0410*	-0.1018*	-0.0286*	0.2281*	-0.0064	0.0052	0.0046	1

C. Multiple Regression

The regression results are shown in "Table IV", and the following conclusions can be drawn:

Whether the controlling shareholder has carried out the equity pledge activity is significantly negatively correlated with the R&D investment level of the enterprise under the 1% significance level, indicating that the controlling shareholder equity pledge will affect the R&D investment level of the enterprise, and the hypothesis 1 is established.

The earnings management and R&D investment of the company are negatively correlated at the 1% level of significance, indicating that the company's earnings management will reduce the R&D investment level of the company, thus confirming the hypothesis 2 of this paper.

The coefficient of interaction (Ple*DA) of equity pledge and earnings management is 0.450, which has a significant negative correlation with corporate R&D investment. Description earnings management as the moderator, the higher the quality, the more we will increase the negative impact of a strong controlling shareholder equity pledge on

R&D investment levels, reducing R&D spending, thus confirming the hypothesis 3.

TABLE IV. THE REGRESSION RESULTS

	Model one	Model two	Model three
	RD	RD	RD
Pledge2	-0.205*		-0.358***
Block	-0.029*	-0.024***	-0.027***
Size	-0.24***	-0.235***	-0.204***
Growth	-0.002	-0.003	-0.002
Lev	-0.043***	-0.046**	-0.045***
Roe	-0.004	-0.003	-0.005
Cf	-0.001*	-0.001***	-0.001***
DA		-0.316***	
Ple*DA			0.450***
Year	Yes	Yes	Yes
Ind	Yes	Yes	Yes
-cons	0.139***	0.132***	0.135***
	-4.348	-3.977	-4.07
N	2007	2007	2007
R2	0.233	0.233	0.233
R2-a	0.223	0.224	0.223
F	24.781	24.432	23.357

^a. *p<0.1, **p<0.05, ***p<0.001

D. Robustness Test

This paper also conducts a robustness test, which changes the accrual earnings management variable to true earnings management, uses the same method to screen samples for calculation, and concludes that whether it is an accrued earnings management activity or a comprehensive real earnings management activity, both have an inhibitory (reverse) effect on the level of R&D investment of enterprises. The test results show that the robustness test is consistent with the conclusions confirmed in the previous paper, indicating that the research conclusions in this paper are reliable.

V. CONCLUSION

The pledge of controlling shareholder equity has become a common phenomenon in listed companies in China, but the existing research on equity pledge is still relatively lacking. Based on the enterprise R&D investment, this paper examines the impact of controlling shareholders' equity pledge on corporate R&D activities through an empirical study of Shanghai and Shenzhen A-share listed companies in 2013-2017. This paper conducts regression research and robustness test on the sample. The results show that the controlling shareholder's equity pledge behavior and the company's earnings management quality will significantly reduce the level of R&D investment; further research shows that the higher the quality of earnings management, the greater the holding. The negative effect of shareholder equity pledge on the level of R&D investment of enterprises. A listed company that has an equity pledge can do a good job of improving its risk-taking ability and is conducive to the good development of the company. In theory, this paper takes the controlling shareholder's equity pledge as the entry point and enriches the related literature. In practice, the conclusions drawn in this paper provide a reference for the listed companies to improve the earnings management

system and the regulatory authorities to regulate the controlling shareholder's equity pledge.

Based on the above research conclusions, this paper puts forward two suggestions: First, enterprises should pay attention to the equity pledge behavior of controlling shareholders in the long-term healthy development. Controlling shareholders and managers must pay attention to the important role of R&D activities. Although research and development is risky, it will bring core competitiveness to the company after success. Therefore, from a long-term perspective, companies can conduct appropriate R&D activities after carefully screening R&D projects, and at the same time, do a good job of risk prevention mechanisms for R&D activities and risk contingency plans. Second, because management can use the subjectivity of the two stages of research and development to adjust the R&D expenditure structure to achieve the purpose of earnings management, companies should strengthen the auditor's audit of R&D expenditure projects, especially the R&D research phase and the division criteria of the development phase to improve the quality of accounting information.

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