

The impact of executive characteristics on earnings management of R&D activities

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Abstract: Based on the data of A-share listed companies in Shanghai and Shenzhen Stock exchanges from 2016 to 2022, this paper investigates the impact of executive characteristics on the degree of earnings management in R&D activities. The results show that the average age, education level, proportion of technical directors, equity and salary of senior management members are negatively correlated with the degree of earnings management of R&D activities, the proportion of female directors of senior management members is positively correlated with the degree of earnings management of R&D activities, and the average tenure of senior management members and the proportion of executive directors have no significant impact on the degree of earnings management of R&D activities.

1. Introduction

Innovation is the driving force of enterprise development and the cornerstone of enterprise long-term development. The enterprise innovation cannot be separated from capital investment. The enterprise innovation investment mainly depends on the ability and vision^{8[1]} of the top management team, its business decisions play a vital role in the development of the enterprise^[2]. Hambrick and Mason mentioned the difference in the characteristics of managers in the upper echelons theory. Managers often make decisions based on their own cognitive basis and values, which are closely related to personal experience, education and work experience.

The separation of ownership and management leads to a certain conflict of interest between owners and management. In the process of increasing R&D investment, it also provides another way for senior executives to manage earnings. That is to adjust operating profit by manipulating the discretionary expense of R&D investment. Research shows that managers are motivated to manipulate earnings through earnings management when corporate performance declines or performance fails to meet investors' expectations. Adjusting investment activities and manipulating real earnings management behavior of R&D investment is an important way for management to whitewash performance and manipulate earnings. Based on the upper echelons theory, the characteristics of top management will affect the degree of earnings management. However, the characteristics of managers are heterogeneous, such as different educational background, knowledge structure, risk-taking spirit, power allocation structure, and different understanding of R&D investment prospects and risks, which will have great differences in deciding the amount of R&D investment. Most of the existing studies have analyzed the relationship between executive characteristics and real earnings management, or studied the impact of executive characteristics on

corporate R&D investment.

2. Theoretical analysis and research hypotheses

2.1 Characteristics of executives' human capital

In this paper, the human capital characteristics of the top management team mainly include four aspects: average age, tenure, education level and R&D background.

2.1.1 Age

Scholars have found that the real earnings management level of young executives is higher^[3], but because young executives are better at accepting new things and like to challenge themselves, they are more inclined to conduct R&D activities. Research on whether young executives tend to conduct R&D earnings management is a way for executives to conduct earnings management.

H1: The older the average age of executives is, the lower the level of earnings management of R&D activities will be.

2.1.2 Tenure

In the early stage, Allen believed that the longer the term of office of senior executives is, the more conducive it is to the accumulation of work and the improvement of business level, and it can save the running-in cost of the top management team. However, with the deepening of research, we found that a longer term of office may make senior executives unwilling to spend time and energy on R&D activities, and have a lower level of risk-taking. And they may exclude those who have different opinions with them, thus making the organization continuously homogenized. As a result, the top management team lacks vision and has low risk-taking ability.

H2: The longer the average tenure of senior executives is, the higher the level of R&D earnings management will be.

2.1.3 Education level

The innovation level of an enterprise largely depends on the management's ability to grasp opportunities and analyze and process information. These abilities are related to the management's cognitive ability and opportunity recognition ability. Executives with higher levels of education have better knowledge reserves and innovative thinking, and can quickly respond to changes in the external environment, find new opportunities, and adjust corporate strategies in time. Executives with higher education levels can more quickly grasp and identify innovation opportunities and promote corporate innovation activities^[4]. Cao et al. (2018) argued that the average education level of corporate executives has a significantly positive impact on corporate R&D investment^[5,6].

H3: The higher the average level of education of executives is, the lower the level of earnings management of R&D activities will be.

2.1.4 R&D background

Executives with different work histories may have different strategic judgments when making decisions. Compared with those with professional experience in finance, law or administration, those with work experience in R&D, production or design are the main discoverers of innovation opportunities and the promoters of innovation practices. Guo (2012) believed that executives with technical backgrounds such as R&D, engineering or production would pay more attention to R&D activities and thus be more willing to invest in R&D^[7]. Gong et al. (2021) believed that technical

independent directors pay more attention to the long-term development of enterprises, integrate internal and external resources of enterprises, provide professional consultation and suggestions for innovation decision-making, play the role of experts, and promote the improvement of enterprise innovation performance^[8]. Therefore, Hypothesis 4 is put forward.

H4: The higher the proportion of top management team members with R&D background is, the lower the level of earnings management of R&D activities will be.

3. Characteristics of the top management team

3.1 Female executives

Gender differences are reflected in values, management styles, analysis and cognition of problems, and attitudes towards risks. In the decision-making process of enterprises, women's personality characteristics, such as careful thinking, make most of them prefer to avoid risks, and tend to reduce the innovation investment of enterprises, resulting in relatively fewer innovation achievements of enterprises. Most scholars have found that female executives or directors play a negative role in R&D investment activities of enterprises^[9]. Therefore, Hypothesis 5 is proposed.

H5: The higher the proportion of women in the top management team is, the higher the level of earnings management in R&D activities will be.

3.2 The proportion of executive directors

The concurrent position of senior management will make the power of senior executives too concentrated, the supervision mechanism between senior executives will be affected to a certain extent, and it is difficult for senior executives to be effectively restrained to act harmful to the overall interests of the company for their own interests^[10]. Based on the hypothesis of director identity and internal checks and balances in the management, some scholars believe that the higher the proportion of executive directors in the management, the more it can inhibit the earnings management of R&D activities that damages the long-term value of the company^[11]. Therefore, Hypothesis 6 is proposed.

H6: The higher the proportion of executive directors in the top management team is, the lower the level of earnings management in R&D activities will be.

4. Team incentive

According to the agency theory, the interests and goals of senior executives and shareholders are not completely consistent. In order to make the interests of managers and shareholders more consistent, many companies will choose to implement executive shareholding, so as to increase the sense of ownership of managers, weaken the short-term behavior of executives, encourage executives to boldly invest in research and development and management innovation, and adopt various new technologies to improve the business performance and core competitiveness of enterprises. In order to continue to gain profits after the end of the term of office, senior executives should not only care about how to improve the performance during the term of office, but also pay attention to the long-term development of the enterprise and take certain risks, so as to ensure the long-term benefits.

The remuneration of senior executives reflects their value, which is a very important part of the management. Enterprises can provide them with an attractive salary, which can not only meet the material needs of managers and their families, but also reflect the enterprise's recognition of talents, which not only enhances the sense of honor of managers, but also improves the sense of belonging in the collective. When the value of executives is satisfied, they can focus on the long-term interests from the perspective of the enterprise, and make R&D investment that is conducive to the long-term

interests of the company for the better development of the company and individuals.

H7: Equity incentives and compensation incentives of the top management team are negatively correlated with the level of earnings management of R&D activities.

5. Research design

5.1 Sample selection and data sources

This paper selects A-share listed companies in Shanghai and Shenzhen Stock exchanges from 2016 to 2022 as the initial sample, and excludes the following: (1) samples of listed companies in the financial and insurance industry; (2) Samples of ST and *ST companies in each year; (3) For samples with asset-liability ratio greater than 1, insolvent companies are regarded as outliers; (4) Samples with missing core research variables, the final sample number is 10149 (companies/years). The data used are all from the CSMAR database. In order to reduce the influence of sample outliers on the model estimation results, all continuous variables are winsorized at the level of the highest and lowest 1%.

5.2 Definition of variables

5.2.1 Explained variable: earnings management of R&D activities

Based on the common method of existing research, this paper adopts the Roychowdhury model of discretionary expense expectation in real earnings management, which holds that there is a linear relationship between R&D expense and previous period's income. In the model, TA represents the total assets at the end of the year, and S represents the main business income.

$$\frac{R\&D_{i,t}}{TA_{i,t-1}} = \alpha_0 + \alpha_1 \times \frac{1}{TA_{i,t-1}} + \alpha_2 \times \frac{S_{i,t-1}}{TA_{i,t-1}} + \varepsilon_{i,t} \quad (1)$$

5.2.2 Explanatory variables

age: It is represented by the average age of top management team members.

Tenure (date) : The average tenure of a member of the top management team is used.

Education level (edu) : The average education level of the top management team is the educational level of the top management team members.

The proportion of Female directors (Female). It is measured by the proportion of female senior management members in the total number of senior management members.

Percentage of executive directors (EXEDIR). Exedir is measured as the ratio of executive directors to the total number of executive members in a company.

Research and development background (Back). It is measured as the ratio of members with a professional background in production, R&D or design to the total number of senior management members.

Senior management shareholding ratio (Sto): it is the proportion of the number of senior management shares in the total share capital of the enterprise.

Executive compensation (Pay): the total compensation of the top three top management team members with the highest amount is used.

5.2.3 Control variables

The control variables are shown in Table 1.

Table 1: Control variables

Enterprise size	Size	Ln (total assets at year-end)
Ownership concentration	Top1	Shareholding ratio of the largest shareholder
Asset-liability ratio	Lev	Total liabilities ÷ total assets
Board size	GM	Natural logarithm of the number of board members
Revenue growth rate	Saleg	(operating income in current year - operating income in last year)/(operating income in last year)
Book-to-market ratio	MB	Book value divided by market value
Industry	Ind	According to CSRC 2012 industry division
YEAR	Year	2016-2022

6. Empirical results and analysis

6.1 Descriptive analysis

There are a total of 10149 samples in this study, and it can be seen from Table 2 that: (1) the minimum value of EXRD is -1.474, and the maximum value is 14.374, indicating that there is a large difference in the earnings management of R&D activities among enterprises. (2) The age difference of the top management team is not too large. The oldest top management team is 57 years old, while the youngest team is 38 years old, with an average age of 48 years. (3) The tenure of the top management team varies greatly. (4) The education level of the top management team is generally high, with a mean of 3, which means that the average education (5) The proportion of executive directors is relatively high, with the maximum value being 1, the minimum value being 0, and the mean value being 0.431. (6) The proportion of female executives in the top management team is relatively low, with a mean value of 0.184. (7) There are many executives with R&D background in the top management team, with the mean value of 0.332, the maximum proportion of 0.875, and the minimum value of 0. (8) The average shareholding ratio of the top management team is 9.2%, the maximum is as high as 59.4%, and the minimum is 0, indicating that there is a large difference in equity incentives; (9) The salary difference of top management is not obvious and basically fluctuates on the average line.

Table 2: Descriptive analysis level of the top management is undergraduate.

Variable	Obs	Mean	Std. Dev.	Min	Max
EXRD	10149	2.894	2.663	-1.474	14.374
age	10149	47.675	3.785	38	56.5
date	10149	52.329	26.34	8.75	141.5
edu	10149	3.304	0.484	2	4.333
EXEDIR	10149	0.431	0.205	0.111	1
Female	10149	0.184	0.17	0	0.667
Back	10149	0.332	0.229	0	0.875
Sto	10149	0.092	0.144	0	0.594
Pay	10149	14.621	0.643	13.145	16.42
size	10149	22.131	1.089	20.085	25.539
lev	10149	0.401	0.186	0.068	0.867
GM	10149	8.383	1.261	6	12
top1	10149	30.062	13.197	7.77	66.33
saleg	10149	0.173	0.376	-0.512	2.177
BM	10146	0.57	0.23	0.133	1.145

6.2 Correlation analysis

It can be seen from Table 3 that the average age of the top management team is significantly negatively correlated with the level of R&D earnings management, and the correlation coefficient is -0.044 , which is significant at the level of 1%. The average tenure of the top management team is not significantly correlated with the level of earnings management of R&D activities, but positively correlated with the correlation coefficient of 0.004 . There is a significant positive correlation between the education level of the top management team and the level of earnings management of R&D activities, and the correlation coefficient is 0.093 , and it is significant at the level of 1%. The proportion of executive directors in the top management team is significantly positively correlated with the level of earnings management in R&D activities, and the correlation coefficient is 0.065 and significant at the level of 1%. The proportion of women in the top management team and the level of earnings management in R&D activities are significant at the level of 10%, and the correlation coefficient is 0.016 . There is a significant positive correlation between the R&D background of the top management team and the level of earnings management of R&D activities, and the correlation coefficient is 0.193 and significant at the level of 1%. The equity incentive and compensation incentive of the top management team are positively correlated with the level of earnings management of R&D activities, and the correlation coefficients are 0.173 and 0.097 , and are significant at the level of 1%. The correlation analysis results show that the correlation values between variables are all less than 0.8 , indicating that there is no obvious multicollinearity relationship between variables. For further test, all the variables were regression, and the VIF values after regression were less than 2 , far below the key threshold of $VIF=10$, and the tolerance was greater than 0.6 .

Table 3: Correlation analysis

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	
(1)EXRD	1.000							
(2)age	-0.044***	1.000						
(3)date	0.004	0.346***	1.000					
(4)edu	0.093***	-0.009	-0.102***	1.000				
(5)EXEDIR	0.065***	-0.037***	0.116***	-0.094***	1.000			
(6)Female	0.016*	0.168***	-0.029**	-0.021*	0.056***	1.000		
(7)Back	0.193***	0.170***	0.034***	0.011	-0.065***	-0.153***	1.000	
(8)Sto	0.173***	-0.037***	0.047***	-0.136***	0.246***	0.075***	0.101***	
(9)Pay	0.097***	0.108***	0.023*	0.281***	-0.110***	-0.002	-0.033***	
(12)size	-0.234***	0.154***	0.065***	0.241***	-0.178***	-0.095***	-0.096***	
(13)lev	-0.190***	0.043***	-0.071***	0.117***	-0.123***	-0.079***	-0.115***	
(14)GM	-0.082***	0.123***	-0.009	0.081***	0.048***	-0.100***	0.074***	
(15)TOP1	-0.086***	0.071***	-0.033**	-0.038***	-0.029**	0.001	0.036***	
(16)saleg	0.158***	-0.053***	-0.040***	-0.001	0.014	-0.019	0.035***	
(17)BM	-0.364***	0.137***	0.011	-0.001	-0.088***	-0.076***	-0.070***	
Variables	(8)	(9)	(12)	(13)	(14)	(15)	(16)	(17)
(8)Sto	1.000							
(9)Pay	-0.091***	1.000						
(12)size	-0.257***	0.449***	1.000					
(13)lev	-0.179***	0.119***	0.441***	1.000				
(14)GM	-0.176***	0.105***	0.232***	0.108***	1.000			
(15)TOP1	0.045***	-0.013	0.116***	0.020*	-0.009	1.000		
(16)saleg	0.042***	0.022*	0.079***	0.004	0.005	0.027**	1.000	
(17)BM	-0.117***	0.101***	0.480***	0.384***	0.140***	0.069***	0.147***	1.000

6.3 Regression analysis

In this study, the least squares estimation method is used to conduct the benchmark model regression, and the industry effect and year effect are controlled. The regression coefficients are estimated using the heteroscedasticity robust standard error to solve the possible heteroscedasticity problem caused by the deviation of the coefficient estimates. The regression estimation results are shown in the table. N represents different variable characteristics.

It can be seen from table 4 that the regression coefficient of the average age of executives is 0.011, which is significant at the level of 10% and inconsistent with the conclusion in the correlation analysis. The regression coefficient of the average educational background of the senior executives is 0.551, which is significant at the level of 1%, indicating that the higher the average educational background of the senior executives is, the more likely it is to inhibit the earnings management of R&D activities. The regression coefficient of the proportion of executives with R&D background is 1.634, which is significant at the level of 1%, indicating that the higher the proportion of executives with R&D background, the more inhibiting the level of earnings management of R&D activities. The regression coefficient of the proportion of female executives is -0.310 , which is significant at the 5% level, indicating that the lower the proportion of female executives is, the more it can inhibit the level of earnings management of R&D activities. The coefficients of executives' equity incentive and compensation incentive are 2.076 and 0.722, which are significant at the level of 1%, indicating that the higher the proportion of executives' shareholding and compensation are, the more they can inhibit the level of earnings management of R&D activities.

Table 4: Regression analysis

VARIABLES	EXRD age	EXRD date	EXRD edu	EXRD Back	EXRD Female	EXRD EXEDIR	EXRD Sto	EXRD Pay
N	0.011* (1.75)	-0.0002 (-0.24)	0.551*** (11.95)	1.634*** (15.66)	-0.310** (-2.23)	0.012 (0.10)	2.076*** (11.77)	0.722*** (16.75)
size	-0.151*** (-4.91)	-0.146*** (-4.73)	-0.222*** (-7.09)	-0.125*** (-4.12)	-0.149*** (-4.87)	-0.146*** (-4.76)	-0.087*** (-2.82)	-0.384*** (-11.54)
lev	-0.069 (-0.50)	-0.083 (-0.59)	-0.138 (-1.00)	0.059 (0.43)	-0.093 (-0.67)	-0.079 (-0.57)	0.049 (0.36)	0.114 (0.83)
GM	0.014 (0.72)	0.017 (0.88)	0.009 (0.46)	-0.016 (-0.84)	0.014 (0.72)	0.017 (0.87)	0.045** (2.34)	0.009 (0.49)
top1	-0.000 (-0.20)	-0.000 (-0.10)	0.001 (0.43)	-0.002 (-0.96)	-0.000 (-0.05)	-0.000 (-0.09)	-0.002 (-1.09)	0.001 (0.71)
saleg	1.107*** (12.02)	1.102*** (11.97)	1.129*** (12.29)	1.066*** (11.71)	1.100*** (11.93)	1.102*** (11.96)	1.053*** (11.60)	1.120*** (12.24)
BM	-3.367*** (-23.38)	-3.361*** (-23.36)	-3.137*** (-21.96)	-3.357*** (-23.73)	-3.371*** (-23.40)	-3.361*** (-23.37)	-3.457*** (-24.07)	-2.912*** (-20.38)
Constant	4.358*** (6.60)	4.763*** (7.62)	4.678*** (7.51)	4.139*** (6.68)	4.917*** (7.80)	4.753*** (7.51)	3.035*** (4.77)	-0.525 (-0.75)
Observations	10,146	10,146	10,146	10,146	10,146	10,146	10,146	10,146
R-squared	0.297	0.297	0.306	0.315	0.297	0.297	0.308	0.317
ind FE	year YES	year YES	year YES	year YES	year YES	year YES	year YES	year YES

The regression coefficient of the average tenure of senior executives is -0.0002 , but the regression result is not significant, indicating that the tenure of senior executives cannot inhibit the earnings management of R&D activities, which may be related to the characteristics of senior executives at different stages of tenure. Some scholars have combined the characteristics of senior executives at different stages of tenure with reputation theory. Some scholars have combined the characteristics of different stages of senior executives' tenure with reputation theory, and found that the early and late

periods of senior executives' tenure significantly enhance the degree of real earnings management by reducing R&D expenditure.

The regression coefficient of the proportion of executive directors is 0.012, but the regression result is not significant. This paper thinks that it may be related to the sample selection. Looking at the positions of executive directors, it is found that most of the executive directors have a professional background of enterprise management, and few executive directors have a technical background. This paper holds that executive directors with management background may affect the governance effect of executive directors.

6.4 Robustness test

6.4.1 Change the explained variable

In the previous test, the explained variable, the degree of earnings management of R&D activities, refers to the method of Chu Youwei. After replacing the explained variable, the test results are basically consistent with the benchmark regression results, and the robustness test passes.

6.4.2 Change the control variables

The control variables are reduced and only size, BM and saleg are used. The regression results obtained by industry and year are consistent with the previous results, which verifies the reliability of the previous conclusions.

7. Conclusions and deficiencies

This paper investigates the relationship between executive characteristics and R&D earnings management. We find that the average age, education level, proportion of technical directors, equity and salary of senior executives are negatively correlated with the degree of earnings management in R&D activities, which indicates that senior executives with older age, higher education level and technical background are less likely to manage earnings by reducing R&D investment. The proportion of female directors is positively correlated with the degree of earnings management in R&D activities, that is, the higher the proportion of female directors is, the lower the degree of earnings management by reducing R&D investment. The average tenure of senior management members and the proportion of executive directors have no significant impact on the earnings management of R&D activities.

Based on the above research, this paper proposes the following implications and suggestions by adjusting the personnel structure of the top management team, promoting corporate R&D expenditure and improving the degree of corporate earnings management: First, when selecting executive directors, enterprises should not only consider their management ability, but also consider their professional background. Especially for some technology enterprises, executive directors with R&D background can better play the governance effect of executive directors. Secondly, the structure of the board team should be reasonably constructed and optimized, and the top management team should be established to match the strategic benefits of the enterprise R&D investment. The top management team should be adjusted in time with the enterprise strategy.

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