

R&D Investment, Executive Compensation and Financial Performance—Evidence from Chinese A-share Manufacturing Listed Companies

Linyu Fan

Department of Accounting, Xiamen University Tan Kah Kee College, Zhangzhou, Fujian, 363105, China

Abstract: *Manufacturing is the foundation of a nation and the cornerstone of a strong country, serving as the lifeblood of the national economy. It plays an irreplaceable role in driving economic development and participating in international competition. Innovation and R&D are the "key link" in the high-quality development of manufacturing, and R&D investment must be placed at the core of manufacturing development. The amount of R&D investment largely depends on the business decisions of corporate executives, which are influenced by the design and implementation of executive compensation incentives. It may also be related to corporate financial performance, as the quality of financial performance directly affects a company's survival and development, as well as its ability to secure sufficient funds for R&D innovation and compensation incentives. This paper uses a sample of 1,089 Chinese A-share manufacturing listed companies from 2019 to 2023, combined with relevant domestic and international literature, to empirically examine the relationships between executive compensation, R&D investment, and financial performance using Stata software. Descriptive statistical analysis, correlation analysis, and regression analysis are conducted. The results show that: executive compensation has a significantly positive correlation with financial performance; R&D investment has a significantly negative correlation with financial performance in the short term; the impact of R&D investment on financial performance exhibits a lag effect, with the negative correlation gradually weakening in the first and second lag periods; and executive compensation has a significant positive moderating effect on the relationship between R&D investment and financial performance.*

Keywords: *Executive Compensation; R&D Investment; Financial Performance; Manufacturing*

1. Introduction

China's economy has shifted from a stage of high-speed growth to a stage of high-quality development. The traditional extensive development model no longer meets the needs of the times, and industrial upgrading through technological innovation has become an inevitable choice for social and economic progress. Manufacturing is the foundation of a nation and the cornerstone of a strong country. Although China's manufacturing industry has developed rapidly since the reform and opening up, strongly promoting industrialization and modernization and significantly enhancing comprehensive national strength, it still lags behind the world's advanced levels in terms of independent innovation capability and resource utilization efficiency. Therefore, transformation is urgently needed.

As the core factor of production, people influence a company's performance and long-term development. Executives are the core operators of an enterprise, playing multiple roles as decision-makers, promoters, and managers. R&D investment is largely determined by executives, and executive incentives serve as a bridge connecting executive interests with the sustainable development of the enterprise. By linking executive compensation closely with financial performance, the personal interests of executives and the interests of the enterprise can be organically unified. To address executives' short-term behavior, encourage them to consider the long-term interests of the enterprise, and promote innovation and R&D, the key lies in establishing and implementing a reasonable executive compensation system. This will inject strong impetus into the enterprise's sustainable development, enhance innovation output capacity, and thereby improve financial performance. How to use executive compensation incentives to maximize financial performance is crucial for an enterprise's development.

This paper conducts an empirical study on manufacturing enterprises to explore how financial performance is influenced by executive compensation and R&D investment. It clarifies that providing compensation incentives to executives can help drive corporate innovation, providing a basis for

designing executive compensation incentive policies. It also serves as a warning for corporate governance, helping to avoid pseudo-innovation, short-sighted innovation, and excessive innovation, and providing early warning indicators for improving corporate governance mechanisms. This research aims to address the dilemmas faced by the transformation and upgrading of the manufacturing industry and provide relevant suggestions for sustainable corporate development.

2. Literature Review

Some scholars believe that executive compensation has a positive correlation with financial performance. Zhao Zitong studied Chinese small and medium-sized board listed companies from 2018 to 2022 and found that there is a significant positive correlation between executive compensation and financial performance. The higher the compensation, the more motivated executives are to manage the company, thereby improving financial performance^[1]. Wu Chunxiang and Liang Xin analyzed panel data from 2011 to 2020 for listed logistics companies and concluded that there is a significant positive correlation between executive compensation incentives and financial performance in logistics enterprises^[2].

Other scholars argue that executive compensation has no correlation or a negative correlation with corporate financial performance, or that the relationship exhibits an inverted "U" curve. Using non-financial A-share listed companies from 2006 to 2016 as samples, Wu Lidong and other scholars found that politically motivated salary increases have a significant negative effect on company performance^[3]. Zhu Qingxiang and Bai Xuemin studied service industry listed companies in Shanghai and Shenzhen and found that the impact of executive compensation on company performance exhibits an inverted "U" curve relationship^[4].

Bogner and Bansal used regression analysis to examine 30,022 patent records from 42 companies and found that R&D expenses have a positive impact on a company's innovation capability^[5]. Verwaal used data from 223 Dutch manufacturing listed companies and argued that high cognitive and normative barriers exist during global outsourcing knowledge exchange, which causes innovation activities to negatively moderate the relationship between global outsourcing and financial performance of manufacturing listed companies^[6]. Zhang Tingting conducted an empirical study on 584 high-tech enterprises from 2017 to 2021 and found that R&D investment inhibits financial performance in the short term, but comparison with lagged data shows that R&D investment has a promoting effect on financial performance^[7]. Scholars Wang Guanyi and Wang Xiaoyuyue studied sample data from 1,124 Shanghai and Shenzhen A-share listed companies from 2013 to 2022 and found that R&D investment can positively promote corporate financial performance, and this promotion is reflected not only in current performance but also in lagged performance^[8].

Qin Jianqi studied Chinese power listed companies from 2012 to 2021 using multiple regression analysis and found that executive compensation has a significant positive impact on R&D investment in Chinese power listed companies^[9]. Li Shufeng and others studied all A-share listed companies in China from 2011 to 2017 and found that executive compensation incentives have a significant positive moderating effect on the relationship between R&D investment and company performance^[10].

Most existing literature studies the impact of executive compensation or R&D investment on financial performance separately, and most explore the correlation by industry. Few studies analyze the relationship between the three variables across industries. This paper takes Chinese A-share manufacturing listed companies as the research object, further clarifies different boundary conditions for analysis, and more precisely explores the internal logic and interaction between executive compensation, R&D investment, and financial performance, aiming to enrich research in related fields and provide management strategy suggestions for manufacturing listed companies to improve financial performance.

3. Research Hypotheses

Based on the literature review of the relationships between executive compensation, R&D investment, and financial performance, and considering how these relationships manifest in different industries, this chapter proposes research hypotheses to reveal the interaction and influence mechanisms between the variables.

H1: Executive compensation incentives have a positive correlation with financial performance.

H2: R&D investment has a negative correlation with current corporate financial performance.

H3: The impact of R&D investment on financial performance exhibits a lag effect.

H4: Executive compensation has a significant positive moderating effect on the relationship between R&D investment and financial performance.

4. Research Design

4.1 Sample Selection and Data Sources

This paper selects Chinese A-share manufacturing listed companies as the research sample. The data comes from the CSMAR database, covering five years (2019-2023). Excel and Stata software are used for data processing and statistical analysis. After obtaining the initial sample, the following screening procedures were implemented:

(1) ST and *ST companies were excluded due to poor operating conditions and extreme financial data that could adversely affect research results.

(2) Companies with missing data for any part of the 2019-2023 period were removed to ensure data continuity.

(3) Samples with missing or incomplete variable data were excluded.

The final sample consists of 1,089 manufacturing listed companies, forming 5,445 valid data observations. Continuous variables were winsorized at the 1% and 99% levels to avoid the influence of extreme values while retaining all observations.

4.2 Variable Selection and Measurement

All variables used in this paper are summarized in Table 1.

Table 1 Definition of Research Variables

Variable Category	Variable Name	Variable Symbol	Variable Definition
Dependent Variable	Financial Performance	ROA	Net profit / Total assets
Independent Variables	R&D Investment	RDIncome	R&D investment / Operating income
	Executive Compensation	EC	Natural logarithm of the sum of compensation for the top three executives
Control Variables	Firm Size	SIZE	Natural logarithm of total assets
	Gross Profit Margin	GPM	(Operating income - Operating cost) / Operating income
	Asset-Liability Ratio	LEV	Total liabilities / Total assets
	Total Asset Turnover	TAT	Operating income / Ending balance of total assets
	Year	YEAR	1 if in the specific year, otherwise 0

4.3 Model Construction

This paper constructs models from four perspectives based on the research hypotheses:

Model 1 (Testing H1): Executive compensation and financial performance

$$ROA_{it} = \alpha_0 + \alpha_1 EC_{it} + \alpha_2 LEV_{it} + \alpha_3 SIZE_{it} + \alpha_4 GPM_{it} + \alpha_5 TAT_{it} + \alpha_6 YEAR_{it} + \varepsilon_1 \quad (1)$$

Model 2 (Testing H2): R&D investment and financial performance

$$ROA_{it} = \beta_0 + \beta_1 RDIncome_{it} + \beta_2 LEV_{it} + \beta_3 SIZE_{it} + \beta_4 GPM_{it} + \beta_5 TAT_{it} + \beta_6 YEAR_{it} + \varepsilon_2 \quad (2)$$

Model 3 (Testing H3): Lag effect of R&D investment on financial performance

$$ROA_{it-1} = \gamma_0 + \gamma_1 RDIncome_{it-1} + \gamma_2 LEV_{it-1} + \gamma_3 SIZE_{it-1} + \gamma_4 GPM_{it-1} + \gamma_5 TAT_{it-1} + \gamma_6 YEAR_{it-1} + \varepsilon_3 \quad (3)$$

Model 4 (Testing H4): Moderating effect of executive compensation

$$ROA_{it} = \delta_0 + \delta_1 RD_{income_{it}} + \delta_2 EC_{it} + \delta_3 (RD_{income_{it}} \times EC_{it}) + \delta_4 LEV_{it} + \delta_5 SIZE_{it} + \delta_6 GPM_{it} + \delta_7 TAT_{it} + \delta_8 YEAR_{it} + \varepsilon_{it} \quad (4)$$

Where i represents the firm, t represents time, and ε is the random error term measuring the portion of financial indicators not explained by the variables.

5. Empirical Analysis

Using data from Chinese manufacturing listed companies from 2019 to 2023, with 5,445 valid samples, this section conducts descriptive statistics, correlation analysis, multicollinearity testing, regression analysis, and robustness testing using Stata software.

5.1 Descriptive Statistics

Table 2 Descriptive Statistical Analysis (N=5445)

Variable	Mean	Std.dev.	Min	Max
ROA	0.053	0.058	-0.172	0.246
EC	15.017	0.659	13.59	17.21
RDincome	5.499	4.517	0.12	29.14
SIZE	22.73	1.197	20.37	26.41
GPM	0.304	0.179	-0.001	0.878
LEV	0.415	0.167	0.072	0.786
TAT	0.65	0.319	0.161	2.132

The results of the Table 2 show that:

- The average ROA is 0.053, ranging from -0.172 to 0.246, indicating relatively low overall profitability with significant differences among manufacturing enterprises.
- The average executive compensation (logarithm) is 15.017, ranging from 13.590 to 17.210, showing significant differences in executive pay across companies.
- R&D investment averages 5.499% of operating income, ranging from 0.120% to 29.140%, indicating large disparities in R&D intensity among companies.

5.2 Correlation Analysis

Based on the Table 3, we can get the follow key findings.

Executive compensation (EC) is significantly positively correlated with current financial performance (ROA) at 0.175 ($p < 0.01$). This indicates that implementing certain salary incentives for executives by enterprises will improve the enterprises' financial performance.

Table 3 Correlation Analysis Results

Variable	ROA	EC	RD income	SIZE	GPM	LEV	TAT
ROA	1						
EC	0.175***	1					
RDincome	-0.091***	0.057***	1				
SIZE	-0.075***	0.449***	-0.209***	1			
GPM	0.456***	0.089***	0.366***	-0.305***	1		
LEV	-0.428***	0.090***	-0.216***	0.459***	-0.513***	1	
TAT	0.153***	0.116***	-0.379***	0.213***	-0.351***	0.218***	1

Note 1: ***, **, and * indicate that the test results are significant at the 1%, 5%, and 10% sig. levels, respectively.

R&D investment (RD income) is significantly negatively correlated with current ROA at -0.091 ($p < 0.01$). This indicates that R&D investment has a long return cycle and cannot generate benefits for enterprises in the current period.

Control variables show expected relationships with ROA: SIZE and LEV are significantly negatively correlated, while TAT and GPM are significantly positively correlated.

5.3 Multicollinearity Test

Table 4 Multicollinearity Test Results

Variable	EC	RDincome	SIZE	GPM	LEV	TAT	Mean VIF
VIF	1.41	1.3	1.72	1.66	1.58	1.29	1.55
1/VIF	0.708	0.771	0.583	0.602	0.633	0.775	

The Multicollinearity Test Results in the Table4 indicates: all VIF values are between 1.29 and 1.72, well below 5, indicating no multicollinearity issues.

5.4 Regression Analysis

This paper employs corporate performance as the dependent variable, with R&D investment (RD income) and executive compensation (EC) as the independent variables, to thoroughly investigate the relationship between the independent and dependent variables. The model was analyzed using Stata statistical software, and the results are presented in Tables 5 and 6, respectively.

Table 5 Regression Results Based on Model 1. Table 6 Regression Results Based on Model 2.

Variable	(1)ROA	(2)ROA	Variable	(1)ROA	(2)ROA	(3)ROA
EC	0.008*** -7.48	0.008*** -6.96	RDincome	-0.003*** (-13.93)		
SIZE	0.005*** -8.42	0.005*** -8.04	L. RD M. income		-0.0022*** (-10.06)	
GPM	0.136*** -24.96	0.159*** -37.45	L2.RD income			-0.0019*** (-7.45)
LEV	-0.119*** (-23.28)	-0.120*** (-27.30)	SIZE	0.007*** -12.13	0.007*** -11.64	0.009*** -11.54
TAT	0.061*** -24.63	0.056*** -26.17	GPM	0.161*** -31.58	0.159*** -27.66	0.157*** -23.82
EC*RD income		0.013*** -11.18	LEV	-0.119*** (-23.42)	-0.118*** (-20.83)	-0.119*** (-18.66)
			TAT	0.053*** -21.41	0.055*** -18.95	0.054*** -15.84
_cons	-0.216*** (-14.42)	-0.242*** (-15.63)	_cons	-0.116*** (-9.83)	-0.132*** (-9.61)	-0.159*** (-9.80)
N	5445	5445	N	5445	4356	3267
YEAR	control	control	YEAR	control	control	control
adj. R ²	0.406	0.455	adj. R ²	0.433	0.42	0.414
F	297.3	414.6	F	349.4	291.8	241.6

Based on the Table 5, the analysis yields the following findings about the variables of Executive Compensation and Financial Performance (ROA):

- EC coefficient: 0.008*** (p<0.01), supporting H1.
- EC×RDincome coefficient: 0.013*** (p<0.01), supporting H4.
- Control variables: SIZE, TAT, and GPM positively affect ROA; LEV negatively affects ROA.

Based on the Table 6, the analysis yields the following findings about the variables of R&D Investment (RD income) and Financial Performance (ROA):

- Current RDincome coefficient: -0.003*** (p<0.01), supporting H2.
- Lagged RDincome coefficients: -0.0022*** (lag 1) and -0.0019*** (lag 2), showing the negative effect weakens over time, supporting H3.

5.5 Robustness Tests

To further verify the reliability of the empirical results in this paper, a robustness test was conducted by replacing variables. To conduct the robustness test, the scope of the variable was expanded: the natural

logarithm of the total compensation of the top three executives (EC) was replaced with the natural logarithm of the total compensation of all executives (EC2), and the results are presented in Table 7.

Table 7 Regression Results of Robustness Test with Replaced Executive Compensation

	EC2	SIZE	GPM	LEV	TAT	EC2*RD income	cons	adj. R^2	F
(1)ROA	0.007*** -7.2	0.005*** -8.2	0.136*** -25.13	-0.120*** -23.38	0.062*** -24.9		-0.207*** -14.15	0.406	294.3
(2)ROA	0.007*** -7.28	0.005*** -8.2	0.160*** -30.25	-0.120*** -23.97	0.057*** -24.09	0.014*** -9.98	-0.235*** -15.89	0.455	309.4

According to the regression result analysis:

- EC2 coefficient: 0.007*** (p<0.01)
- EC2×RDincome coefficient: 0.014*** (p<0.01)
- Results remain consistent with main findings.

Specifically, the dependent variable Return on Assets (ROA) in Models 1 to 4 was replaced with Return on Equity (ROE) for the robustness test, and the analysis results are presented in Table 8.

Table 8 Regression Results of Robustness Test with Replaced ROA

	(1)ROE	(2)ROE	(3)ROE	(4)ROE	(5)ROE
EC	0.017*** (4.63)				0.015*** (4.64)
SIZE	0.016*** (6.26)	0.019*** (8.98)	0.020*** (8.09)	0.023*** (7.29)	0.016*** (8.11)
GPM	0.220*** (16.07)	0.273*** (20.27)	0.271*** (18.23)	0.266*** (14.93)	0.272*** (21.01)
LEV	-0.176*** (-6.35)	-0.176*** (-6.43)	-0.175*** (-5.86)	-0.192*** (-5.05)	-0.178*** (-13.31)
TAT	0.122*** (16.6)	0.104*** (16.19)	0.111*** (13.99)	0.111*** (10.83)	0.111*** (17.09)
RDincome		-0.006*** (-6.69)			-0.0106*** (-15.10)
L.RDincome			-0.004*** (-6.40)		
L2.RDincome				-0.003*** (-4.21)	
EC*RDincome					0.031*** (8.47)
_cons	-0.601*** (-12.26)	-0.390*** (-10.08)	-0.414*** (-8.93)	-0.489*** (-7.80)	-0.661*** (-14.09)
N	5445	5445	4356	3267	5445
YEAR	control	control	control	control	control
adj. R^2	0.177	0.196	0.198	0.185	0.213
F	104.7	95.14	81.7	75.08	135.1

Results (1) to (5) in the Table 7 sequentially show the regression results of executive compensation, R&D investment, the lagged effect of R&D investment, and the interaction term on ROE. These results are consistent with those obtained when ROA was used as the dependent variable, and all passed the 1% significance test.

So the empirical results of this study demonstrate a certain degree of robustness overall.

6. Conclusions and Management Recommendations

6.1 Research Conclusions

Based on the above empirical results, this paper draws four conclusions:

- (1) Executive compensation has a significantly positive correlation with financial performance.
- (2) R&D investment has a significantly negative correlation with current financial performance due to high upfront costs and uncertain returns.

(3) The impact of R&D investment on financial performance exhibits a lag effect.

(4) Executive compensation positively moderates the relationship between R&D investment and financial performance.

6.2 Management Recommendations

Firstly, the companies can develop reasonable long-term executive compensation systems in the ways: balance short-term and long-term incentives; link compensation to company performance indicators; implement various incentive models (base salary + performance, profit sharing, tenure incentives).

Secondly, Corporate management, should develop suitable compensation and incentive schemes, including but not limited to the following areas: consider company size; financial status and strategic goals; implement differentiated compensation based on position, ability, and performance; consider equity incentives to align personal and company interests

Thirdly, Manufacturing firms, particularly those in high-tech fields, should increase spending on research and innovation. Efforts can be made on the following fronts: conduct multi-dimensional assessments before starting R&D projects; analyze market demand and future trends; improve R&D personnel quality through training and recruitment; establish university-industry collaborations

Lastly, enterprises should also explore methods to accelerate the translation of R&D expenditures and enhance their conversion efficiency: strengthen market research to ensure alignment with needs; accelerate transformation of R&D results into usable technology; maintain patience with R&D projects while continuously improving them; take a long-term view to build core competitiveness.

References

- [1] Zhao, Zitong. *The relationship between executive compensation, ownership concentration, and firm performance*. *Market Modernization*, 2022, (21): 53-56.
- [2] Wu, Chunxiang, and Liang Xin. *A study on the relationship between executive compensation incentives and operational performance of listed logistics companies*. *Logistics Technology*, 2023, 46(13): 18-20+41.
- [3] Wu, Lidong, Fan Jiaying, and Wang Kai. *Private shareholders' appointed directors, executive compensation, and firm performance*. *Dongyue Tribune*, 2019, 40(01): 143-154.
- [4] Zhu, Qingxiang, and Bai Xuemin. *A study on the inverted U-shaped impact of executive compensation gap on company performance—Taking listed service companies in China as an example*. *Communication of Finance and Accounting*, 2013, (18): 34-36+129.
- [5] Bogner, William C., and Pratima Bansal. *Knowledge management as the basis of sustained high performance*. *Journal of Management Studies*, 2007, 44(1), 981-998.
- [6] Verwaal, E. *Global outsourcing, explorative innovation and firm financial performance: A knowledge-exchange based perspective*. *Journal of World Business*, 39(6), 981-998.
- [7] Zhang, Tingting. *A study on the impact of R&D investment on the financial performance of high-tech enterprises*. *Management and Technology of SME*, 2023, (22): 185-187.
- [8] Wang, Guanyi, and Wang Xiaoyue. *R&D investment, internal control quality, and firm financial performance—An empirical study based on A-share listed companies in China*. *Journal of Inner Mongolia Agricultural University (Philosophy and Social Sciences Edition)*, 2024, 26(04): 39-48.
- [9] Qin, Jianqi, and Lin Qizhi. *A study on the relationship between executive compensation, R&D investment, and firm growth*. *Technology and Market*, 2023, 30(05): 131-134+139.
- [10] Li, Shufeng, Yang Yun, and Huang Xiaolin. *A study on the relationship between R&D investment and company performance under the moderation of executive incentives*. *Friends of Accounting*, 2020, (11): 66-72.