

Ownership Structure and R&D Innovation——Based on Panel Data of Domestic Listed Companies

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Abstract: Taking Chinese listed companies from 2013 to 2018 as samples, this paper conducts an empirical study on the relationship between ownership structure and R&D innovation. The empirical results show that ownership concentration has a significant inhibitory effect on R&D innovation. Further, in the case of distinguishing the nature of corporate ownership, the research shows that ownership concentration has a significant negative correlation with R & D innovation of enterprises no matter the ownership nature is state-owned or non-state-owned. In order to improve innovation ability of Chinese listed companies, governance mechanism of major shareholders should be improved.

Keywords: Ownership Structure; Ownership Concentration; R&D Innovation

1. Introduction

Modern commercial society, market competition is extremely fierce, science and technology rapid development. In this context, R&D investment is an important strategic measure for companies to build sustainable competitive advantages, establish long-term market position and achieve sustainable development. Because of this, R&D investment is valued by the government and companies, and also a hot topic discussed by scholars all the time.

A survey of research literature on R&D investment shows that there are many factors affecting R&D investment, including company scale, credit policy, CEO characteristics, managerial tenure, institutional investors, etc. [2-6]. But among all the factors affecting R&D investment, corporate governance mechanism cannot be ignored. Among various corporate governance mechanisms, ownership structure is very crucial [7]. In fact, the ownership structure is at the core of corporate governance, which determines the contradiction of corporate internal governance and ultimately influences the company's R&D investment behavior. However, based on relevant literature, scholars are inconsistent on the relationship between ownership structure and R&D investment, and even mutually exclusive. In view of this, this paper does further exploration in this aspect. The research of this paper is expected to make the following contributions: First, this study provides new empirical evidence for the relationship between ownership structure and R&D investment; Secondly, based on the innovative research under the corporate governance framework, the research results reflect the governance contradictions existing in our corporate governance; Finally, based on the empirical analysis results of listed companies, this paper can provide some theoretical basis for our listed companies' R&D investment decisions.

2. Theoretical Analysis and Literature Review

Among all corporate governance mechanisms, ownership structure plays a particularly important role. The research of modern corporate governance is essentially divided according to the status of ownership structure. Early studies on corporate governance focused on agency conflicts between shareholders and management under the condition of decentralized ownership structure. With the discovery of new evidence of ownership structure, the research of corporate governance turns to the governance of major shareholders under the condition of ownership concentration. Different ownership structure states determine the existence of different conflicts in the company. Specifically, in the case of equity dispersion, as a single shareholder holds a low proportion of shares, there is no

incentive to supervise the management, which makes the management more likely to engage in selfish behaviors. With the increase of ownership concentration, major shareholders are motivated to supervise the management, which alleviates the proxy conflicts between shareholders and management to a certain extent. But at the same time, another contradiction shows that major shareholders can use their control rights for personal gain, which will damage the interests of minority shareholders. On the whole, ownership structure is the root cause of internal governance problems. This kind of governance problem caused by ownership structure will lead to a series of economic consequences, and finally have an impact on the company's R&D investment behavior. In practice, the factors influencing R&D investment behavior are very complex. However, in terms of the relationship between ownership structure and R&D investment, firstly, in the case of decentralized ownership structure, the agency problem between shareholders and management is prominent, and management generally makes decisions based on its own interests. Because of the risky nature of R&D investment, management is generally discouraged, especially those who tend to be risk averse. In the case of equity concentration, for major shareholders, their equity is too concentrated to disperse the risk. As a result, large shareholders will face great risks if they invest in research and development on a large scale. Under the condition of equity dispersion, the failure of R&D investment may only affect the position and professional reputation of the management in the company. In the case of concentrated equity, the failure of R&D investment may affect the major shareholders' own business. Therefore, in the case of equity concentration, major shareholders may be more cautious and less willing to invest in research and development.

In addition to theoretical analysis, scholars also conducted empirical tests on the relationship between ownership structure and R&D investment. Foreign scholars have concluded that there is a significant positive correlation between ownership concentration and corporate R&D innovation ^[8], a negative correlation ^[9], and an "N" type relationship and an insignificant relationship ^[10]. On the basis of learning from the research experience of foreign scholars, domestic scholars also discussed the relationship between ownership structure and R&D investment. The main research conclusions are that there is a significant positive correlation between ownership concentration and R&D investment ^[11], a negative correlation ^[12], a U-shaped relationship and no significant correlation ^[13]. Based on the research conclusions of domestic and foreign scholars, it can be seen that there are serious differences in scholars' views on the relationship between ownership structure and R&D investment. The reasons may be as follows: firstly, the relationship between ownership structure and R&D investment can be logically sorted out effectively, and there are signs of data mining in relevant studies ^[14]. Secondly, the research sample source is single, the selected sample is from a certain region or a certain industry. As a result, the main research results are only significant in the region or industry where the sample companies are located, so it is worth discussing to further popularize the research conclusions.

To sum up, scholars are unable to form a unified opinion on the relationship between ownership structure and R&D investment either theoretically or empirically. Specific to the actual situation, Chinese listed companies generally have the characteristics of a single share and high concentration of ownership. Therefore, the main contradiction in Chinese listed company governance is a conflict of interest between major shareholders and small shareholders. The listed companies are controlled by the major shareholders, and become the tools for the major shareholders to seek private gains and occupy the interests of the minority shareholders. In practice, major shareholder's violation guarantee, unfair related transactions and other transportation benefits of events frequently occur, indicating that our listed companies have serious major shareholder governance problems. In this case, listed companies have no intention of R&D investment, and the higher the concentration of ownership, the lower the intention of R&D investment. In addition, under the background that Chinese enterprises are dominated by state-owned equity, it is a very valuable research direction to distinguish the nature of equity and investigate the behavior of major shareholders.

3. Research Hypothesis

Based on the above analysis, the following assumptions are made:

Hypothesis 1: The increase of ownership concentration will reduce the company's R&D investment.

Hypothesis 2: The influence of ownership concentration on R&D investment is significant in both state-owned enterprises and non-state-owned enterprises.

4. Research Design

4.1 Sample Selection

This paper takes listed companies in China from 2013 to 2018 as research samples, and carries out the following screening procedures: (1) Remove ST, *ST and delisted companies, because their companies are in the abnormal operation state. (2) The listed companies in the financial industry should be excluded because of the particularity of the industry. (3) Companies with incomplete research data within the test interval are excluded. Through the above screening, finally obtained 9019 companies - annual effective panel sample data. All the data in this paper are from CSMAR database and obtained by manual sorting.

4.2 Model Setting

In order to test the hypothesis proposed in this paper, a multiple regression model is constructed to analyze the relationship between ownership structure of Chinese enterprises and R&D innovation. The equation to be tested is set as (1):

$$\text{Innovation}_{it} = \beta_0 + \beta_1 \text{Share}_{it} + \beta_2 \text{Control}_{it} + \delta_i + \gamma_t + u_{it} \quad (1)$$

Where, subscript i is the company, t is the year; Innovation is R&D investment, Share is ownership concentration, and Control is control variable. The individual fixed effect and time fixed effect of the model are δ and γ , respectively.

4.3 Variable Design

- The explained variable is R&D innovation. The following indicators are used to measure R&D innovation: R&D investment 1, as measured by R&D investment/main business revenue (Innovation1), and R&D investment 2, as measured by the natural logarithm of R&D expenditure (Innovation2). In this paper, the analysis of variables mainly adopts the first measurement method, and the second measurement method is used for robustness analysis.

- Explanatory variable is ownership structure. In this paper, the ownership concentration degree is used to express the ownership structure of the company, and the shareholding proportion of the largest shareholder (Share) is adopted.

- Control variables are executive compensation (Salaryg), Return on asset (ROA), board size (Boardn), proportion of independent directors (IND), Dual (Dual), asset-liability ratio (LEVE) and company size (Comsize). Equity nature (NATU).

The definition and description of variables used in the model are shown in Table 1.

Table 1 Summary of research variables.

Variable type	Variable name	Variable symbol	Variable value taking method and description
dependent variable	R & D intensity	Innovation1	Proportion of R & D investment in operating income (%)
Innovation2	R & D investment	Innovation2	R & D investment amount is taken as natural logarithm
independent variable	Equity concentration	Share	Shareholding ratio of the largest shareholder%
Mediating variable	Return on total assets	ROA	Net profit after tax / total assets
control variable	Board size	Boardn	Total number of directors
	Executive compensation	Salaryg	Natural logarithm of executive compensation
	Board independence	IND	Number of independent directors / total number of directors
	Two in one status	Dual	When the chairman of the board concurrently serves as the general manager, take 1, otherwise take 0
	Asset liability ratio	LEVE	Total liabilities / total assets
	company size	Comsize	Natural logarithm of total assets
	Nature of equity	NATU	If the nature of the company equity owned by the actual controller is state-owned, take 1, otherwise take 0

4.4 Descriptive Statistics

Before the empirical analysis of the data, descriptive statistics of all variables were first made. Detailed results are shown in Table 2.

Table 2 Descriptive statistics.

Variable	N	Mean value	Median	Standard deviation	Minimum value	Minimum value
Innovation1	9019	4.674	3.540	5.402	0	137.4
Innovation2	9018	17.98	17.94	1.440	5.094	25.02
Share	9019	33.34	31.13	14.26	3.003	87.46
Boardn	9019	8.570	9	1.672	3	18
Salaryg	9019	15.37	15.32	0.669	13.12	18.95
IND	9019	0.375	0.333	0.056	0.231	0.800
Dual	9019	0.268	0	0.443	0	1
LEVE	9019	0.407	0.394	0.199	0.008	2.394
ROA	9019	0.039	0.036	0.071	-1.859	1.202
NATU	9019	0.334	0	0.472	0	1
Comsize	9019	22.25	22.08	1.243	19.01	28.25

5. Empirical Analysis

5.1 Analysis on the Influence of Ownership Structure on R&D Investment

The aforementioned research samples were used for regression of model (1) to test the influence of equity structure on R&D investment (Innovation1). The regression method was OLS mixed regression, and the standard error was adjusted by cluster at the company level. In addition, in order to eliminate the influence of individual extreme values and outliers, we used the Stata software to perform bidirectional tail shrinkage processing at the 1% level for all data. This method was adopted for all regressions below. Detailed regression results are shown in Table 3.

Table 3 Regression results.

	Model (1) Innovation1	Model (2) Innovation2	State-owned Innovation1	Non state-owned Innovation1
Share	-0.041*** (0.004)	-0.005*** (0.001)	-0.039*** (0.005)	-0.038*** (0.006)
Boardn	-0.177*** (0.039)	-0.045*** (0.009)	-0.149* (0.061)	-0.147** (0.050)
Salaryg	0.904*** (0.086)	0.890*** (0.021)	1.255*** (0.109)	0.430** (0.137)
IND	5.319*** (1.123)	2.309*** (0.272)	6.829*** (1.590)	2.667 (1.621)
Dual	0.796*** (0.123)	0.028 (0.030)	0.826*** (0.142)	-0.105 (0.299)
LEVE	-8.077*** (0.299)	-1.431*** (0.073)	-10.002*** (0.397)	-4.286*** (0.475)
ROA	-10.232*** (0.821)	-2.206*** (0.199)	-11.333*** (0.958)	-7.709*** (1.624)

_cons	-4.867*** (1.361)	-2.193*** (0.330)	-10.247*** (1.808)	0.939 (2.116)
N	9019	9018	6008	3011

Note: (1) The numbers in parentheses are standard errors; (2) ***, ** and * represent the significance levels of 1%, 5% and 10% respectively.

According to model (1), the shareholding ratio of the largest shareholder is negatively correlated with the R&D investment at the significance level of 1%, indicating that with the increase of ownership concentration, the R&D investment of the company is less. This means that there is a widespread problem of major shareholders in Chinese listed companies. Major shareholders take advantage of their own private interests and are not willing to improve the value of the company by means of improving research and development investment, let alone take the interests of the majority of minority shareholders as the starting point of decision-making.

The robustness test is further done in this paper. As mentioned above, the variable of R&D investment is changed to R&D investment 2 (Innovation2) in this paper, and the analysis is carried out again according to the previous steps. It can be seen from the measurement results of model (2) that the above conclusion is still valid.

5.2 Analysis on the Influence of Ownership Concentration on R&D Investment under the Different Ownership Nature

The sample companies are divided into state-owned and non-state-owned by the actual controller. Then model (1) is used for regression. As shown in the measurement results in Table 3, the negative correlation between ownership concentration and R&D investment is significant in both state-owned enterprises and non-state-owned enterprises.

6. Conclusions and Policy Recommendations

Taking Chinese listed companies from 2013 to 2018 as research samples, this paper explores the relationship between ownership structure and R&D investment. The results of empirical analysis show that the level of R&D investment decreases with the increase of the shareholding ratio of the largest shareholder. Further analysis shows that the ownership nature does not affect the relationship between ownership structure and R&D investment. That is, the negative correlation between the shareholding ratio of the largest shareholder and R&D investment exists in both state-owned and non-state-owned companies. This paper means that the major shareholder governance problems exist in Chinese listed companies, and the proxy conflicts between the major and small shareholders restrain the innovation of the companies.

The implication of this paper is that R&D investment is influenced by corporate governance mechanism. When the governance problem of major shareholders exists, the R&D investment of the company decreases and the innovation of the company is inhibited. This shows that, in order to improve the innovation level of Chinese companies, the important link is to improve the governance of Chinese listed companies, improve the concentration of shares of listed companies is generally too high, and improve the governance mechanism of major shareholders.

Admittedly, there are some limitations in this study. First, in terms of the measurement of ownership structure and R&D innovation, this study only uses the information disclosed in the statement for data processing, which does not rule out the possibility of the company's management whitewashing the statement data. In other words, the characterization of equity ownership and R&D innovation in this paper lacks comprehensiveness.

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