

R&D Investment and Corporate Governance Systems for the Performance of Chinese Firms

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중국기업들의 성과를 위한 연구개발투자와 기업지배구조의 활용방안에 대한 연구

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Abstract This study aims to examine the impact of corporate governance systems on the relationship between R&D investment and the performance of Chinese firms. The sample firms were obtained from the statistical yearbook of Chinese high-tech firms. We implement a multiple-regression analysis for an empirical examination. The findings showed that the separation of the board chair with CEO strengthens the R&D investment-performance relationship of Chinese firms. However, the outsider ratio of the board was found to negatively moderate that relationship. This study provides practical guidelines for Chinese firms undertaking R&D management and corporate governance systems. It also encourages future study on the effects of corporate governance as the means for R&D investment management.

Key Words : R&D management, Agency theory, Corporate governance system, Chinese firms

요약 본 연구는 중국기업들의 R&D 투자와 성과 간의 관계에 대한 기업지배구조 시스템들의 차별적인 영향을 분석하는데 주된 목적을 두고 실행되었다. 연구표본은 중국 첨단기업들에 대한 통계연보에서 획득하였고, 실증분석을 위해서는 다중회귀분석을 실행하였다. 분석결과에 따르면 중국기업들의 R&D 투자와 성과 간의 유의한 정(+)의 관계는 CEO-이사회 의장직의 분리에 의해 강화되는 것으로 나타났다. 반면, 이사회 구성에 대한 사외이사 비율 증가는 R&D 투자와 성과 간의 관계를 약화시키는 것으로 나타났다. 본 연구는 기업지배구조 시스템을 구축하고 R&D 투자 관리를 통해 성과 향상을 도모하고 있는 중국 기업들에게 실질적인 활용 지침을 제공하고 있다. 또한 R&D 투자관리 방안으로서 기업지배구조의 영향에 대한 미래 연구를 제안하고 있다.

주제어 : 연구개발 관리, 대리인 이론, 기업지배구조, 중국 기업

1. Introduction

R&D management has been considered a critical factor for firms to gain a sustainable

competitive advantage based on new product and services[1]. However, the outcome of R&D investment is often uncertain because such investments are unique and long-term by nature.

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R&D investment may negatively influence the short-term performance of firms. Thus, the decision on R&D investment is one of the most difficult tasks of top managers. However, little is known about how investment decisions on R&D activities are determined by top managers under various internal and external controlling systems, and their complex impacts on firm performance[2]. In addition, it is still unclear what types of corporate governance systems should be used to minimize a firm's agency costs that can be happen in the decision procedure of R&D investment of firms[3].

According to agency theorists, top managers could exhibit opportunistic behaviors when verifying the outcomes of a specific investment is not straightforward. Thus, there is high possibility top managers adopt opportunistic behaviors when they make a decision on R&D investment and innovation activities. In those settings, information asymmetry and different risk profiles between managers and shareholders exist. Incentive mechanisms may be beneficial to reconcile the interests of top managers with shareholders' regarding R&D investment[4].

However, corporate governance systems include various internal mechanisms besides incentive mechanisms[5]. Thus, strategic decision-making on R&D investment and the performance of firms are more likely affected by them indirectly as well as directly. This argument has been made by many scholars for a long time[6]. However, researchers did not focus on indirect effects of multiple governance systems. Instead, they focused on analyzing the direct effect of a single governance system on strategic outcomes of firms.

Thus, the goal of present study is to deal with this limitation of prior researches in the areas of innovation and corporate governance systems by exploring the indirect effect of various governance systems on the performance of Chinese firms. For this goal, we examine the

moderating effects of (1) the CEO stock ownership, (2) the separation of the board chair with CEO, and (3) the outsiders ratio in board composition on the relationship between R&D investment and the performance of 343 largest publicly listed firms in China.

2. Literature Review

2.1 Agency Problem and R&D Investment

Publicly-held modern corporations are characterized by a separation of the roles of management decision making with risk bearing. Top managers try to avoid the risk as they are mainly responsible for strategic decision making and operational functions. On the other hand, shareholders, as residual claimants, bear the most part of the risk deriving from the decisions of the top managers[7]. While the separation between ownership and management is an efficient method to guarantee the existence and operation of modern corporations, it often induces agency problem between decision makers and owners[8]. Thus, since the 1970s, researchers have investigated the relationships between managers and shareholders of publicly-held modern corporations. The existing literature defines this link as an agency relationship and refers to the related issues as agency problems[9].

In the agency relationship between managers and shareholders, corporate governance systems are the useful tools for protecting the needs and interest of shareholders. They are the group of monitoring systems existed in inside and/or outside the firms to prevent the potential adverse effects of self-interested managers[10,11]. Effective corporate governance systems may help assure the long-term strategic investment and high returns to shareholders. In most cases, they can improve the quality of the decision-making of managers as well as firm valuations in the market[7].

Agency theorists argue that the conflict between managers and shareholders has substantial implications for the effectiveness of R&D investment of firms. First, the degree of risk that managers are willing to bear may not be in line with that of shareholders. Second, because of information asymmetries between managers and shareholders, it is very difficult and costly for shareholders to predict the decisions and behaviors of managers in advance. Agency theorists assume that the objective of shareholders is to increase the return as a benefit for investment. On the other hand, managers focus on the continuity of their job and higher compensation for their work. In terms of attitude and risk profile, managers are thought to have a risk-averse attitude, while shareholders reveal a risk-neutral tendency. Managers cannot diversify their risk, while shareholders can do that in the market. Therefore, managers value more short-term and efficiency-seeking strategies. However, the tendency of managers to focus on the short term can be weakened by corporate governance systems. Scholars in agency theory argue that corporate governance systems can increase the value of shareholders by intensifying the effectiveness on R&D investment[12,13].

However, some scholars provide alternative perspectives. They argue that the high-pressure exercised by shareholders make managers more focus on short-terms investment[14]. Investment on R&D is risky. The outcomes of R&D activities are also uncertain because R&D activities require lots of tacit knowledge. Due to these reasons, shareholders are less likely to understand the features of R&D activities and their potential impact on future firm performance. On the other hands, managers who monitor R&D activities know the opportunities and potential influence of these activities on long-term performance although they have a difficulty to precisely outline the expected outcomes of R&D activities to the shareholders. This might results in leading

shareholders not to comprehend or less concern the impact of R&D activities. Rather, they will more likely focus on value maximization activities of firms in the short-term[15]. Therefore, implementing governance systems targeted to protecting the interest of shareholders can decrease the positive effect of R&D investment on innovation and firm performance[16].

Accordingly the findings from some empirical studies showed that implementing governance systems targeted to protecting the interest of shareholders can decrease the effectiveness of R&D activities and innovation of firms[16]. For instance, focusing on US firms, some recent studies found that increasing market monitoring and intensifying financial controlling systems may result in decreased innovation-related outcomes[17]. However, the empirical support for this alternative perspective is limited to the US firms. Some researcher found that the governance systems that have priority on the interest of shareholders have a positive influence on the effectiveness of R&D activities of 110 publicly-held French firms[18,19].

In sum, the findings of prior researches imply that the relationship of the R&D management with firm performance depend on corporate governance systems that differ across countries. Thus, the research on this issue should be further expanded into various settings. To address this issue, this study examine a sample of Chinese firms that achieved a fast development in the recent years.

2.2 Corporate Governance System in China

Before 1980s, China was in a centrally planned economic system. Most corporate shares were held by the government and state institutions. However, during the last four decades, the Chinese economic system has significantly changed. The Chinese government has carried on

several economic reforms. The ownership structure of both government- and state-owned firms has been transformed into private under the guidance of the government. Furthermore, to liberalize the economic system as a whole, the reforms initiated by the Chinese government have been extended to privately-held firms, which changed their ownership structures as well as operational methods[20,21].

Those changes in the market system and ownership structure have led to various transformations in the corporate governance systems of Chinese firms. In particular, several firms began to alter their ownership structure and transform it into an internal governance system. They also developed internal governance policies and identified the board of directors as the highest decision-making body[18]. The Chinese government gave more autonomy to the management teams and encouraged them to exercise more power in key decision-making. Most firms are now allowed to retain and share their profit[22]. Furthermore, the government assigned the specific functions to the boards of Chinese firms by introducing a new Corporate Law in 1994. Based on this law, the board of directors acquired the authority to make key decisions on corporate management, including decisions about the investment on new product development.

These changes in the economic systems and policies made the corporate governance systems of Chinese firms similar to those of Western firms. However, there are still some distinct features in the corporate governance systems of Chinese firms. First, the ownership of many firms, especially public enterprises, is still highly concentrated on a small number of parties. Second, despite the continuous privatization of government- or state-owned firms, many public institutes still have large portion of the ownership of firms. They often exercise an unparalleled level of power in the strategic

decision-making of firms.

Third, many firms have the power to control other listed firms as they often retain a substantial portion of their shares. This unique ownership structure allows many Chinese firms to extract various gains, especially a tacit consent from other firms regardless the disagreement of minority owners. Fourth, there was no official market for corporate control in China before 2007. Thus, corporate control could not be traded in the market. However, the situation changed in 2007 as untradable shares formally moved to the open market. Since then, market competition for corporate control as an external governance system prevailed. However, more than half of the larger block of shares in Chinese firms are still owned by government- or state-owned institutions. Unlike private investors, those entities are not just concerned with the maximization of shareholder value. Their concern includes several macroeconomic and political issues, which influence their decision-making regarding the firm management.

3. Research Model and Methodology

Under these circumstances, it might be very meaningful to analyze the indirect effects of the corporate governance systems on the relationship between R&D investment and performance of Chinese companies. Therefore, the following research models and hypotheses were examined in this study.

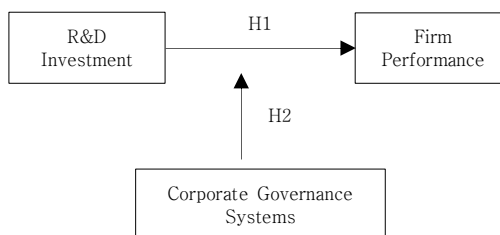


Fig. 1. Research Model

- H1. R&D investment of Chinese high-tech firms is positively related to its performance.
- H2. The interaction of R&D investment and corporate governance systems of Chinese high-tech firms is positively related to a firm's performance
- H2-1. The interaction of R&D investment and the ratio of CEO ownership is positively related to a firm's performance.
- H2-2. The interaction of R&D investment and the proportion of outside board members in board composition is positively related to a firm's performance.
- H2-3. The interaction of R&D investment and the separation of the board chair with the CEO is positively related to a firm's performance.

The importance of R&D investment to do an innovation and achieve high level of performance varies across industries. Therefore, we include firms in various manufacturing and services industries operating in the Chinese market. This sampling method is to increase the generalizability of the research findings. In particular, we adopted a multi-year (2009–2014) sample of Chinese firms in chemical, pharmaceutical, industrial machinery and tools, computer, communication equipment, electronic equipment, precision machinery, medical equipment, and chemical appliances industries from the statistical yearbook of Chinese high-tech firms in 2009. However, we excluded all subsidiaries from the sample to minimize the possibility of distortion potentially caused by corporate governance systems. We also excluded firms from the sample that did not exist until 2013.

The information regarding the R&D investment of sample firms was obtained from the statistical yearbook of Chinese high-tech firms from 2009 to 2014. In this study, we did a multiple-regression analysis for an empirical examination. The

effects of firm age, firm size, debt ratio, and industry type were controlled in the analysis. Debt ratio was measured as dividing the debt by equity amount. Firm size was measured as the logarithm of total asset. Finally, the type of industry was measured as a dummy variable (1=if a firm operates in the manufacturing industry, 0=otherwise).

The independent variable, R&D investment, was calculated by the ratio of R&D cost to sales profit. We adopted three different corporate governance systems, (1) the ratio of CEO ownership, (2) the proportion of outside board members in board composition, and (3) the separation of the board chair with the CEO, as moderating variables in the analysis. We measured the ratio of CEO ownership by dividing the CEO stake by the total number of shares and then multiplying this value by 100. To measure the proportion of outside board members, the number of outside board was divided by the total number of board and then multiplying this value by 100. Finally, the separation of the board chair with CEO was measured and included in the model as a dummy variable (separation=1, dual=0).

We searched the CSMR and the iFinD database to obtain all information regarding the governance systems. A market-based performance measure is generally assumed to be superior to an accounting-based performance indicator to evaluate the performance implications of governance systems. Thus, in this study, we adapt the Tobin's Q, calculated by the "market value/replacement cost," to measure firm performance as dependent variable.

4. Results

The descriptive statistics and Pearson correlation matrix are reported in Table 1 and Table 2 respectively. A review of the correlations

indicates a significantly positive relation between some variables. Thus, variance inflation factors (VIFs) of variables were checked for possible multicollinearity. All of the VIFs are within the acceptable range, below 3, indicating no multicollinearity in the regression analysis.

Table 1. Descriptive statistics (n=343)

	Min	Max	M	SD
1. Tobin's Q	0.19	14.68	2.42	1.94
2. R&D Investment	0.01	29.24	4.78	4.68
3. CEO Ownership	0.01	31.57	5.61	8.59
4. Board Outsiders Ratio	25.0	71.42	36.88	5.40
5. CEO/Board Chair Duality	0	1	0.68	0.47
6. Firm Age	1.30	21.67	8.51	4.37
7. Debt Ratio	1.78	93.27	40.13	18.26
8. Firm Size	19.3	25.26	21.70	0.93
9. Type of Industry	0	1	0.83	0.37

Table 2. Pearson Correlation (n=343)

	1	2	3	4	5	6	7	8	9
1	1								
2	.46**	1							
3	.23**	.17**	1						
4	-.08*	.04	-.03	1					
5	.26**	.25**	.46**	.10**	1				
6	-.30**	-.20**	-.43**	.11**	.18**	1			
7	-.51**	-.36**	-.18**	0.5	.13**	.22**	1		
8	-.39**	-.16**	-.03**	.09**	.23**	.46**	.35**	1	
9	-.22**	-.26**	-.04	-.03	.02	.06	-.03	-.05	1

1) * < .05; ** < .01

2) The number indicates that the variable is the same as the variable of the same number included in Table 1.

For empirical analysis of hypotheses, we did a multiple-regression analysis. In particular, we analyzed three different models sequentially. In the first model, we analyzed the control variables only. In the second model, we analyzed the control and independent variables. Finally, in the third model, control, independence, and control variables were all analyzed simultaneously. Table 3 present the findings of those analyses.

Table 3 Results of Multiple Regression Analysis

	(n=343)		
	Model 1	Model 2	Model 3
Firm Age	-0.09 (-2.70**)	-0.06 (-1.95*)	-0.07 (-2.01*)
Debt Ratio	-0.43 (-13.85**)	-0.34 (-10.8**)	-0.33 (-10.0**)
Firm Size	-0.22 (-6.44**)	-0.22 (-6.65**)	-0.19 (-5.7**)
Type of Industry	-0.25 (-8.61**)	-0.18 (-6.28**)	-0.15 (-4.9**)
R&D Investment		0.24 (7.68**)	0.85 (3.13**)
CEO Ownership			-0.07 (-1.06)
Board Outsiders Ratio			0.01 (0.02)
CEO/Board Chair Duality			-0.02 (-0.47)
R&D*CEO Ownership			0.09 (1.20)
R&D*Board Outsiders Ratio			-0.61 (-2.30*)
R&D*Duality			0.12 (2.54*)
R ²	0.368	0.430	0.452
F-Statistic	117.85**	113.46**	56.72**
Adj. R ²		0.045	0.026
Change in F		58.95**	5.78**

1) *p < .05; **p < .01

2) Standardized regression coefficients are reported

3) T-values are in parentheses

4) Dependent variable is the performance of firms measured by Tobin's Q

According to the findings, there is significant positive relationship between the R&D investment of Chinese firms and their performance. Thus, H1 was supported. All three corporate governance factors did not reveal statistically significant impact on firm performance. Furthermore, one of three corporate governance systems present positive moderating effects on the relationship between R&D investment and firm performance. In particular, the results show that the separation of the board chair with the CEO also strengthens the positive relation of R&D investment with performance. Thus, H2-3 was supported. Whereas, the percentage of outside members in the board was found to negatively moderate the R&D investment-performance relationship. Also CEO stock ownership did not present a moderating effect on the R&D investment-performance relationship of Chinese firms. Thus, both H2-1 and H2-2 were rejected.

Regarding the control variables, firm age

presents negatively significant impacts on the performance of Chinese firms. This finding implies that, as a firm become older, it tends to achieve a lower performance level. The debt ratio also shows a negative and significant relationship with the performance of Chinese firms. Furthermore, firm size reveals negatively significant impact on performance. Finally, the type of industry presents a significant negative impact on firm performance, meaning that firms in the service industries are characterized by a higher performance level compared to firms in the manufacturing industries in China.

5. Conclusion

Drawing on agency theory, this study explores the relationship between R&D investment and the performance of Chinese firms, as well as the moderating effects of various corporate governance systems on this relationship. The findings of this study provide important implication for both researchers and practitioners, showing that R&D investment is beneficial for increasing the performance of Chinese firms. They also imply that R&D investment may have a more positive impact on the performance of Chinese firms when the decisions of top managers are monitored and controlled through specific governance systems. Thus, this study provides practical guidelines for Chinese firms undertaking R&D management with the control systems for opportunistic behaviors of top managers. Chinese firms will be able to achieve more positive outcomes when they effectively use their governance systems to monitor top managers' decision on R&D investment. Specifically, they can separate the board chair with CEO to effectively monitor and control the R&D investment of top managers.

In addition, this study contributes to the development of agency theory and its application to the market of developing countries. Prior

studies provided conflict findings on the impact of corporate governance systems on firms' performance. They also suggested that it is questionable that the corporate governance systems developed based on agency theory can apply to the R&D management of firms in developing countries. We examined a set of corporate governance systems in the proposed model, rather than focusing on one single dimension of governance systems. The results showed significantly different impact of them on the relationship between R&D investment and performance. Thus, this study implies an importance of an empirical model that allows to examine the complex and/or conflict impacts of different governance systems. This study also complements prior researches, which mostly concentrated on Western developed markets, including the United States[18], France[19], and the United Kingdom by providing empirical evidence for the firms in developing country[23].

Despite the above practical and theoretical implications, this study has the following limitations, and these limitations could be improved through future research. First, although there are more diverse types of corporate governance systems available to firms, this study analyzed only the effects of the three most important systems for the focus of research. However, the effects of other systems not included in the study may also have a significant impact on R&D management and corporate performance. Future research that focus on their effects could help overcome the limitations of this study.

Second, China's high-tech industry has gradually changed in corporate governance since it was classified according to the national business classification standard in 2008. Therefore, it is assumed that the interaction effects of R&D investments with corporate governance systems on performance will not significantly differ from the findings of this study, even if the data after

2014 are analyzed. However, since such assumptions can be confirmed only through further analysis, further research needs to be carried out with more recent data.

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