

The Effect of R&D on Firm Performance of Venture Companies on KOSDAQ Listed Venture Business

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Abstract

This study analyzed the effects of R&D cost on corporate performance of the companies on KOSDAQ market venture business division. Our results are as follows. First, both R&D cost and R&D intensity of KOSDAQ listed venture companies had significant negative effects on corporate performance. The reason why research and development costs of KOSDAQ market venture companies show negative relationship is that they often give up short-term profitability while focusing on R&D as a characteristic of venture company. Therefore, due to the nature of R&D intensive industry, the degree of R&D costs on sales would be expected to affect long-term performance. Second, the ownership is significantly positive to the corporate performance. Unlike previous studies, KOSDAQ companies often have a professional founder working on the management front, which seems to be due to less agent problems, which supports the consensus hypothesis. Third, the leverage and the sales growth have negative and positive effects on the company performance, respectively. These results can be interpreted as the increasing cost or investment on R&D deteriorates the profitability of the company, but the sales control the level of R&D expenditure and contribute to the profitability of the company

Key words: R&D cost, Corporate Performance, Venture Company

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I. Introduction

In 2018, Korea's R&D cost totaled 85.7287 trillion won, the fifth largest among OECD countries, and the proportion of R&D costs to GDP was the world's No. 1. In 2021, the government budget for R&D expenses in Korea was 27.4 trillion (24.2 trillion won in the previous year), up 13.14% from the previous year. These R&D expenditures are being invested in the direction of government R&D investment in 2021 to strengthen the research capacity of innovative subjects, expand the base of economic growth, and improve the quality of life, reflecting the national trend of 'innovation' and 'inclusive'.

The proportion of venture companies in the KOSDAQ market is 29.7% in 2011, 35.4% in 2015, 41.1% in 2019, and 42.6% in 2020, Their proportion is increasing continuously. The reason for this increase is that the proportion of venture companies among newly listed companies has increased significantly since 2015, thanks to the policy to strengthen venture capital supply such as the activation of the technology special system. Last year, more than half of the 86 companies newly listed on the KOSDAQ (55.8%) were venture companies. However, out of the listed companies in the KOSDAQ market, which is a settlement corporation in December 2019, a total of 33 companies were delisted due to inappropriate opinions (limited scope, refusal of opinions). In addition, 28 companies were designated as management stocks due to operating losses during the four business years, large-scale losses, and reasons for delisting.

Therefore, it is meaningful to find out how the R&D activities of venture companies in the KOSDAQ market, which has a high proportion of venture companies, have a special impact on corporate performance and profitability. This is because it is necessary to present concrete directions through research on how small and medium venture companies should establish and implement R&D investment policies in order to secure survival and competitive advantage in a rapidly changing industrial environment. For this purpose, this study aims to analyze the impact of R&D expenditure and ownership structure on corporate performance of KOSDAQ market (KOSDAQ) venture business division, which is an innovative company among Korean companies, and to suggest policy direction for innovative venture companies based on the results. In the previous studies on R&D and corporate performance, various different results were reported, which is presumed to be the result of not analyzing the results by subdividing into industry and type considering the situation of the company. Therefore, this study is different from the existing research in that it

empirically analyzed the impact of R&D expenditure and ownership structure on corporate performance by considering corporate characteristics, types and industrial characteristics, and applied the agent theory to identify them.

The composition of this study is as follows. In section 2, the previous studies were examined as theoretical basis. In section 3, hypothesis setting was made for research design, sample was selected for the subject of research, and a verification model for hypothesis verification was designed. Section 4 presents the correlation analysis with the descriptive statistics of variables as an empirical analysis, and empirically verifies the effect of R&D investment and ownership structure on corporate performance. Finally, last section presents summary and conclusion of the study, and presents limitations of this study and future research directions.

II. Theoretical Background

In this chapter, the previous studies related to this study are divided into research on the relationship between R&D investment and corporate performance, and research on the relationship between ownership structure and corporate performance.

1. Previous Studies on R&D Investment and Corporate Performance

The previous studies that analyzed the impact of R&D costs on corporate performance have not shown consistent results. Many previous studies have reported that R&D costs have a positive effect on corporate performance, but some studies have reported that there is no negative relationship or significant relationship.

The overall change in the profit margin of manufacturing companies in relation to accounting of R&D expenses was found to decrease by 50% when capitalizing R&D costs rather than costing them, and it was found that they were more sensitive to R&D costs than advertising expenses (Grabowski and Mueller, 1978). In addition, when capitalizing R&D costs, the company value was increased and the target company's amortization period was the sixth year, which showed the highest explanatory power (Chambers, Jennings, and Thompson, 2003). According to a study on manufacturing only, the past advertising and R&D investment had a significant positive effect on the net profit of the previous and the current period (Lev and Sougiannis, 1996).

As a result of researching the relationship between R&D costs and profitability of KOSDAQ companies, the research and development expenditure of KOSDAQ companies reported the positive relationship with profitability of KOSDAQ companies (Jeong G. E, and Kim S. G., 2001). In addition, the research and development expenditure of the company has a positive effect on profitability for the next two to four years (Cho S. P and Jeong J. Y. 2001), and the research and development expenditure of the company has a significant positive effect only on the future management performance with time difference (Kim H. K and Song Y. R., 2004). In this study, the research and development investment and technological innovation ability of Innobiz companies were studied to study the impact on corporate performance. Innovative companies showed that the more active R&D investment, the more positive impact on financial performance compared to their goals except for R&D intensity (Kim I.S. and Kim W.B. 2018). In addition, the analysis of the impact of internal and external R&D investment on productivity showed that R&D investment had a statistically significant positive effect on productivity growth in internal, external (outsourcing), internal and external aspects of large corporations, but in the case of small and medium enterprises, R&D investment concentration, which only performs external R&D, had a statistically significant negative effect on productivity growth. In order to internalize the technology and knowledge caused by external R&D investment and connect it to the performance of the company, internal investment of the company is important. Small and medium enterprises argue that external R&D investment can negatively affect the performance of the company due to lack of such absorption capacity (Kim M. J. 2020). As a result of analyzing productivity improvement through R&D using domestic company data, R&D investment has a significant effect on productivity increase overall. In particular, in the service industry, investment in capital contributed to the increase in production (Yu, M. H. and Jang S. M., 2018). As mentioned above, research and development expenditure and profitability of companies report positive results, but there are studies that report that there is no negative or significant relationship.

Choi M. S. and Kim Y. C. (2011) studied on the capitalization of R&D costs versus the cost of the current period. And the difference of the impact of R&D costs on future profit growth was analyzed. In case of capitalization, it is reported that it has negative (-) effect on future profit growth. Lee Y. H. and Lee H. J. (2009) analyzed the relationship between R&D investment and corporate performance of domestic IT service companies and argued that there was no significant relationship between R&D expenditure and financial performance.

The impact of R&D costs on the performance and corporate value of the company may vary by industry and type. If external funds are easy to use and growth potential is high, it can have a positive impact on the profitability of the company because it is possible to spend continuously on research and development (Lee J. K., 2010). Companies with high uncertainty have greater profitability and profit growth due to R&D costs than those with low uncertainty (Chung and Park, 2016). In addition, the research and development investments in the high-tech industry group have more influence on the corporate value (Kang K. H., 2015). In the case of venture companies, innovative management activities through continuous research and development have a positive effect on the actual sales of companies (Jeon H. J. and Park Y. T., 2010). In the past 20 years, the impact of tangible and intangible assets investment on corporate profitability was analyzed. As a result, the profitability contribution of R&D costs was not significant in R&D intensive industry. On the other hand, the significant effect of the corporate value was interpreted as the fact that R&D costs had a significant effect on the long-term corporate value rather than the short-term effect on the recent profit (Cho S. P., Park S. Y. and Kim S. Y. 2014).

2. Previous Studies on Ownership Structure and Corporate Performance

The first study involving intensive ownership of stocks was done by McEachern and Romeo (1978), which confirmed that R&D spending intensity was higher in companies with external shareholders with more than 4% of shares. In this regard, there is inevitably a problem of agent due to the discrepancy of interests between managers and shareholders, controlling shareholder and external shareholders. Accordingly, the method of reducing the agency costs has emerged in the relationship between ownership structure and corporate performance. The agent theory can be divided into the Convergence of Interest Hypothesis and the Management Entrenchment Hypothesis. Convergence of interest hypothesis is the theory that the interests of shareholders and management are consistent as the shares in the management increase, and as a result, the cost of agents decreases (Jensen and Meckling, 1976; Ang, J., R. Cole and J. Lin, 2000; Anderson and Reeb, 2003). And the managerial entrenchment hypothesis is that if the manager or controlling shareholder has a large share, the controlling shareholder is not threatened by the management rights even if it pursues its own interests based on the sacrifice of the external shareholders, so the increase in the controlling shareholder's shares can lead to an increase in the cost of the agent (Demsetz, 1983; Fama and Jensen, 1983; La Porta, R. Lopez-De-Silanes, F., Shleifer, A. and Vishny, R. 2002). Generally, managers and the largest shareholder with high ownership have

sufficient voting rights, so it is very likely to make decisions to pursue their own interests. In this case, the profitability and value of the company is very likely to decline. Therefore, the higher ownership of managers and the largest shareholders, the more negative relationship with corporate performance (Fama and Jensen, 1983; Dittmar, A., J. Mahrt-Smith, and H. Servaes. 2003; Lu Zhang, 2005; Han J. B. and Lee J. H., 2011). This supports the management entrenchment Hypothesis.

In the previous studies of Park K. S.(2002), he confirmed that there is a positive correlation between the ownership of the largest shareholder and the total asset profit rate, but many studies confirmed that there is a negative correlation between the ownership of the largest shareholder and the corporate value. In addition, as in foreign countries, the management entrenchment Hypothesis is supported (Park K. S. and Lee E. J., 2004; Kim M. H and Park Jong, I., 2005; Shin M. S. and Kim S. E, 2011; Han J. B. and Lee J. H., 2011; Lim H. J., Choi J. S., 2012; Lee H.S. and Koo J. S. 2017). This means that the ownership retained by the largest shareholder has a negative impact on corporate performance because the largest shareholder is very likely to pursue decisions that can increase private profits in the process of decision making about the company's management. In addition, the relationship between manager ownership and corporate performance is nonlinear, and until the manager ownership is about 40-50%, two variables have positive relationships, and negative relationships in more than that, according to the study (McConnell and Servaes, 1990), A study that reported that there was a nonlinear relationship between the ownership of the founders and the company performance (Anderson and Reeb, 2003), The study reported that there was a similar nonlinear relationship between family's ownership and corporate performance (Morck, R., A. Shleifer and R. Vishny, 1988 ; Kim B. H., 2002; Seo D. S. and Park J. K., 2009). Lee S.W and Kim N. R.(2012) argue that there is a non-monotonic relationship that has a positive relationship when the overall negative relationship is very high between the largest shareholder's shares and management performance in a large enterprise group.

Meanwhile, Cho and Jung (2017) explained that the separation of ownership and management is not strictly divided, so that R&D costs and governance structure are positively related. Kwak and Jeong(2014) showed that the company value and R&D costs have positive relationship where the largest shareholder holds exceeding 50% ownership.

III. Research Design

1. Hypothesis

The R&D expenditures of companies are essential expenditure items for future revenue generation and are key investments to increase corporate value (Hall, B. H., A. Jaffe, and M. Trajtenberg, 2005). However, R&D expenditure has a delay effect and uncertainty of future profit, so if R&D fails, it will have a negative impact on corporate profitability. Previous studies that verify the impact of R&D expenditure on corporate performance report mixed results. As described above, Many previous studies reported that R&D expenditures have a positive effect on the business performance of companies (Hirschey and Weygandt, 1985; Sougiannis, 1994; Cho D. H. and Kim T. H., 1999; Cho S. P. and Jeong J. Y., 2001; Jeong H. Y., Jeon S. I. and Kim H. J., 2003; Kim J. K. and Seo J. S., 2007). In addition, the research and development expenditure of the company has a positive effect on profitability for the next two to four years (Cho S. P and Jeong J. Y., 2001), and the research and development expenditure of the company has a significant positive effect only on the future management performance with time difference (Kim H. G. and Song Y. R., 2004). However, some studies have reported that R&D investment has a negative impact on the business performance of the company or R&D expenditure of the company in the introduction period has a negative impact on future profitability (Choi M. S. and Kim Y. C., 2011; Yu J. Y., Lee S. R. and Park S. B., 2018). The reason why such mixed research results appear is presumed to be the result of not analyzing the actual results by subdividing them into industry and type considering the situation of the company. Therefore, this study aims to verify the relationship between R&D cost and corporate performance by considering the characteristics, types and industrial characteristics of the company, and the following hypotheses were set up.

Hypothesis 1. R&D expenses will have a positive effect on corporate performance.

Hypothesis 2. The intensity of R&D expenditure will have a positive effect on corporate performance.

In addition, The discrepancy of interests between managers and shareholders, controlling shareholders and external shareholders inevitably causes agent problems. The agent cost

according to the agent problem can be reduced by optimizing the ownership structure of enterprise. The agent theory can be divided into the Convergence of Interest Hypothesis and the management entrenchment Hypothesis. Generally, managers and major shareholders with higher ownership have sufficient voting rights, so it is very likely to make decisions to pursue their own interests. In this case, the profitability and value of the company is very likely to decline. Therefore, the higher ownership of managers and major shareholders, the more negatively related to corporate performance, and the support of the management entrenchment Hypothesis (Fama and Jensen, 1983; Dittmar et al., 2003; Lu Zhang, 2005). In the previous studies in Korea, Park K. S.(2002) confirmed that there is a positive correlation between the ownership of the largest shareholder and the total asset profit rate, but many studies confirmed that there is a negative correlation between the largest shareholder share and the corporate value. In addition, as in foreign countries, the management entrenchment Hypothesis is supported (Park K.S. and Lee E. J., 2004; Kim M. H. and Park J. I., 2005; Shin M. S. and Kim S. E., 2011; Lee H. S. and Koo J. S., 2017; Jeong W. J., and Lee J. H., 2005). Accordingly, the following hypotheses were set up.

Hypothesis 3. The higher ownership of the largest shareholder, the more negatively impacts on corporate performance.

2. Sample Selection

The sample companies used for hypothesis verification were listed on the KOSDAQ market venture business division¹⁾ of the Korea Exchange as of the end of 2019. However, the financial sector, the accounting settlement date, not the end of December, or the companies subject to stock management or the companies with capital infiltration were excluded. The data on the variables adopted in this study were collected from the stock price data provided by the Korea Exchange (KRX) and the electronic disclosure system (DART) of the Financial Supervisory Service.

1) The criteria of venture division in Korea market are summarized as follows. All of firms should be commonly qualified as a Small and Medium-sized Enterprises(SME) under framework act on the SME. And then these firms are evaluated at the characteristics of firms on VC-backed by venture capital association or R&D types by SME startups Agency or innovation growth by accredited 7 agencies such as Korea Technology Finance Corp., Korea Institute of Industrial Technology, and Korea Institute of Science and Technology Information, respectively.

[Table 1] Sample distribution of firms by industry breakdown

Industrial Classification	No.	Industrial Classification	No.
Machine equipment	59	Fibrous clothing	4
IT, S/W	36	Publication media	2
Transport equipment parts	21	Construction	3
Pharmaceutical company	20	Distribution	3
Communication broadcasting service	13	Entertainment	4
Medical precision equipments	12	Metal	7
Chemistry	10	IT H/W	6
Other manufacturing	24	General electric and electronic	6
Other services	13	food & beverage and tobacco	4
Total		247	

The distribution of sample companies according to the classification code of the Korea Exchange is as shown in the following [Table 1]. As shown in Table 1, the KOSDAQ venture business division has relatively high proportion of machinery equipment, IT and S/W, transportation equipment parts and other manufacturing and pharmaceutical bio-related companies.

3. Verification Model

In this study, the research model of the following (1) and (2) was set up to confirm the effect of R&D expenditure and ownership structure on corporate performance. The dependent variable was the return on equity (ROE). This index has been widely used as an index representing corporate performance and profitability. Previous studies have used Tobin's Q, an indicator of corporate value (Morck et al., 1988; Lins, 2003; Core, E., R. Guay and A. Buskidi 2003; Shin M. S. and Kim S. E., 2011), and The financial performance index, the return on equity (ROE) or the return on assets (ROA), is used to classify Demsetz and Lehn, 1985; Ang et al., 2000; Park G. S., 2002). However, considering that Tobin's Q is largely dependent on future potential profitability rather than past performance, this study is reasonable to use financial indicators rather than Tobin's Q because it is interested in how R&D expenditure and ownership structure have affected actual financial performance.

$$ROA_{i,t} = \alpha_0 + \alpha_1 RND_{i,t} + \alpha_2 \text{Log_SIZE}_{i,t} + \alpha_3 \text{LEV}_{i,t} + \alpha_4 \text{OWN}_{i,t} + \alpha_5 \text{SGR}_{i,t} + \varepsilon_i \quad (1)$$

$$ROA_{i,t} = \beta_0 + \beta_1 RND_{i,t} * D_FOCUS + \beta_2 \text{Log_SIZE}_{i,t} + \beta_3 \text{LEV}_{i,t} + \beta_4 \text{OWN}_{i,t} + \beta_5 \text{SGR}_{i,t} + \varepsilon_i \quad (2)$$

here, Return on Assets (ROA) : Net Income/Total Assets

R&D Costs (RND): (ordinary research and development expenses + Non-ordinary research and development expenses)/Sales,

R&D intensity(D_FOCUS): If RND is above average in 2019, the dummy variable is 1, and if not, 0,

Firm Size(Log_SIZE) : Log on the total assets,

Debt Ratio(LEV) : (Total Liabilities - cash and cashable asset)/Total assets,

The ownership of the largest shareholder (OWN): The percentage of ownership of retained by the largest shareholder including its related parties

Sales Growth Rate (SGR): sales for the year/sales for the previous year - 1,

ε : residuals

According to previous studies, R&D cost (RND), R&D intensity (D_FOCUS), debt ratio (LEV), corporate size (Log_SIZE), the ownership of the largest shareholder (OWN), and sales growth rate (SGR) were considered in the model.

3. Verification Model

In this study, the research model of the following (1) and (2) was set up to confirm the effect of R&D expenditure and ownership structure on corporate performance. The dependent variable was the return on equity (ROE) [ROA]. This index has been widely used as an index representing corporate performance and profitability. Previous studies have used Tobin's Q, an indicator of corporate value (Morck et al., 1988; Lins, 2003; Core et al., 2003; Shin M. S. and Kim S. E., 2011), and Demsetz and Lehn(1985) and Ang et al.(2000) are used the return on equity (ROE) or the return on assets (ROA) as the financial performance index.

IV. Results of Empirical Analysis

1. Descriptive Statistics

[Table 2] represents the descriptive statistics of the variables used for hypothesis verification. In panel A, average of the total return on assets (ROA) of the dependent variable was 2.7%. The RND ratio of R&D cost to sales was 5.9%, which was higher than that of Jeong W. H., Lee J. H. and Cho Shin(2018). The average debt ratio (LEV) is 0.737, which shows that debt is consist of 74% of total assets. Total assets (SIZE) for total assets was 83.0 billions of KRW on average, and OWN was 33.3% on average. Sales growth rate (SGR), or sales compared to the previous year, grew by an average of 8.5%.

[Table 2] Descriptive Statistics

(Panel A) Summary of Characteristics for 247 samples				
	Mean	Minimum	Maximum	Standard Deviation
ROA	0.027	-0.418	0.609	0.098
RND	0.059	0.000	0.600	0.076
LEV	0.737	0.014	8.997	0.941
SIZE(billions of KRW)	83.0	11.8	527.6	60.9
OWN	0.333	0.050	0.854	0.142
SGR	0.085	-0.685	2.176	0.347

(Panel B) Summary of Mean by R&D cost-injected 210 samples						
	Highest-tertile(1)	Middle-tertile(2)	Lowest-tertile(3)	Differences		
	N=70	N=70	N=70	(1)-(3)	(1)-(2)	(2)-(3)
ROA	0.007	0.031	0.046	-0.039**	-0.024	-0.015
RND	0.142	0.045	0.013	0.129***	0.097***	0.032***
LEV	0.811	0.658	0.719	0.092	0.153	-0.061
SIZE(billions of KRW)	69.2	79.5	92.6	-23.4***	10.3	-13.1
OWN	0.309	0.341	0.352	-0.043**	-0.032	-0.011
SGR	0.112	0.088	0.047	0.065	0.024	0.041

Note) * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

For further investigation of R&D cost to ROA, we provided the averages by the tertile data from 210 R&D cost-injected samples expect the single the highest RND ratio in panel B. When compared to the highest and the lowest tertiles, we find that firms that inject greater R&D cost to sales, ROA of those firms on average is reduced and also these firms

are hold lesser ownership as well as firm size than those of the lowest tertile firms.

Before multiple regression analysis, correlation analysis was conducted to find out whether there is correlation and multiple collinearity among variables. As shown in Table 3, the return on assets (ROA) showed a positive correlation with the ownership of the largest shareholder (OWN) ($r=0.303$, $p<0.01$) and the sales growth rate (SGR) ($r=0.335$, $p<0.01$), and the RND ($r=-0.159$, $p<0.05$), the debt ratio (LEV) ($r=-0.310$, $p<0.01$) showed a negative correlation. These results are similar to the results of Choi Man-sik and Kim Young-chul (2011), who reported that capitalization of R&D cost has a negative effect on future profit growth, and R&D cost of companies are contrary to the results of Jeong G. E. and Kim S. G.(2001), which reported a positive relationship with KOSDAQ companies' profitability. The reason why research and development costs of KOSDAQ market venture companies show negative relationship is that they often give up short-term profitability while focusing on R&D relatively in the early days of start-up. In addition, R&D investment has always uncertainty, so it can be seen that it has a negative effect on the net profit margin of total assets by processing it at the cost of the capitalization without assetization.

Next, the positive correlation between the ownership and the ROE was the same as the research of Jeong W. J. et al.(2018) and Park K.S (2002). This means that the more the ownership of the management increase, the more the interests of the shareholders and the management are matched, and as a result, the Convergence of Interest Hypothesis is supported (Jensen and Meckling, 1976). These results suggest that the stable management rights of the largest shareholder are contributing to the improvement of corporate performance rather than the cost of agents due to the recent improvement of governance structure. Finally, there was no problem of multi collinearity as it showed a correlation of 0.335 or less between independent variables.

[Table 3] The results of the Durbin-Watson Tests

	ROA	RND	LEV	Log_SIZE	OWN	SGR
ROA	1					
RND	-0.159*	1				
LEV	-0.310**	0.066	1			
Log_SIZE	-0.009	-0.214**	0.089	1		
OWN	0.303**	-0.164**	-0.136*	-0.067	1	
SGR	0.335**	0.040	-0.084	0.057	0.019	1

Note) ** $p<0.05$, *** $p<0.01$

2. Multiple Regression Analysis

In order to examine the effect of R&D cost on corporate performance, regression analysis was conducted with the net asset return as a dependent variable, and the results are as follows. The value in parentheses in table 4 is a t-value for the estimated coefficient. The regression analysis models (1) and (2) are stepwise regression models adding variables, and (3) and (4) are further analyzed to confirm the significance of R&D costs by adding dummy variables. The F-test results of the regression model showed that each model was significant and the Durbin-Watson statistic was just more or less than 2, so there was no problem of self-correlation. In addition, multiple collinearity between dependent variables is well controlled as Variance Inflation factor (VIF) is less than 5. The results of the analysis show that the research and development cost has a negative effect on the corporate performance. As a result of verifying <Hypothesis 2>, the intensity of R&D cost as seen in the research models (3) and (4) has a negative effect on the performance of the company. These results are contrary to the previous studies (Hirschey and Weygandt, 1985; Sougiannis, 1994; Cho D. H., Kim T. H., 1999; Cho S. P., Jeong J. Y., 2001; Jeong H. Y., Jeon S. I. and Kim H. J., 2003; Kim J. K and, Seo J. S., 2007) which reported that R&D cost had a positive effect on the business performance of the company. In addition, the research and development expenditure of the company has a positive effect on profitability for the next two to four years (Cho S. P. and Jeong J. Y., 2001), and the research and development cost of the company does not match the research (Kim H. K. and Song Y. R., 2004) that claims that it has a significant positive effect only on the future management performance with time difference. However, some studies have shown that R&D investment has a negative impact on the business performance of the company or R&D cost of the company in the introduction period has a negative impact on the future profitability (Choi M. S. and Kim Y. C., 2011; Yu J. Y. et al., 2018). The result on <Hypothesis 3> showed that the higher ownership of the company, the more positive influence on the corporate performance.

[Table 4] Multi-regression Analysis

Variable	(1)		(2)		(3)		(4)	
	ROA		ROA		ROA		ROA	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	0.113	0.465	0.050	0.221	0.011	0.049	0.017	0.078
RND	-0.142	-2.295**	-0.119	-2.075**				
D_FOCUS					-0.105	-1.858*		
D_FOCUS*RND							-0.106	-1.871*
LEV	-0.299	-4.917***	-0.241	-4.301***	-0.242	-4.328***	-0.240	-4.286***
Log_SIZE	-0.013	-0.215	-0.015	-0.265	-0.007	-0.121	-0.008	-0.149
OWN			0.244	4.332***	0.253	4.531***	0.250	4.441***
SGR			0.316	5.708***	0.317	5.717***	0.315	5.682***
Adj. R²	0.104		0.258		0.256		0.256	
F-value	10.556***		18.140***		17.910***		17.923***	
Durbin-Watson	1.977		1.997		1.974		1.986	

Note) ***, **, * means significance at 1%, 5%, 10% level, respectively.

These results show that the higher ownership of managers and major shareholder, the negative relationship with corporate value. The reason for this is that KOSDAQ companies often have a professional founder working on the management front, which means that there are less agent problems, which supports the Convergence of Interest Hypothesis. Meanwhile, the size of the company (Log_SIZE) did not have a statistically significant effect on the net profit margin (ROA). On the other hand, the debt ratio (LEV) had a negative effect on the corporate performance within 1%, and the sales growth rate (SGR) had a positive effect on the corporate performance within 1%.

V. Robustness Check

[Table 5] Multi-regression Analysis by tertile sample collections

Variable	Highest-tertile(1)		Middle-tertile(2)		Lowest-tertile(3)		Total(4)	
	ROA(N=70)		ROA(N=70)		ROA(N=70)		ROA(N=210)	
	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value	Coeff.	t-value
Intercept	0.035	1.259	0.086	2.912***	-0.030	-0.854	0.177	0.254
RND	-0.298	-1.739*	-0.631	-0.989	0.571	0.433	-0.244	-2.684***
LEV	-0.041	-2.908***	-0.043	-3.823***	-0.004	-0.314	-0.027	-3.621***
Log_SIZE	0.053	1.146	0.076	2.339**	-0.170	-5.112***	-0.016	-0.691
OWN	0.034	0.300	0.190	3.866***	0.190	2.822***	0.161	3.618***
SGR	0.134	4.533***	0.123	1.298	0.101	2.868***	0.082	4.274***
Adj. R²	0.308		0.388		0.369		0.251	
F-value	7.152***		9.740***		9.055***		15.018***	
Durbin-Watson	2.012		1.832		2.281		1.970	

Note) ***, **, * means significance at 1%, 5%, 10% level, respectively.

In Table 5, we execute a additional ordinary least squares analysis of each tertile data by the relative ratio R&D cost to sales(RND) from only R&D cost-injected samples which are excluded the single the highest R&D cost to sales ratio sample as well as the 36 samples of non-R&D cost-injected. As consisted with the results in regression (2) in the tabe 4, RND and LEV are significantly negative to ROA, meanwhile, OWN and SGR are positively related to ROA. In regression (1) and (2) of the highest and the middle tertiles on RND, the variable of RND is negatively related to ROA at 10% level, but that is insignificantly negative to ROA, respectively. Therefore, we find that the significantly negative coefficient on RND is consistent with the notion that R&D cost is recognized as a less corporate profitability.

VI. Conclusions

R&D cost is an investment in future growth value and is an essential investment item (Hall et al., 2005) that can secure competitive advantage in the global market. It is a necessary corporate activity for the sustainable growth of the company. However, research and development cost have the delay effect and uncertainty of future profits, and previous studies that verify the effect of research and development cost on corporate performance reported different results. This is presumed to be the result of not analyzing empirically by classifying by industry and type considering the situation of the company. In this study, the relationship between R&D cost, the ownership of the largest shareholder and corporate performance was empirically analyzed considering corporate characteristics, types and industrial characteristics. For this purpose, the research and development expenditure and the business performance of the companies belonging to the KOSDAQ market venture business division were analyzed as of the end of 2019.

The results of the empirical analysis of this study are summarized as follows. First, both R&D cost and R&D intensity of KOSDAQ listed venture companies had a significant negative effect on corporate performance. The reason why research and development costs of KOSDAQ venture companies are negative is because they often give up short-term profitability while focusing on R&D relatively in the early days of start-up. In addition, R&D investment has always uncertainty, so it can be seen that it has a negative effect on the net profit margin of total assets by processing it at the cost of the capitalization without assetization. Therefore, due to the nature of R&D intensive industry, R&D costs does not affect the corporate performance, but it can be expected to affect the long-term corporate performance. This is expected to be a great help for managers to make decisions on R&D cost.

Second, the higher ownership of the largest shareholder, the more significant the effect on the corporate performance. Unlike previous studies, KOSDAQ companies often have a professional founder working on the management front, which seems to be due to less agent problems, which supports the Convergence of Interest Hypothesis. Therefore, unlike the securities market, companies belonging to the KOSDAQ market venture business department do not show an alternative relationship between the ownership of the largest shareholder and R&D cost, and they are more encouraged to spend R&D cost.

Third, the debt ratio (LEV) had a negative effect on the corporate performance, and the

sales growth rate (SGR) had a positive effect on the corporate performance. This can be interpreted as the increase of the cost and investment for R&D cost deteriorates the profitability of the company, but the sales control the level of R&D cost and contribute to the profitability of the company.

The contribution of this study is as follows.

First, it is meaningful to investigate the determinants of corporate performance along with the effects of R&D cost of the KOSDAQ market venture business department on corporate performance for the first time in domestic research.

Second, this study contributed to the widening of understanding of agent problems by applying agent theory to R&D field in the relationship between the ownership of the largest shareholder and corporate performance.

Third, it is suggested that R&D cost should be made by considering the environment and characteristics of the company by showing differences according to the characteristics, types and industrial characteristics of the company.

Therefore, managers should fully consider the uncertainty such as the possibility of recovery of R&D cost and the size of future performance compared to R&D cost.

The limitations of this study were not able to analyze the time lag effect (delayed effect) on the past R&D cost and not to verify the effect of capitalized development costs on corporate performance. However, this study was conducted on the premise that the venture companies listed on the KOSDAQ market continued to invest in R&D for competitive advantage. In future studies, it is considered that the effect of R&D cost on corporate performance will be helpful to compare with general KOSDAQ companies and to verify the difference using machine learning techniques.

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코스닥기업의 벤처기업 R&D가 기업 성과에 미치는 영향

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요약

본 연구는 코스닥(KOSDAQ)시장 벤처기업부 소속기업의 연구개발비 지출과 기업성과를 분석하였으며, 연구결과는 다음과 같다. 첫째, 코스닥상장 벤처기업의 연구개발비와 연구개발집약도 모두 기업성과에 유의미한 부(-)영향을 미치는 것으로 나타났다. 코스닥시장 벤처기업의 연구개발비가 기대와 달리 부(-)적 관계를 나타내는 이유는 창업 초기 기업들이 상대적으로 R&D에 집중하면서 단기적인 수익성을 포기하는 경우가 많기 때문으로 보인다. 따라서 연구개발 집약적인 산업 특성상 연구개발지출은 바로 기업성대로 나타나지 않고 장기적 기업성과에 영향을 미칠 것으로 예상할 수 있다. 둘째, 대주주지분율이 높을수록 기업성과에 양(+)의 유의미한 영향을 미치는 것으로 나타났다. 기존 선행연구 결과와 달리, 코스닥 기업에 서는 전문성을 가진 창업자가 경영 일선에서 활동하는 경우가 많아서 대리인 문제가 덜 일어나기 때문으로 보이고, 이는 이해일치가설을 뒷받침해주고 있다. 셋째, 부채비율(LEV)은 기업성과에 부정적으로 작용하였고 매출성장률(SGR)은 기업성과에 긍정적으로 작용하였다. 이는 연구개발 지출을 위한 비용 및 투자의 증가로 기업의 수익성은 악화되지만 매출액은 연구개발비 지출수준을 통제하며 기업의 수익성에 기여하는 것으로 해석 할 수 있다.

핵심 주제어 : 연구개발비, 기업성과, 벤처기업

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