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# Exploration and Exploitation of Listed Companies in Korea: Focusing on the Relationship between R&D and Advertising Expenses and Enterprise Value

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**ABSTRACT**

Based on the theoretical basis of Myers (1977) and Ohlson (1995), this study explored the effect of R&D expenses as a company's exploratory activities and advertising expenses as an activity that utilizes existing capabilities on corporate value. As a way for companies to explore new capabilities, the effect of R&D expenses on corporate value is examined, and as a method for strengthening existing capabilities and strengthening market competitiveness, the effect of advertising expenses on corporate value is considered. The empirical analysis subjects of this study are companies listed on the Korean stock market from 2011 to 2021. Ultimately, the number of sample data used in the empirical analysis of this study is 9,220 firm-year, and all are extracted from the KIS-VALUE DATABASE. In an empirical analysis using a regression model, the relationship between R&D and advertising R&D expenses on corporate value is investigated. The results of the regression analysis showed that both R&D expenses and advertising expenses had a positive effect on corporate value. An increase in R&D expenses increases corporate value by increasing future growth opportunities beyond a company's present value, and an increase in advertising expenses maximizes product or service value and enhances corporate value by strengthening market competitiveness. In addition, it is found that the impact of R&D expenses on corporate value is greater than that of advertising expenses, indicating the importance of R&D as a company's exploratory activities. These results provide important implications for corporate strategic management. Companies can achieve corporate value improvement through strategic investment and management of R&D and advertising expenses. Companies can strengthen their competitiveness through R&D as a future exploration activity and through advertising to create results in the existing market.

**KEYWORDS**

Exploration, Exploitation, R&D expenses, Advertising expenses, Enterprise Value, Value Relevance

## 1. INTRODUCTION

In today's rapidly changing hyper-competitive environment, the rise and fall of companies is appearing (D'aveni, 2010). Competitive companies suddenly collapse and new startups appear. Since the 2000s, a hyper-competitive environment has begun to appear, and many companies are now facing a new digital environment change with the rapid development of artificial intelligence technology in 2023. In this environment, some companies are making efforts to explore new digital capabilities, while others are trying to strengthen their market dominance.

In order to maintain competitiveness, companies must not only maintain their existing capabilities, but also build capabilities to maintain competitiveness in the future through continuous R&D. In corporate management, activities to explore new capabilities, complement existing capabilities, and efforts to maintain competitiveness in the market are essential. It is not easy for companies to simultaneously strengthen their dominance in existing markets while exploring new capabilities

March (1991) presented the concept of exploration and exploitation, emphasizing the importance of

exploring new capabilities and utilizing existing capabilities in corporate organizational learning, and emphasized the balance between the two concepts. Because the concepts of exploration and exploitation presented by March are in a trade-off, it is difficult for organizations to pursue both (Luger & Schimmer, 2018). An organization may form a routine of organizational operation in the direction of exploring new things, or conversely, a routine of organizational operation may be formed in the direction of utilizing existing capabilities (Luger & Schimmer, 2018).

This concept of exploration and exploitation is quite abstract, so it is not easy to measure in practice. Therefore, in this paper, in order to measure the concept of exploration and exploitation, exploration is matched with R&D expenses and exploitation with advertising expenses, and the correlation with corporate value is analyzed.

The purpose of this study is to explore the influence of exploration and exploitation activities on corporate value by using the theoretical foundations of Myers (1977) and Ohlson (1995). Myers (1977) and Ohlson (1995) had a great influence on setting up models that affect firm value. Based on this model, this study analyzes the impact of organizational exploration and exploitation on corporate value. Specifically, in order to apply James March's "exploration and exploitation" (March, J. G. 1991), this paper analyzes the relationship between R&D expenses, advertising expenses, and corporate value in order to measure them. R&D expenses are used as an activity to explore new capabilities of the company, and the effect of advertising expenses on corporate value is analyzed to supplement existing capabilities and maintain competitiveness in the market.

The research question of this study is how to analyze the effect of R&D expenses and advertising expenses on corporate value. To this end, a model is designed using the theoretical basis of Myers (1977) and Ohlson (1995). This model has the purpose of examining the impact of current R&D expenses and advertising expenses, respectively and exploring the impact on corporate value formation by examining the relationship between the two factors. In this way, this study expands the theoretical understanding of corporate value evaluation and empirically analyzes the impact of important cost factors such as R&D expenses and advertising expenses on corporate value.

## 2. THEORETICAL BACKGROUND

### 2.1. Exploration and Exploitation in Firm

March (1991) presented the concept of exploration and exploitation in organizational learning. Exploration is finding new knowledge or taking on new challenges. Although uncertain and likely to fail, it is a challenge to explore new capabilities. Through this exploration, organizations can cultivate new capabilities in a new environment. Exploitation can be said to be an effort by a company to further strengthen and improve its capabilities based on its existing capabilities. Companies have capabilities that have been accumulated from the past and can be said to be further improved and supplemented (March, J. G. 1991).

These concepts of exploration and exploitation are difficult to pursue simultaneously in a single company because these two concepts conflict with each other (Luger & Schimmer, 2018). Some companies fail to explore new ones and fail while trying to supplement their existing competencies, while others pursue only new competencies and fail to achieve great results. In order to overcome the problems of competency trap and failure trap, two contradictory activities, exploration and exploitation, are required simultaneously(Levinthal, D. A., & March, J. G. 1993).

In this way, companies will be able to form biased business operation routines in terms of organizational learning. Although there are many papers related to exploration and exploitation, there has been insufficient effort to actually measure the concept of exploration and exploitation and link it with corporate value. In this study, in order to actually measure the concept of exploration and exploitation, it is linked with R&D expenses and advertising expenses. It can be said that R&D is essential for companies to continue their exploration activities. R&D investment is very important in order to respond to the development of technology and the current uncertain and disconnected environmental changes. Through such R&D investment, it will be possible to explore new knowledge and develop new technologies. The concept of exploitation in which a company further enhances its existing capabilities can be linked to advertising expenses. It can be said that advertising expenses are very important in order to further enhance the value of products or services that companies already have and to expand their dominance in the market.

### 2.2. R&D by exploring new capabilities

R&D consists of research and development. Research consists of basic research and applied research. In general, companies are concentrating on applied research and development. There are studies that require certain basic research for corporate knowledge diversity (Schilling, 2008). Companies have research institutes and carry out continuous research, and the expenses used during this process are treated as R&D expenses (Schilling, 2008). Companies can explore new capabilities based on these R&D. In terms of accounting, research, and development expenses can be classified and treated as intangible assets or expensed.

### 2.3. Advertising as exploitation of existing capabilities

From a marketing point of view, advertising is a very important marketing tool that imprints the image of a product on target market customers and enables new customers to buy (Mohr, 2011). The 4Ps of marketing are product, price, promotion, and place (distribution), and out of these, marketing promotion is a very important marketing tool (Mohr, 2011). In addition, from the perspective of the current integrated marketing communication (IMC), the power of advertising to strengthen the dominance of the existing market and create new customers can be said to be very great. That is why companies are aware of the importance of advertising as well as R&D. In addition, many companies emphasize the importance of marketing in connection with the market as well as R&D from the beginning of product planning (Rein, 2004). Advertising expenses generally refer to expenses used for advertising products.

### 2.4. Enterprise Valuation (EV)

Corporate value management is a new management paradigm, and based on accounting information, can be evaluated and measured. Valuation models based on accounting information include the excess earnings model and the Ohlson model (Kwon et al., 2003). It can be used to establish an investment strategy by utilizing the accounting information valuation model, and it is possible to refine the estimation of the company's intrinsic value (Kang et al., 1997; Qumer & Estrella 2021).

Ohlson (1995) has an important implication in the field of accounting research, providing a theoretical basis for a firm valuation model. However, later studies by Burghstahler & Dichev (1997) and Zhang (2000) pointed out the problem that Ohlson's (1995) valuation model had an error in the linear assumption.

Ohlson's (1995) model presented a mathematical approach to firm valuation. This model expressed corporate value as a function of net income and book value of equity and presented a new perspective on valuation based on financial information and profitability.

However, research by Burghstahler & Dichev (1997) and Zhang (2000) pointed out the limitations of this model assuming a linear relationship between firm value and accounting variables. This linear assumption caused the problem of not fully reflecting the corporate value relationship in the real world. Therefore, subsequent studies have tried to supplement the corporate valuation model by introducing nonlinear assumptions to solve these problems. Theoretically, by applying non-linear assumptions, the purpose is to more accurately explain the process of forming corporate value in the real world.

## 3. HYPOTHESIS AND EMPIRICAL MODEL

### 3.1 Hypothesis

The impact of R&D expenses and advertising expenses on corporate value is a subject that has a significant impact on understanding and decision-making about corporate management. As discussed earlier in this paper, the theory of Myers (1977) and Ohlson (1995) is used as an important tool to elucidate and analyze this relationship.

Myers (1977) argues that corporate value should be evaluated by considering hidden value factors that are not reflected in actual financial statements. It is suggested that the value of a company can be expressed as the sum of the market value of measured net assets and the value of future investment opportunities of unmeasured net assets. This suggests that ordinary R&D expenses and advertising expenses, which are cost elements that are not recorded in financial statements, can affect a company's value.

Ohlson (1995) mathematically validates firm valuation, proposing that firm value can be expressed as a function of the book value of capital and net income. This model is used to calculate the value based on the company's financial information and profitability, and through this, it is possible to analyze the value forming factors of the company.

Based on this theoretical background, this study analyzes the impact of current R&D expenses and

advertising expenses on corporate value. Model 1 verifies the effect of R&D expenses, and Model 2 verifies the effect of advertising expenses. In addition, in Model 3, these two cost factors are considered together to examine the relative enterprise value relationship between them.

Hypothesis derivation can be done as follows:

**Hypothesis for Model 1:**
In this study, it is hypothesized that R&D expenses affect corporate value. Based on the theory of Myers (1977), this is the future investment opportunity value of unmeasured net assets, and R&D expenses are expected to have a positive (+) effect on corporate value.

**Hypothesis for Model 2:**
In this study, a hypothesis can be established that advertising expenses affect corporate value. Similarly, according to Myers (1977) theory, advertising expenses equal to the future investment opportunity value of unmeasured net worth are expected to contribute positively to firm value

**Hypothesis for Model 3:**
It can be hypothesized that there is a significant difference in the effect of ordinary R&D and advertising expenses on corporate value.

Therefore, the hypotheses in this study can be finally summarized as follows:

H1: Current R&D expenses have a significant impact on corporate value.

H2: Advertising expenses have a significant effect on corporate value.

H3: There is a significant difference in the impact of recurring R&D expenses and advertising expenses on corporate value.

**3.2 Empirical Model**
This study designs an empirical analysis model based on Myers's (1977) research theory and Ohlson's (1995) firm valuation model to verify the effect of R&D expenses and advertising expenses on firm value.

Myers (1977) argues that the value of an enterprise can be expressed as the market value of its recognized and measured net assets and the future cash inflow opportunity value of its unmeasured and unrecognized net assets. He argues that assets that are not recorded on financial statements because they are not recognized because they are not measured include advertising expenses and R&D expenses. After Myers (1977), Ohlson (1995) establishes a mathematically verified firm valuation model. In his firm valuation model, the company's value can be expressed as a function of net income and book value of equity, and the part that cannot be explained by these two variables is expressed as an error term.

Model 1: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIR_{i,t}}{SALE_{i,t}} + a_3 \frac{R\&D_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$, **(1)**

Model 2: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIA_{i,t}}{SALE_{i,t}} + a_3 \frac{ADV_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$, **(2)**

Model 3: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIRA_{i,t}}{SALE_{i,t}} + a_3 \frac{R\&D_{i,t}}{SALE_{i,t}} + a_4 \frac{ADV_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$, **(3)**

Where,

$MV_{i,t}$: $MV_{i,t}$: Total stock prices at the 3 months after of fiscal year t, where year t is the event year,

$BV_{i,t-1}$: Book value of equity at the end of year t-1,

$NI_{i,t}$: Accounting earnings in period t,

$NIR_{i,t}$: Accounting earnings in period t before deducting R&D expenses ($RND_{i,t}$),

$NIA_{i,t}$: Accounting earnings in period t before deducting advertising expense ($ADV_{i,t}$),

$NIRA_{i,t}$: Accounting earnings in period t before deducting R&D expenses and advertising expenses,

$R\&D_{i,t}$: Total amount of R&D expenses in the income statement and manufacturing costs statement for the period t,

$ADV_{i,t}$: Total amount of advertising expenses in the income statement and manufacturing costs statement for the period t,

$SALE_{i,t}$: Total sales in period t,

$\varepsilon_{i,t}$: A normally distributed error term.

Model 1 is to verify how R&D expenses affect corporate value, and Model 2 is to verify the effect of advertising and publicity costs on corporate value. Model 3 is to verify the relationship between the relative enterprise value between these two variables by inputting the R&D expenses and advertising expenses together.

All variables are standardized by total sales ($SALE_{i,t}$) to control for heteroscedasticity. In addition, this study excludes all sample companies whose Cook's Distance is greater than 1 and the absolute value of the studentized residuals is greater than 3 among the results of the first-order regression analysis. After that, the second regression analysis is performed to verify the value relationship between advertisement cost and R&D expenses.

## 4. EMPIRICAL ANALYSIS

### 4.1 Sample selection

This study verifies the value relationship between R&D expenses and advertising expenses for companies listed in the Korean capital market over the period from 2011 to 2021. To this end, all variables are extracted from the KIS-VALUE DATABASE. All of the following variables are excluded from the empirical analysis data of this study.

1) Companies belonging to the financial or insurance industry

2) Companies that are not corporations with settlement of accounts at the end of December

3) Companies not included in statutory receivership

4) Companies that are not subject to capital impairment

5) Companies that do not have numerical values for variables required for empirical analysis of this study

Companies belonging to the financial industry or insurance industry are excluded because the account subject and accounting treatment method of the relevant industry are different from those of general companies. In addition, companies other than end-of-December settlement companies are excluded because there is a high possibility of deterioration in comparability because they are often companies belonging to a specific industry due to seasonal characteristics. In addition, court-managed companies and capital-impaired companies are excluded because they often have extreme values, and companies without numerical values for variables necessary for the empirical analysis of this study are excluded for the robustness of the empirical analysis results.

**Table 1.** Selection procedure for companies included in the sample

| | |
|---|---|
| Number of sample data collected from KIS-VALUE DATABASE at the end of 2011–2021 (firm-year) | 30,184 |
| Number of samples excluded (-): | -20,964 |
| 1) Companies belonging to the financial or insurance industry<br>2) Companies that are not corporations with settlement of accounts at the end of December<br>3) Companies not included in statutory receivership<br>4) Companies that are not subject to capital impairment<br>5) Companies that do not have numerical values for variables required for empirical analysis of this study | |
| Number of total samples (firm-year) | 9,220 |

### 4.2 EMPIRICAL ANALYSIS

#### 4.2.1 Descriptive statistics

Table 2 shows the descriptive statistical results of all variables used in the empirical analysis of this study. All variables are standardized by total sales ($SALE_{i,t}$). The average of the enterprise value ($\frac{MV_{i,t}}{SALE_{i,t}}$), which is the dependent variable, is 6.1611446, the standard deviation is 122.8439863, the minimum value is 0.0339312, and the maximum value is 10526.55. The average of the book value ($\frac{BV_{i,t-1}}{SALE_{i,t}}$) is 1.5539899, the standard deviation is 11.6786337, the minimum value is 0.0097166, and the maximum value is 925.2201753. The minimum value of net income before deducting R&D expenses ($\frac{NIR_{i,t}}{SALE_{i,t}}$) is 0.0787693, the standard deviation is 13.9266677, the minimum value is -844.7011363, and the maximum value is

787.6857028. The average of the net income before deducting advertising expenses ($\frac{NIA_{i,t}}{SALE_{i,t}}$) is -0.0146841, the standard deviation is 13.8473831, the minimum value is -849.9427898, the maximum value is 787.8741091, and the average of the net profit before deducting the R&D expenses and advertising expenses ($\frac{NIRA_{i,t}}{SALE_{i,t}}$) is 0.0955349, the standard deviation is 13.9821270, the minimum value is -844.1814391, and the maximum value is 787.9635697. The average of the R&D expenses ($\frac{RND_{i,t}}{SALE_{i,t}}$) is 0.1102190, the standard deviation is 2.6004706, the minimum value is 3.0286604E-8, and the maximum value is 222.7111870. The average of the advertisement ratio ($\frac{ADV_{i,t}}{SALE_{i,t}}$) is 0.0167656, the standard deviation is 0.3630076, the minimum value is 6.1113499E-8, and the maximum value is 33.1619373.

**Table 2.** Descriptive statistics of main variables

| Number | Variable | Median | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| **9,220** | $\frac{MV_{i,t}}{SALE_{i,t}}$ | 6.1611446 | 122.8439863 | 0.0339312 | 10526.55 |
| | $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | 1.5539899 | 11.6786337 | 0.0097166 | 925.2201753 |
| | $\frac{NIR_{i,t}}{SALE_{i,t}}$ | 0.0787693 | 13.9266677 | -844.7011363 | 787.6857028 |
| | $\frac{NIA_{i,t}}{SALE_{i,t}}$ | -0.0146841 | 13.8473831 | -849.9427898 | 787.8741091 |
| | $\frac{NIRA_{i,t}}{SALE_{i,t}}$ | 0.0955349 | 13.9821270 | -844.1814391 | 787.9635697 |
| | $\frac{RND_{i,t}}{SALE_{i,t}}$ | 0.1102190 | 2.6004706 | 3.0286604E-8 | 222.7111870 |
| | $\frac{ADV_{i,t}}{SALE_{i,t}}$ | 0.0167656 | 0.3630076 | 6.1113499E-8 | 33.1619373 |

Note: $MV_{i,t}$: Total stock prices at the 3 months after of fiscal year t, where year t is the event year, $BV_{i,t-1}$: Book value of equity at the end of year t-1, $NI_{i,t}$: Accounting earnings in period t, $NIR_{i,t}$: Accounting earnings in period t before deducting R&D expenses($RND_{i,t}$), $NIA_{i,t}$: Accounting earnings in period t before deducting advertising expense($ADV_{i,t}$), $NIRA_{i,t}$: Accounting earnings in period t before deducting R&D expenses and advertising expenses, $R\&D_{i,t}$: Total amount of R&D expenses in the income statement and manufacturing costs statement for the period t, $ADV_{i,t}$: Total amount of advertising expenses in the income statement and manufacturing costs statement for the period t, $SALE_{i,t}$: Total sales in period t.

### 4.2.2 Correlation analysis

Table 3 shows the results of Pearson's correlation analysis of the variables used in the empirical analysis of this study. Enterprise value, a major dependent variable, shows a significant positive (+) correlation with all independent variables at the 1% level. The book value of capital ($\frac{BV_{i,t-1}}{SALE_{i,t}}$) shows a significant correlation with all variables at the 1% level. Looking at the signs of the correlation, net income before deducting advertising expenses ($\frac{NIA_{i,t}}{SALE_{i,t}}$) and net income before deducting R&D expenses and advertising expenses ($\frac{NIRA_{i,t}}{SALE_{i,t}}$) shows a negative (-) correlation, but shows a positive (+) correlation with the rest of the variables.

There is a very high correlation between net profit before deducting R&D expenses ($\frac{NIR_{i,t}}{SALE_{i,t}}$), net profit before deducting advertising expenses ($\frac{NIR_{i,t}}{SALE_{i,t}}$), and net profit before deducting R&D expenses and advertising expenses ($\frac{NIRA_{i,t}}{SALE_{i,t}}$). However, in actual empirical analysis, these variables are included in separate regression analysis models (Model 1, Model 2, and Model 3).

R&D expenses ($\frac{RND_{i,t}}{SALE_{i,t}}$) has a statistically significant positive (+) correlation with all variables input to Model 1 and Model 3 at the 1% level. The advertising cost ($\frac{ADV_{i,t}}{SALE_{i,t}}$) also shows a statistically significant positive (+) correlation with all variables of Model 2 and Model 3 at the 1% level.

**Table 3.** Pearson correlation

| Variables | $\frac{MV_{i,t}}{SALE_{i,t}}$ | $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | $\frac{NIR_{i,t}}{SALE_{i,t}}$ | $\frac{NIA_{i,t}}{SALE_{i,t}}$ | $\frac{NIRA_{i,t}}{SALE_{i,t}}$ | $\frac{R\&D_{i,t}}{SALE_{i,t}}$ | $\frac{ADV_{i,t}}{SALE_{i,t}}$ |
|---|---|---|---|---|---|---|---|
| $\frac{MV_{i,t}}{SALE_{i,t}}$ | 1 | 0.10956 | 0.12557 | -0.03365 | 0.14811 | 0.97552 | 0.88703 |
| | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | 0.10956 | 1 | -0.25827 | -0.27948 | -0.25615 | 0.11097 | 0.04214 |
| | <.0001 | | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 |
| $\frac{NIR_{i,t}}{SALE_{i,t}}$ | 0.12557 | -0.25827 | 1 | 0.98645 | 0.99967 | 0.12219 | 0.14005 |
| | <.0001 | <.0001 | | <.0001 | <.0001 | <.0001 | <.0001 |
| $\frac{NIA_{i,t}}{SALE_{i,t}}$ | -0.03365 | -0.27948 | 0.98645 | 1 | 0.98258 | -0.04183 | 0.00178 |
| | <.0001 | <.0001 | <.0001 | | <.0001 | <.0001 | 0.8643 |
| $\frac{NIRA_{i,t}}{SALE_{i,t}}$ | 0.14811 | -0.25615 | 0.99967 | 0.98258 | 1 | 0.14456 | 0.16546 |
| | <.0001 | <.0001 | <.0001 | <.0001 | | <.0001 | <.0001 |
| $\frac{R\&D_{i,t}}{SALE_{i,t}}$ | 0.97552 | 0.11097 | 0.12219 | -0.04183 | 0.14456 | 1 | 0.88013 |
| | <.0001 | <.0001 | <.0001 | <.0001 | <.0001 | | <.0001 |
| $\frac{ADV_{i,t}}{SALE_{i,t}}$ | 0.88703 | 0.04214 | 0.14005 | 0.00178 | 0.16546 | 0.88013 | 1 |
| | <.0001 | <.0001 | <.0001 | 0.8643 | <.0001 | <.0001 | |

1) Variable Definitions: see Table 2, two-sided test.

**4.2.3 Regression results on the value relevance of R&D and Advertising expenses: Total samples**

This study uses Model 1 and Model 2 to analyze the value relationship between R&D expenses and advertising expenses, and Model 3 to verify the relative value relationship between R&D expenses and advertising expenses.

Table 4 shows the regression analysis results for Model 1, Model 2, and Model 3. First, as for the adjusted R-Square value representing the explanatory power of the model, Model 3 is the highest at 0.7775, followed by Model 1 at 0.6942 and Model 2 at 0.2107.

As a result of the regression analysis on Model 1, Model 2, and Model 3, the F-value representing the goodness of fit of the model all showed statistically significant values at the 1% level. The Variance Inflation Factor (VIF), which indicates multicollinearity between variables, is less than 2 in all three models, so the possibility of multicollinearity is very low.

In the analysis result of Model 1, the coefficient value of R&D expenditure is 42.56374, showing a statistically significant value at the 1% level. This means that the expenditure of R&D expenses brings about an increase in corporate value.

In the analysis result of Model 2, the coefficient value of advertisement cost is 44.54829, showing a statistically significant value at the 1% level. This also means that the higher the advertising expenditure, the higher the corporate value.

The analysis results of Model 3 show the relative value relationship between R&D expenses and advertising expenses. This indicates that R&D expenses have a greater influence on corporate value than advertising expenses.

**Table 4.** Regression results on the value relevance of R&D and Advertising expenses: Total samples

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| **Intercept** | 0.98202*** | 1.25250*** | 0.45676*** |
| $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | 0.37828*** | 1.05337*** | 0.71815*** |
| $\frac{NIR_{i,t}}{SALE_{i,t}}$ | -0.15896*** | | |
| $\frac{NIA_{i,t}}{SALE_{i,t}}$ | | -0.26831*** | |
| $\frac{NIRA_{i,t}}{SALE_{i,t}}$ | | | -0.19043*** |

| | | | |
|---|---|---|---|
| $\frac{R\&D_{i,t}}{SALE_{i,t}}$ | 42.56374*** | | 38.39798*** |
| $\frac{ADV_{i,t}}{SALE_{i,t}}$ | | 44.54829*** | 4.85776*** |
| Industry Dummy | Included | Included | Included |
| Year Dummy | Included | Included | Included |
| F-Value | 1158.43*** | 137.24*** | 1689.25*** |
| Adj R-Sq. | 0.6942 | 0.2107 | 0.7775 |
| Number of Samples After Deleting Outlier | 9,180 | 9,187 | 9,179 |

1) Variable Definition: see Table 2,

2) Model 1: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIR_{i,t}}{SALE_{i,t}} + a_3 \frac{R\&D_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$,

3) Model 2: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIA_{i,t}}{SALE_{i,t}} + a_3 \frac{ADV_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$,

4) Model 3: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIRA_{i,t}}{SALE_{i,t}} + a_3 \frac{R\&D_{i,t}}{SALE_{i,t}} + a_4 \frac{ADV_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$,

5) Total number of sample data used in the analysis is calculated by excluding sample data that have an absolute value of studentized residuals greater than 3, and a Cook's Distance of greater than 1,

6) *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.

**4.2.4 Value relevance of R&D and Advertising expenses in High-technology and Low-technology companies**

Tables 5 and 6 show the results of analyzing the relevance of corporate value between R&D expenses and advertising expenses by classifying sample companies into high-technology and low-technology companies, and Table 7 shows the results of analyzing the relative value relationship between R&D expenses and advertising expenses.

In this study, high-technology and low-technology companies are classified according to Himmelberg and Petersen (1994). They include manufacturing of electronic components, computers, audiovisual and communication equipment, medical, precision optical instruments and clock manufacturing, electrical equipment manufacturing, and other machinery and equipment manufacturing as high-technology enterprises, and the rest of the enterprises not included in high-technology enterprises are low-technology enterprises.

**1) Value relevance of R&D expenses in High-technology and Low-technology companies**

Table 5 shows the results of analyzing the relationship between R&D expenses and corporate value by classifying the sample companies into high-technology and low-technology companies.

The Adjusted R-Square value, which represents the explanatory power of the model, is higher in high-technology companies (0.7560) than in low-technology companies (0.5025), and the F-value, which indicates the goodness of fit of the model, is also higher in high-technology companies (982.01) than in low-technology companies (228.81). appear much higher.

The Variance Inflation Factor (VIF), which indicates multicollinearity between variables, shows that all variables are less than 2 in both business groups, so the possibility of multicollinearity is very low.

The coefficient value of R&D expenses is higher for high-technology companies (40.13718) than for low-technology companies (13.21987).

Comparison of coefficient values of variables between high-technology and low-technology companies can be confirmed through the fact that the result of the Chow Test's F-value is statistically significant at the 1% level. This result means that the expenditure of R&D in high-technology companies is bringing about a greater increase in corporate value than in low-technology companies.

**Table 5.** Value relevance of R&D expenses in High-technology and Low-technology companies

| Variables | High-technology | Low-technology |
|---|---|---|
| **Intercept** | **2.23603*** ** | **0.96231*** ** |
| $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | 0.12505*** | 0.69125*** |
| $\frac{NIR_{i,t}}{SALE_{i,t}}$ | -0.03079** | -0.41825*** |
| $\frac{R\&D_{i,t}}{SALE_{i,t}}$ | 40.13718*** | 13.21987*** |
| Industry Dummy | Included | Included |
| Year Dummy | Included | Included |
| F-Value | 982.01*** | 228.81*** |
| Adj R-Sq. | 0.7560 | 0.5025 |
| Number of Samples After Deleting Outlier | 5,066 | 4,061 |
| Chow Test | Break Point | F-Value |
| | 5,095 | 2.14*** |

1) Variable Definition: see Table 2,

2) Model 1: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIR_{i,t}}{SALE_{i,t}} + a_3 \frac{R\&D_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$,

3) Total number of sample data used in the analysis is calculated by excluding sample data that have an absolute value of studentized residuals greater than 3, and a Cook's Distance of greater than 1,

4) *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.

**2) Value relevance of Advertising expenses in High-technology and Low-technology companies**

Table 6 shows the results of analyzing the relationship between advertising expenditure and corporate value by classifying sample companies into high-technology and low-technology companies.

The Adjusted R-Square value, which represents the explanatory power of the model, is slightly higher in low-technology companies (0.2741) than in high-technology companies (0.2741), and the F-value, which indicates the goodness of fit of the model, is also higher in low-technology companies (194.01) than in high-technology companies (120.68).

Variance Inflation Factor (VIF), which indicates multicollinearity between variables, is less than 2 for all variables in both business groups, so the possibility of multicollinearity is very low. The coefficient value of advertising expenses is higher for high-technology companies (126.30910) than for low-technology companies (13.53366).

Comparison of the size of these coefficient values can be confirmed through the fact that the result of the F-value of the Chow Test is statistically significant at the 1% level. This result means that advertising expenditures in high-technology companies are bringing about a greater increase in corporate value than in low-technology companies.

**Table 6.** Value relevance of advertising expenses in High-technology and Low-technology companies

| Variables | High-technology | Low-technology |
|---|---|---|
| **Intercept** | 2.94469*** | 1.15151*** |
| $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | 1.59702*** | 0.84402*** |
| $\frac{NIA_{i,t}}{SALE_{i,t}}$ | -0.44129*** | -0.53917*** |
| $\frac{ADV_{i,t}}{SALE_{i,t}}$ | 126.30910*** | 13.53366*** |
| Industry Dummy | Included | Included |

| Year Dummy | Included | Included |
|---|---|---|
| F-Value | 120.68*** | 194.01*** |
| Adj R-Sq. | 0.2741 | 0.4608 |
| Number of Samples After Deleting Outlier | 5,071 | 4,066 |
| Chow Test | Break Point | F-Value |
| | 5,095 | 5.89*** |

1) Variable Definition: see Table 2,

2)) Model 2: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIA_{i,t}}{SALE_{i,t}} + a_3 \frac{ADV_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$,

3) Total number of sample data used in the analysis is calculated by excluding sample data that have an absolute value of studentized residuals greater than 3, and a Cook's Distance of greater than 1,

4) *: p < 0.1, **: p < 0.05, ***: p < 0.01.

**3) Comparative value relevance of R&D and Advertising expenses in High-technology and Low-technology companies**

Table 7 shows the results of analyzing the relationship between the relative enterprise value of R&D expenses and advertising expenses by classifying the sample companies into high-technology companies and low-technology companies.

The Adjusted R-Square value, which represents the explanatory power of the model, is higher in high-technology companies (0.7588) than in low-technology companies (0.5102), and the F-value, which indicates the goodness of fit of the model, is also higher in high-technology companies (938.50) than in low-technology companies (223.54). Variance Inflation Factor (VIF), which indicates multicollinearity between variables, is less than 2 for all variables in both business groups, so the possibility of multicollinearity is very low.

Comparing the coefficients of R&D expenses and advertising expenses, both high-technology companies (38.64513 > 3.32013) and low-technology companies (12.39844 > 11.06591) show that R&D expenses are larger than advertising expenses. However, in high-technology companies, the difference in coefficient values is very large, but in low-technology companies, the difference is very small.

In addition, in the case of advertising expenses, low-technology companies show statistically significant coefficients at the 1% level, while high-technology companies show statistically insignificant coefficients.

Comparison of the size of the coefficient value for each sample group can be confirmed when the result of the Chow Test's F-value appears significantly at the 1% level.

These results show that the impact of R&D expenses on corporate value is greater than that of advertising expenditure in both high-technology and low-technology firms, whereas in low-technology firms, the difference between R&D expenses and advertising expenditure in relation to corporate value is very small.

**Table 7.** Comparative value relevance of R&D and advertising expenses in High-technology and Low-technology companies

| **Variables** | **High-technology** | **Low-technology** |
|---|---|---|
| Intercept | 2.30663*** | 0.79344*** |
| $\frac{BV_{i,t-1}}{SALE_{i,t}}$ | 0.12243*** | 0.73484*** |
| $\frac{NIRA_{i,t}}{SALE_{i,t}}$ | -0.02793** | -0.45408*** |
| $\frac{R\&D_{i,t}}{SALE_{i,t}}$ | 38.64513*** | 12.39844*** |
| $\frac{ADV_{i,t}}{SALE_{i,t}}$ | 3.32013 | 11.06591*** |
| Industry Dummy | Included | Included |

| Year Dummy | Included | Included |
|---|---|---|
| F-Value | 938.50*** | 223.54*** |
| Adj R-Sq. | 0.7588 | 0.5102 |
| Number of Samples After Deleting Outlier | 5,067 | 4,061 |
| Chow Test | Break Point | F-Value |
| | 5,095 | 2.51*** |

1) Variable Definition: see Table 2,

2) Model 3: $\frac{MV_{i,t}}{SALE_{i,t}} = a_0 + a_1 \frac{BV_{i,t-1}}{SALE_{i,t}} + a_2 \frac{NIRA_{i,t}}{SALE_{i,t}} + a_3 \frac{R\&D_{i,t}}{SALE_{i,t}} + a_4 \frac{ADV_{i,t}}{SALE_{i,t}} + \varepsilon_{i,t}$,

3) Total number of sample data used in the analysis is calculated by excluding sample data that have an absolute value of studentized residuals greater than 3, and a Cook's Distance of greater than 1,

11) *: p < 0.1, **: p < 0.05, ***: p < 0.01.

## 5. CONCLUSIONS

This study analyzes the impact of current R&D expenses and advertising expenses on corporate value using the theoretical background of Myers (1977) and Ohlson (1995). First, in the theoretical background, the importance of exploration and exploitation in corporate management is considered. Exploration is matched with R&D expenses, and exploitation is matched with advertising expenses. For a company to continuously create value and move forward, it is necessary to pursue both exploration and exploitation. In this paper, this important concept of exploration and exploitation is actually matched with accounting R&D expenses and advertising expenses, and it is linked to corporate value.

As a result of the study, it is found that ordinary R&D expenses and advertising expenses each had a significant positive effect on corporate value. An increase in R&D expenses contributes to the increase in corporate value by increasing the value of future investment opportunities, and an increase in advertising expenses maximizes the value of a product or service to strengthen the company's market competitiveness.

Also, in the results of Model 3, it is confirmed that R&D expenses have a relatively greater impact on corporate value than advertising expenses. This suggests that exploratory activities within an organization have a significant impact on the long-term value creation of a company through the discovery of new knowledge and future investment opportunities. A new digital environment is emerging in the current rapidly changing super-competitive environment. This digital environment is called the 4th industrial revolution and requires many changes from companies. Companies that adapt well to these new digital environment changes will survive, and those that do not adapt will perish. Adapting well means developing new capabilities suitable for a new environment through research and development. In this sense, R&D is very important in the current environment. The results of the empirical analysis also show the empirical connection between R&D and enterprise value.

These results provide important insights into corporate management strategies and financial management, and companies can seek ways to increase corporate value by effectively investing and managing R&D expenses and advertising expenses. In addition, it is emphasized that strategic investment and management through understanding the importance of R&D expenses and advertising expenses are essential elements for securing competitiveness and sustainable growth. In this study, exploration and exploitation are matched with R&D and advertising expenses, which are actual accounting variables. In addition, the relationship between R&D and advertising expenses and corporate value is analyzed in depth. In future studies, it would be desirable to conduct more in-depth studies on various accounting variables that affect companies' exploration activities.

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