

A Study on the Role of Institutional Investors in the Process of Corporate Innovation Activities*

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〈Abstract〉

This study examines whether institutional investors have a significant influence on the process of corporate innovation activities. The process of corporate innovation activities can be classified into research and development activities. Research activities are related to uncertain future earnings rather than development activities and expenditures for research activities are made from a long-term perspectives. Research and development expenditures were respectively used as proxies for the process of corporate innovation activities. The type of institutional investors were classified into foreign and domestic institutional investors.

This study used a sample of public companies listed on the Korean Stock Exchange from 2001 to 2014. This study's main result indicates that foreign institutional investors have a significant positive impact on research expenditures but not on development expenditures. Domestic institutional investors were found to have no significant impact on either research or development expenditures. Foreign institutional investors significantly impact research expenditures in the two-stage instrumental variable approach to address endogeneity factors in foreign institutional ownership. These results suggest that corporate innovation activities may vary depending on the type of institutional investors and that foreign institutional investors take a long-term perspective and increase the corporate innovation activities such as research activities. Empirical findings of this study will provide practical implications for policies that regulate institutional investors who may not monitor managers to under-invest corporate innovation activities and encourage corporate innovation activities.

〈Key words〉 Corporate innovation activities, Research expenditures, Development expenditures, Foreign institutional investors, Domestic institutional investors

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I. INTRODUCTION

Recently, new technologies such as artificial intelligence and electric vehicles have emerged swiftly, and the business environment is changing rapidly. In this environment, the activities of companies exploring new information and technologies are crucial for sustainable growth and maintaining competitive advantages. Therefore, companies have invested in research and development activities to maximize corporate profits and sustainable development(Lev 2000 ; Ballester et al. 2003).

The manager determines whether to invest in R&D activities, the amount, timing, etc. However, there are numerous potential failures in the process of product development, and determining the economic benefits and timing of realization in the future is uncertain. Uncertainty is the most important characteristic of R&D activities(Hoskisson et al. 1993). Uncertainty leads to higher information acquisition costs, making information asymmetry more serious between managers and external investors(Yoo and Rhee 2013).

Uncertainty in R&D activities further increases managers' discretion in R&D investments. Managers tend to avoid long-term projects because their tenure and compensation are related to their companies' short-term performance. Additionally, managers tend to avoid projects that develop and explore new products because they require more effort, such as predicting market demand, compared to existing projects. Therefore, managers have the incentive to invest less in R&D activities that explore new technologies that lead to the long-term growth of a company and can select projects or change results for their benefit. This is called the agency problem.

Previous studies have examined the ownership mechanisms that can reduce this agency problem and their results are controversial(Grossman and Hart 1980 ; Shleifer and Vishny 1986 ; Gasper et al. 2005 ; Aghion et al. 2013 ; Yan and Zhang 2009 ; Graham et al. 2005). And prior studies have considered only institutional investors as a homogeneous group with similar goals and strategies and typically overlooked that they have different investment objectives, styles, and regulatory schemes and exhibit divergent activism for corporate governance reform(Gillan and Starks 2000 ; Almazan et al. 2005 ; Lerner et al. 2011 ; Aghion et al. 2013 ; Kim et al. 2019).

Most studies related to R&D activities have considered research expenditures used in the early stages of exploring new technologies and development expenditures in the completion phase as homogeneous expenditures(Bayersinger et al. 1991 ; Lee and O'Neill 2003). However, research expenditures and development expenditures have heterogeneous expenditures because they have different effects on the process of corporate innovation activities. Research expenditures are

related to the process of developing new technologies and products, such as gathering, analyzing, evaluating, and selecting innovative ideas for long-term gain. Development expenditures are related to the process in which direct revenue is guaranteed in the completion of innovative ideas.

To verify that institutional investors with different investment objectives, styles, and regulatory schemes affect the manager's agency problem associated with the corporate innovation activities, this study examines whether the process of corporate innovation activities varies depending on the type of institutional investor. Therefore, this study classifies institutional investors as foreign and domestic institutional investors and verify their impact on research and development expenditures using a sample of non-financial Korean listed companies. If institutional investors have long-term investment objectives, corporate innovation activities such as research activities will increase. Otherwise, they would not affect the corporate innovation activities such as research activities.

This study intends to add to the literature in two ways. The first is to classify institutional investors as foreign and domestic institutional investors, and to examine whether they have heterogeneous characteristics in the process of corporate innovation activities. The second is to classify the process of corporate innovation activities as research and development activities because they related to different stages of the R&D process. Empirical findings of this study will provide practical implications for policies that regulate institutional investors who may not monitor managers to under-invest corporate innovation activities and encourage corporate innovation activities.

This study is organized as follows : Following the introduction in Chapter I , Chapter II reviews the existing literature and sets hypotheses. Chapter III describes the data collection and regression models used in this study. Chapter IV presents the empirical results for the hypotheses and the robustness checks performed. The final section concludes the paper.

II. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Firms invest in R&D activities for corporate innovation. R&D investments generate new products and information and enhance companies' ability to exploit existing information(Cohen and Levinthal 1990 ; Shin and Park 2020). However, investment in R&D activities is less feasible. Time and money are required to complete the project, and it is difficult to recover funds. Additionally, projects that create new products or processes require predicting market demand for new products or estimate new production functions, which may take a longer time.

R&D activities are divided into research activities in the early stages and development activities during the completion phase. Specifically, the International Accounting Standards Board(IASB) presents research activities in International Financial Reporting Standards(IFRS) as follows : (a) activities aimed at obtaining new knowledge, (b) the search for evaluation and final selection of applications of research findings, or other knowledge ; (c) the search for alternative materials, devices, products, processes, systems, or services ; and (d) the formulation, design, evaluation, and final selection of possible alternatives for new or improved materials, devices, products, processes, systems, or services. In other words, research activities explore new information in the early stages of the process of corporate innovation activities. Research expenditures are the amount invested in research activities. If an entity cannot demonstrate whether these expenditures generate probable future economic benefits, expenditures on research would be recognized as expenses when it is incurred.

The IASB presents development activities in IFRS as follows : (a) the design, construction, and testing of pre-production or pre-use prototypes and models, (b) the design of tools, jigs, molds, and dies involving new technology ; (c) the design, construction, and operation of a pilot plant that is not economically feasible for commercial production ; and (d) the design, construction, and testing of a chosen alternative for new or improved materials, devices, products, processes, systems, or services. Development activities are primarily related to the completion phase of the process of corporate innovation activities. Development expenditures are the amount invested in development activities. Development expenditures will be recognized as an intangible asset if, and only if, an entity can demonstrate all of the following : (a) the technical feasibility of completing the intangible asset so that it will be available for use or sale, (b) its intention to complete the intangible asset and use or sell it, (c) its ability to use or sell the intangible asset, and (d) how the intangible asset will generate probable future economic benefits. Among other things, the entity can demonstrate the existence of a market for the output of the intangible asset or the intangible asset itself or, the usefulness of the intangible asset if it is to be used internally, (e) the availability of adequate technical, financial, and other resources to complete the development and to use or sell the intangible asset, and (f) its ability to reliably measure the expenditure attributable to intangible assets during its development. Consequently, because it is not easy for an entity to demonstrate the six points about development expenditures, it can be recognized as expenses when it is incurred.

The criteria for recognizing development expenditures may depend on the industry and the characteristics of the entity. The pharmaceutical bio-industry has different asset recognition

standards depending on drug types such as new drugs, generics, and biosimilars. For example, new drugs require the recognition of development expenditures as intangible assets from the time phase III of clinical trials is approved. In addition, biosimilars require development expenditures to be recognized as intangible assets from the inception of phase I clinical trials. In the case of other industries, the Financial Supervisory Service is preparing guidelines for accounting standards by types of industry, and it provides useful information for external users to determine asset recognition of development expenditures by preparing “best practices for development expenditures disclosure.”

In most prior studies, research and development expenditures were used as proxies for long-term investment in intangible assets and considered to have homogeneous characteristics (Bayersinger et al. 1991 ; Lee and O'Neill 2003). However, research and development expenditures have heterogeneous characteristics because they are spent at different stages of the R&D process and have different effects on firm value and corporate innovation. Oh(2012) reported that research expenditures are more relevant to future performance than development expenditures. Kwak and Wang(2013) reported the relationship between research and development expenditures and stock prices. They found that research expenditures were more related to stock prices than development expenditures in high-tech and high-growth companies. In non-high-tech and low-growth companies, only research expenditures have a positive relationship with stock prices. In other words, they reported that research expenditures play a very important role in generating firm value rather than development expenditures. Research expenditures invested in activities exploring new technologies for innovation in a rapidly changing environment are becoming more important than development expenditures.

R&D activities for corporate innovations have high risks due to high uncertainties and require strategic investment from a long-term perspective. Managers have great discretion in R&D activities. Managers prefer short-term performance and are risk-averse due to their compensation. Therefore, there are agency problems between shareholders who prefer long-term performance and managers who prefer short-term performance.

Since the 1980s, studies have examined the factors that reduce agency problems from R&D activities, such as market structure, industrial characteristics, and corporate financial variables. It has been shown that mechanisms for reducing agency costs through ownership structures can be efficiently operated(Fama and Jensen 1983). Particularly, studies have also examined the impact of institutional investors on research and development expenditures. There are two perspectives on the impact of institutional investors on research and development expenditures. First, institutional

investors increase corporate innovation activities by increasing research and development expenditures(Gasper et al. 2005 ; Aghion et al. 2013). Second, institutional investors do not play an important role in increasing research and development expenditures(Yan and Zhang 2009 ; Graham et al. 2005).

Prior studies on the relationship between institutional ownership and research and development expenditures have provided mixed evidence. This mixed evidence may be due to the varying incentives of different groups of institutional investors. Kim et al.(2019)'s study found the following : Various types of institutional investors exhibit heterogeneous characteristics that affect their involvement in corporate decisions. They have different investment objectives, styles, and regulatory schemes and exhibit divergent activism for corporate governance reform(Gillan and Starks 2000 ; Almazan et al. 2005). Not all institutional investors exhibit shareholder activities because their investment objectives, styles, and managerial incentives differ. They also face different regulatory and legal environments(Gillan and Starks 2000 ; Yan and Zhang 2009). Additionally, non-U.S. countries have different geopolitical characteristics, such as the protection of minority shareholders and business ties. These differences may distinctly influence their corporate governance roles(Shin and Park 2020).

Foreign institutional investors have international experience, expertise, and high monitoring capabilities because they have invested through fundamental analysis in many countries(Aggarwal et al. 2011 ; Ferreira et al. 2010). And Foreign institutional investors are freer from management pressure or business tie because they have alternatives to investment in many countries, making it easier to reduce risk(Shin and Park 2020). Cheon(2003) reported that Foreign institutional investors had international experience and expertise in analyzing corporate value, so they identified companies with high-quality earnings. Grinblatt and Keloharju (2000) and Karolyi (2002) reported empirical analysis results that foreign institutional investors achieve superior investment performance based on advanced investment methods and information analysis capabilities. Foreign institutional investors also have the incentive to facilitate investment in profitable, high-growth companies and increase resource allocation efficiency. Therefore, they have a long-term perspective and influence corporate decision-making.

However, because foreign institutional investors trade across borders, information asymmetry may be higher than domestic institutional investors due to factors such as language barriers, high transaction costs, political risks, and currency risks(Kho 2017). Therefore, they may avoid risky investments and require high-rate dividends to recover investment funds early. Research and development expenditures could fall because companies try to buy their shares to prevent hostile

mergers and acquisitions(M&As) from foreign institutional investors. Therefore, this study examines the impact of foreign institutional investors on research and development activities respectively.

H1-1 : Foreign institutional ownership positively affects research expenditures.

H1-2 : Foreign institutional ownership positively affects development expenditures.

Domestic institutional investors want to change the long-term value of companies because they have an advantage in collecting information. Additionally, domestic institutional investors are influential as major shareholders, even if they have small individual holdings. Domestic institutional investors make distributed investments, so it is possible to sell their holdings if investment losses occur due to short-term price changes. Consequently, domestic institutional investors are neutral about the risks to entities. In particular, domestic institutional investors have the resources to monitor managers and have the incentive to reduce the agency problem between shareholders and managers(Grossman and Hart 1980 ; Shleifer and Vishny 1986). Therefore, they have an incentive to increase research and development expenditures.

However, domestic institutional investors seek short-term returns because they are evaluated in a short cycle and lack access to the entity's details. The distributed portfolio can cause very small individual company holdings, potentially leading to problems with free rides, and business ties can lead to reduced research and development expenditures(Choi et al. 2007). Therefore, in this study, the following hypothesis was established to verify the impact of domestic institutional investors on R&D activities.

H2-1 : Domestic institutional ownership positively affects research expenditures.

H2-2 : Domestic institutional ownership positively affects development expenditures.

III. METHODOLOGY

1. Data collection

This study used a sample of public companies listed on the Korean Stock Exchange from 2001 to 2014. The analysis of foreign institutional ownership covers a longer sample period from 2001 to 2014, the last year in which foreign institutional ownership data are available. However, the

analysis of domestic institutional investors is based on a sample period beginning in 2001 and ending in 2004 because these data were disclosed by companies until 2004.

The required financial data for calculating the test variables were extracted from the KIS-VALUE database. As a comparison between financial statements is difficult, this study deletes firms in financial industries to control for financial industry effects. This study excluded companies where December was not the month of accounts settlement and companies with impaired capital as they were forecast to distort the study results. The sampling procedures resulted in 7,655 firm-year observations, consisting of 5,913 observations with foreign institutional ownership over the 15-year study period and 1,742 observations with domestic institutional ownership over the 5-year study period.

2. The regression models

This study examines whether foreign and domestic institutional investors significantly influence the process of corporate innovation activities. Model (1) and (2) were used to test research hypotheses.

$$R_ACT(D_ACT) = \beta_0 + \beta_1 FORIN + \beta_2 PPE + \beta_3 ASSET + \beta_4 ROA + \beta_5 LEV + \beta_6 HFD + \beta_7 CAP + \beta_8 AGE + \beta_9 BM + \beta_{10} VOL + \beta_{11} DIV + \sum IND + \sum YR + \varepsilon \quad (1)$$

$$R_ACT(D_ACT) = \beta_0 + \beta_1 DOMIN + \beta_2 PPE + \beta_3 ASSET + \beta_4 ROA + \beta_5 LEV + \beta_6 HFD + \beta_7 CAP + \beta_8 AGE + \beta_9 BM + \beta_{10} VOL + \beta_{11} DIV + \sum IND + \sum YR + \varepsilon \quad (2)$$

where,

- R_ACT* : Research expenditures, divided by the beginning total assets
- D_ACT* : Development expenditures, divided by the beginning, total assets
- FORIN* : The proportion of foreign institutional investors' ownership
- DOMIN* : The proportion of domestic institutional investors' ownership
- PPE* : Ratio of net property, plant, and equipment to the beginning, total assets
- ASSET* : The natural log of the total assets
- ROA* : Return-to-assets ratio, calculated as the income before extraordinary items divided by the beginning total assets
- LEV* : Leverage ratio, calculated as the sum of long-term and short-term debts divided by total assets
- HFD* : Herfindahl index of three-digit SIC industry j to which firm ii belongs
- CAP* : Capital expenditure scaled by the book value of total assets at the beginning of fiscal year t
- AGE* : Natural logarithm of one plus firm's age

<i>BM</i>	: Book-to-market ratio, defined as book value of equity to the market value of equity
<i>VOL</i>	: Variability in sales calculated by variance over the past five years
<i>DIV</i>	: Dummy variable, coded as one if a firm pays dividends and 0 otherwise
<i>IND</i>	: Dummy variables for fixed effects of year
<i>YR</i>	: Dummy variables for fixed effects of industry

The dependent variable (*R_ACT*, *D_ACT*) is the process of corporate innovation activities. Research and development expenditures were used as proxies for the process of innovative corporate activities. They were also divided into total assets to eliminate errors due to differences in size between firms.

The key independent variables are equity ownership by foreign and domestic institutional investors *FORIN* and *DOMIN*, respectively. This captures the effects of institutional investors on managerial decision-making concerning the process of corporate innovation activities. Foreign and domestic institutional investors' ownership data are matched with the next year's research and development expenditures to mitigate endogeneity concerns.

To test the marginal effects of foreign and domestic institutional investors on the process of corporate innovation activities, this study controls for the following determinants identified in the literature as important factors that may affect corporate innovation activities; Fixed asset intensity (*PPE*), firm size (*ASSET*), profitability (*ROA*), leverage (*LEV*), product market competition (*HFD*), investment in fixed assets (*CAP*), firm age (*AGE*), growth opportunities (*BM*), volatility (*VOL*), and dividend-paying tendency (*DIV*). Finally, industry- and year-fixed effects were included in the regression models.

Following Hall and Ziedonis (2001), the model includes firm size (*ASSET*) and capital intensity (*PPE*) as control variables, measured as the natural logarithm of total assets and the ratio of net property, plant, and equipment to the beginning total assets, respectively. Larger companies have greater utility for asset use (Baysinger and Hoskisson 1990) and greater motivation for risky investments, such as R&D (Connolly and Hirschey 2005). Large companies also have relatively large resources, making it more affordable for them to withstand long-term investments, such as R&D (Cohen and Levinthal 1990).

In this study, the return to assets ratio (*ROA*) was used as an entity's profitability variable. An entity's performance is a variable that is closely related to its R&D investments, which increases its R&D investment if it has abundant resources (Hoskisson et al. 2002). Highly profitable companies are expected to increase R&D investments because they have ample internal investment funds for R&D activities.

The lower R&D investments will be due to financial burden and capital constraints(Myers and Majluff 1984 ; McConnell and Servaes 1995). To reflect this, LEV(measured as the leverage ratio) was included as the control variable. HFD, measured by the Herfindahl index based on annual sales, is included to control for industry characteristics. AGE(measured as the logarithm of the difference between the current year and the founding year of the firm) is included to control for the possibility that older firms have more experience managing the investment opportunity.

BM is a variable that represents the growth of an entity and is calculated as the market value versus the book value. Lach and Sankerman(1989) argued that companies with high stock returns signal good growth opportunities. An entity that receives an optimistic assessment of future profitability will exhibit relatively active investment activities compared to those that do not. The higher the risk of companies, the more dividends they pay, the less they will invest. Thus, VOL and DIV were considered as control variables. VOL is the variability in sales, and DIV is a dummy variable coded as one if a firm pays dividends and 0 otherwise.

As investments are made during the year, that is, there is a time difference in the determination and execution of investments, the control variables used the data at the end of the previous year.

IV. EMPIRICAL RESULTS

1. Descriptive statistics and correlation analysis

Table 1 presents the descriptive statistics of the variables used in the empirical analyses. The mean value of R_ACT was 1.0352, and the median was 0.2179. This means that a few companies have spent considerable research expenditures. The mean value of D_ACT value was 0.1216. The mean value of FORIN was 9.72%, indicating that 9.72% of the total shares of the sample companies were owned by foreign institutional investors. The mean value of DOMIN was 8.19%, indicating that 8.19% of the sample companies' total shares were owned by domestic institutional investors. The average sample companies had a PPE of 35.12%, ASSET of 26.5077, ROA of 3.13%, LEV of 45%, HFD of 0.1267, CAP of 0.2179, BM of 1.8401, VOL of 0.2233, and DIV of 0.7152. Overall, the variables used in this study were normally distributed.

〈Table 1〉 Descriptive statistics

Variable	N	Mean	Standard deviation	25%	Median	75%
<i>R_ACT</i>	7,655	1.0352	1.8097	0.0000	0.2179	1.2041
<i>D_ACT</i>	7,655	0.1216	0.4227	0.0000	0.0000	0.0000
<i>FORIN</i>	7,655	0.0972	0.1413	0.0030	0.0296	0.1351
<i>DOMIN</i>	1,742	0.0819	0.1197	0.0040	0.0350	0.1116
<i>PPE</i>	7,655	0.3512	0.2045	0.2040	0.3414	0.4787
<i>ASSET</i>	7,655	26.5077	1.5237	25.4447	26.2321	27.3109
<i>ROA</i>	7,655	0.0313	0.0885	0.0061	0.0348	0.0729
<i>LEV</i>	7,655	0.4517	0.2058	0.2976	0.4494	0.5935
<i>HFD</i>	7,655	0.1267	0.1308	0.0347	0.0731	0.1731
<i>CAP</i>	7,655	0.2179	0.2700	0.0610	0.1266	0.2606
<i>AGE</i>	7,655	3.5171	0.5253	3.3322	3.6109	3.8501
<i>BM</i>	7,655	1.8401	8.4404	0.7850	1.3525	2.2516
<i>VOL</i>	7,655	0.2233	0.8036	0.0778	0.1394	0.2377
<i>DIV</i>	7,655	0.7152	0.4513	0.0000	1.0000	1.0000

Table 2 shows the Pearson correlation coefficients of the test variables. Correlation analysis suggests that *R_ACT* was positively correlated with *FORIN*, indicating higher foreign institutional ownership and higher research expenditures. However, *D_ACT* was not significantly correlated with *FORIN* and *DOMIN*. *R_ACT* and *D_ACT* were significantly correlated with *PPE*, *ROA*, *CAP*, and *DIV*. More than 0.3 significant correlations were found between *ROA*, *LEV*, and *DIV*, but no multicollinearity problems were found.

Table 2> Pearson correlation

	<i>R_ACT</i>	<i>D_ACT</i>	<i>FORIN</i>	<i>DOMIN</i>	<i>PPE</i>	<i>ASSET</i>	<i>ROA</i>	<i>LEV</i>	<i>HFD</i>	<i>CAP</i>	<i>AGE</i>	<i>BM</i>	<i>VOL</i>	<i>DIV</i>
<i>R_ACT</i>	1.000	0.185 (<0.0001)	0.208 (<0.0001)	0.016 (0.492)	-0.134 (<0.0001)	0.095 (<0.0001)	0.126 (<0.0001)	-0.107 (<0.0001)	-0.005 (0.673)	0.021 (0.065)	-0.092 (<0.0001)	-0.034 (0.003)	-0.012 (0.282)	0.105 (<0.0001)
<i>D_ACT</i>		1.000	0.006 (0.622)	0.001 (0.970)	-0.048 (<0.0001)	0.016 (0.155)	-0.040 (<0.0001)	0.013 (0.261)	0.065 (<0.0001)	0.035 (0.003)	-0.014 (0.236)	0.015 (0.186)	-0.001 (0.921)	-0.058 (<0.0001)
<i>FORIN</i>			1.000	0.070 (0.004)	-0.028 (0.014)	0.471 (<0.0001)	0.254 (<0.0001)	-0.146 (<0.0001)	0.157 (<0.0001)	0.045 (<0.0001)	-0.057 (<0.0001)	-0.049 (<0.0001)	-0.019 (0.091)	0.237 (<0.0001)
<i>DOMIN</i>				1.000	0.088 (0.000)	0.251 (<0.0001)	0.100 (<0.0001)	0.078 (0.001)	0.106 (<0.0001)	-0.037 (0.119)	0.094 (<0.0001)	0.031 (0.189)	0.127 (<0.0001)	-0.051 (0.033)
<i>PPE</i>					1.000	0.113 (<0.0001)	0.027 (0.017)	0.180 (<0.0001)	0.057 (<0.0001)	-0.017 (0.128)	0.062 (<0.0001)	0.046 (<0.0001)	-0.082 (<0.0001)	0.002 (0.873)
<i>ASSET</i>						1.000	0.154 (<0.0001)	0.143 (<0.0001)	0.280 (<0.0001)	-0.055 (<0.0001)	0.054 (<0.0001)	-0.012 (0.285)	-0.019 (0.090)	0.201 (<0.0001)
<i>ROA</i>							1.000	-0.354 (<0.0001)	0.014 (0.233)	0.097 (<0.0001)	-0.091 (<0.0001)	0.019 (0.098)	-0.001 (0.920)	0.472 (<0.0001)
<i>LEV</i>								1.000	0.104 (<0.0001)	-0.073 (<0.0001)	-0.003 (0.818)	-0.035 (0.002)	0.075 (<0.0001)	-0.384 (<0.0001)
<i>HFD</i>									1.000	0.006 (0.577)	-0.011 (0.345)	-0.020 (0.086)	0.073 (<0.0001)	-0.052 (<0.0001)
<i>CAP</i>										1.000	-0.093 (<0.0001)	-0.014 (0.237)	0.037 (0.001)	0.045 (<0.0001)
<i>AGE</i>											1.000	0.041 (0.000)	-0.034 (0.003)	-0.012 (0.293)
<i>BM</i>												1.000	-0.026 (0.021)	-0.016 (0.171)
<i>VOL</i>													1.000	-0.055 (<0.0001)
<i>DIV</i>														1.000

Notes : All p-values were based on two-tailed tests.

2. Results of multivariate analyses

Table 3 provides the multivariate regression results of H1, which examines the association between corporate innovation activities and foreign institutional ownership over the study period 2001–2014. The regression coefficient of foreign institutional ownership(FORIN) for R_ACT was 1.9199, positive and statistically significant at the 1% level. These results indicate that foreign institutional ownership tends to increase research activities in the early stages of corporate innovation activities.

R_ACT was positively associated with $ASSET$, ROA , and negatively associated with LEV regarding control variables. These results are similar to those of existing studies that show that the larger the company's size, the more profitable it is, the lower the leverage ratio, the more research activities it has.

〈Table 3〉 Foreign Institutional Investors and R&D Activities

Variable	Dependent variable= R_ACT		Dependent variable= D_ACT	
	Coef.	p-value	Coef.	p-value
<i>Intercept</i>	0.4437	0.3055	−0.1006	0.3364
$FORIN_{it-1}$	1.9199	<0.01	−0.0233	0.5686
PPE_{it-1}	−1.1245	<0.01	−0.1251	<0.01
$ASSET_{it-1}$	0.0580	<0.01	0.0116	<0.01
ROA_{it-1}	1.1702	<0.01	−0.1411	0.0297
LEV_{it-1}	−0.3232	<0.01	−0.0565	0.0470
HFD_{it-1}	−0.4031	0.0121	0.1908	<0.01
CAP_{it-1}	−0.0283	0.7069	0.0474	<0.01
AGE_{it-1}	−0.2475	<0.01	−0.0087	0.3480
BM_{it-1}	−0.0048	0.0430	0.0007	0.1915
VOL_{it-1}	−0.0397	0.1130	−0.0073	0.2305
DIV_{it-1}	0.0487	0.3631	−0.0557	<0.01
<i>IND & YR</i>	FIXED		FIXED	
Adj. R^2	0.0828		0.0167	
N	7,655		7,655	

Notes : All p-values are based on two-tailed tests, and standard errors are corrected for heteroscedasticity.

However, foreign institutional ownership(FORIN) had no significant relationship with D_ACT, as the estimated coefficient is not significantly different from zero (-0.0233 , $p=0.5686$). This means that foreign institutional ownership(FORIN) is not related to development activities, which are in the completion stages of the corporate innovation activities, indicating that they have a different impact on each process of corporate innovation activities.

Table 4 provides the regression results of H2, which examines the association between corporate innovative activities and domestic institutional ownership(DOMIN) over the study period 2001–2004. The regression coefficients of domestic institutional ownership(DOMIN) for R_ACT and D_ACT were 0.0234 ($p=0.9331$) and -0.0076 ($p=0.9360$), respectively, which were not statistically significant. This means that domestic institutional ownership(DOMIN) does not play a dominant role in improving corporate innovation activities.

〈Table 4〉 Domestic Institutional Investors and R&D Activities

Variable	Dependent variable=R_ACT		Dependent variable=D_ACT	
	Coef.	p-value	Coef.	p-value
<i>Intercept</i>	-0.1717	0.7886	0.0034	0.9875
<i>DOMIN_{it-1}</i>	0.0234	0.9331	-0.0076	0.9360
<i>PPE_{it-1}</i>	-1.2364	<0.01	-0.1753	<0.01
<i>ASSET_{it-1}</i>	0.1184	<0.01	0.0218	0.0118
<i>ROA_{it-1}</i>	1.8716	<0.01	0.0171	0.8953
<i>LEV_{it-1}</i>	-0.5699	<0.01	-0.0877	0.1773
<i>HFD_{it-1}</i>	-0.3580	0.1302	0.2196	<0.01
<i>CAP_{it-1}</i>	-0.1636	0.0836	0.0719	0.0262
<i>AGE_{it-1}</i>	-0.3139	<0.01	-0.0890	<0.01
<i>BM_{it-1}</i>	-0.0251	<0.01	-0.0046	0.0343
<i>VOL_{it-1}</i>	-0.0402	0.3192	-0.0192	0.1642
<i>DIV_{it-1}</i>	0.1330	0.1191	-0.0586	0.0446
<i>IND & YR</i>	FIXED		FIXED	
Adj. R ²	0.1129		0.0344	
N	$1,742$		$1,742$	

Notes : All p-values are based on two-tailed tests, and standard errors are corrected for heteroscedasticity.

Table 5 provides the regression results of H1, which examines the association between

corporate innovation activities and foreign institutional ownership after controlling for domestic institutional ownership. Furthermore, an additional analysis includes both foreign and domestic institutional ownership variables in the regression model to test their incremental explanatory power.

Foreign institutional ownership(FORIN) was significantly and positively related to R_ACT (1.7121, $p < 0.01$), and domestic institutional ownership(DOMIN) was not significantly related to R_ACT (0.1018, $p = 0.7121$). However, the regression coefficients of foreign institutional ownership (FORIN) and domestic institutional ownership(DOMIN) for D_ACT were not statistically significant. This is consistent with the findings shown in Tables 3 and 4, thereby confirming the differential roles played by foreign and domestic institutional investors in the process of corporate innovation activities.

〈Table 5〉 Foreign Institutional Investors and R&D Activities after controlling for Domestic Institutional Investors

Variable	Dependent variable= R_ACT		Dependent variable= D_ACT	
	Coef.	p-value	Coef.	p-value
<i>Intercept</i>	1.4773	0.0323	-0.0972	0.6833
$FORIN_{it-1}$	1.7121	<0.01	-0.1045	0.2836
$DOMIN_{it-1}$	0.1018	0.7121	-0.0124	0.8962
PPE_{it-1}	-1.1916	<0.01	-0.1780	<0.01
$ASSET_{it-1}$	0.0410	0.1434	0.0265	<0.01
ROA_{it-1}	1.5668	<0.01	0.0357	0.7854
LEV_{it-1}	-0.4005	0.0353	-0.0980	0.1357
HFD_{t-1}	-0.3667	0.1173	0.2201	<0.01
CAP_{it-1}	-0.1798	0.0549	0.0729	0.0243
AGE_{it-1}	-0.2766	<0.01	-0.0913	<0.01
BM_{it-1}	-0.0173	<0.01	-0.0051	0.0222
VOL_{it-1}	-0.0372	0.3510	-0.0194	0.1603
DIV_{it-1}	0.1022	0.2272	-0.0567	0.0523
<i>IND & YR</i>	FIXED		FIXED	
Adj. R^2	0.1314		0.035	
N	1,742		1,742	

Notes : All p-values are based on two-tailed tests, and standard errors are corrected for heteroscedasticity.

3. Robustness check

While foreign institutional investors may positively impact research and development expenditures, they may choose stocks that have already invested in R&D. Ordinary least-squares regression may overlook the potential endogenous problems faced by variables such as foreign institutional investors and domestic institutional investors. To alleviate concerns about the reverse causality that foreign institutional investors invest in firms with higher corporate innovation activities, this study also adopts a two-stage instrumental variable approach.

In this study, the Morgan Stanley Capital International(MSCI) All Country World Index(ACWI) was used as an instrumental variable for foreign institutional ownership. According to Ferreira and Mathos(2008) and Cremers et al.(2016), foreign institutional investors prefer companies listed in the U.S. or listed in the MSCI ACWI. However, although MSCI ACWI has a positive relationship with foreign institutional ownership, it is not related to corporate decisions, such as automatically increasing research and development investments(Shin and Park 2020). Hence, a two-stage instrumental variable approach is used to mitigate potential endogeneity concerns due to reverse causality.

Panel A of Table 6 shows the first regression result. The dependent variable FORIN had a statistically significant positive association with MSCI. MSCI is a variable that gives a value of 1 if it is listed on MSCI ACWI during the sample period and 0 otherwise. Panel B-1 of Table 6 shows second-stage regression results using the predicted value of foreign institutional ownership estimated from the first-stage model as the independent variable. The regression coefficient of instrumental FORIN was significantly positive(5.2205, $p < 0.01$, 0.5257, $p < 0.01$). This result holds after controlling for the effect of DOMIN. As shown in Panel B-2 of Table 6, the coefficient for DOMIN was not statistically significant(0.0139, $p = 0.9604$, -0.0120, $p = 0.8999$).

The main test results and robustness checks using instrumental variables provide consistent evidence that foreign and domestic institutional investors may have different incentives on each process of corporate innovation activities. Unlike domestic institutional investors, foreign institutional investors can increase research activities in the early stage of corporate innovation activities for long-term gain.

〈Table 6〉 2SLS Regressions

Panel A : First–Stage Regression		
Variable	Dependent variable=FORIN	
	Coef.	p–value
Intercept	−0.6063	<0.01
MSCI _{it−1} [Instrument]	0.1107	<0.01
PPE _{it−1}	−0.0362	0.0439
ASSET _{it−1}	0.0284	<0.01
ROA _{it−1}	0.1704	<0.01
LEV _{it−1}	−0.0897	<0.01
HFD _{t−1}	0.0462	0.1619
CAP _{it−1}	0.0187	0.0292
AGE _{it−1}	−0.0117	0.1066
BM _{it−1}	−0.0005	0.0234
VOL _{it−1}	−0.0026	0.0185
DIV _{it−1}	0.0113	0.1583
IND & YR	FIXED	
Adj. R ²	0.3443	
N	7,655	

Panel B : Second–Stage Regression

Panel B–1 : Foreign Institutional Investors and R&D Activities

Variable	Dependent variable=R_ACT		Dependent variable=D_ACT	
	Coef.	p–value	Coef.	p–value
Intercept	3.7866	<0.01	0.4298	0.0160
FORIN _{it−1} [Predicted]	5.2205	<0.01	0.5257	<0.01
PPE _{it−1}	−0.9736	<0.01	−0.0986	<0.01
ASSET _{it−1}	−0.0899	<0.01	−0.0130	0.0931
ROA _{it−1}	1.4227	<0.01	−0.1401	0.0323
LEV _{it−1}	0.0217	0.8743	0.0106	0.7489
HFD _{t−1}	−0.5574	<0.01	0.1672	<0.01
CAP _{it−1}	−0.0747	0.3299	0.0370	0.0460
AGE _{it−1}	−0.2033	<0.01	0.0023	0.8273
BM _{it−1}	−0.0055	0.0556	0.0011	0.1185
VOL _{it−1}	−0.0241	0.3379	−0.0053	0.3840
DIV _{it−1}	−0.0087	0.8732	−0.0642	<0.01
IND & YR	FIXED		FIXED	
Adj. R ²	0.0767		0.0186	
N	7,655		7,655	

〈Table 6〉 2SLS Regressions (continued)

Panel B-2 : Foreign Institutional Investors vs. Domestic Institutional Investors				
Variable	Dependent variable= R_ACT		Dependent variable= D_ACT	
	Coef.	p-value	Coef.	p-value
<i>Intercept</i>	2.5779	0.0149	0.0186	0.9589
$FORIN_{it-1} [Predicted]$	3.0111	<0.01	0.0729	0.8173
$DOMIN_{it-1}$	0.0139	0.9604	-0.0120	0.8999
PPE_{it-1}	-1.0733	<0.01	-0.1659	<0.01
$ASSET_{it-1}$	-0.0111	0.8128	0.0179	0.2631
ROA_{it-1}	1.9638	<0.01	0.0408	0.7556
LEV_{it-1}	-0.1920	0.3814	-0.0538	0.4718
HFD_{it-1}	-0.4834	0.0425	0.2335	<0.01
CAP_{it-1}	-0.2127	0.0255	0.0680	0.0362
AGE_{it-1}	-0.2712	<0.01	-0.0728	0.0186
BM_{it-1}	-0.0213	<0.01	-0.0045	0.0418
VOL_{it-1}	-0.0284	0.4792	-0.0192	0.1617
DIV_{it-1}	0.1005	0.2453	-0.0519	0.0786
<i>IND & YR</i>	FIXED		FIXED	
Adj. R^2	0.1169		0.0327	
N	1,742		1,742	

Notes : All p-values are based on two-tailed tests, and standard errors are corrected for heteroscedasticity.

V. CONCLUSIONS

As the global economy suffers from severe difficulties due to Covid-19 and low interest rates continue, it is becoming increasingly difficult for companies to invest in corporate innovation activities. Therefore, the role of institutional investors with the potential and resources to improve the resilience of the financial system as well as the economic growth of the company is important.

Prior studies overlooked the heterogeneity of institutional investors and the process of corporate innovation activities. However, this study classified institutional investors and the process of corporate innovation activities and delicately analyzed the effect of ownership mechanism on the process of corporate innovation activities. Therefore, this study provides new evidence to the literatures that examine the determinants of corporate innovation activities.

This study's main result indicates that foreign institutional investors have a significant positive impact on research expenditures but do not have a significant positive impact on development expenditures after controlling for variables such as firm size, leverage, industry competition, and dividends. Domestic institutional investors were found to have no significant impact on either research expenditures or development expenditures. Foreign institutional investors have a significant positive impact on research expenditures in the two-stage instrumental variable approach used to address endogeneity factors in foreign institutional ownership. These results suggest that foreign institutional investors have long-term perspectives and increase firm value by increasing corporate innovation activities such as research activities.

This study provides evidence that domestic institutional investors who have short-term perspectives may not monitor managers to under-invest corporate innovation activities. Moreover, empirical results of this study suggest that the role of domestic institutional investors was influenced by the difference of investment goals, managerial incentive, regulatory, legal environment, and geopolitical characteristics. Domestic institutional investors may have the incentive to prefer short-term investment due to short-term asset management performance and risk assessments, the global economic slowdown, and low interest rates. These investment incentives of domestic institutional investors can serve as factors that result in rapid changes in the capital market and increase the risk of companies.

One example of evidence showing that domestic institutional investors result in rapid changes in the capital market and increase risk of companies is that domestic institutional investors sold their shares to avoid risks during the 2008 financial crisis and such large-scale stock sales results in greater volatility of stock prices. As price volatility increased due to the financial crisis, domestic institutional investors preferred only safe assets and did not prefer risky assets or long-term investments. In other words, if financial markets become unstable, domestic institutional investors prefer short-term investments and do not play an important role in preventing managers from reducing corporate innovation activities such as R&D activities. This pattern has emerged not only in Korea but also around the world. Therefore, it is very necessary to establish policies so that domestic institutional investors can invest with a long-term perspective and encourage corporate innovation activities.

In Korea, discussions are being held to encourage domestic institutional investors to play the role of long-term investors through the economic policy of the "Korean version of New Deal" announced in July 2020. The following efforts are considered necessary to induce domestic institutional investors to invest with a long-term perspective. First, typical factors for domestic

institutional investors to make short-term investments include the difficulty of valuation of long-term investments due to lack of information and low transparency, and the lack of experts and systems to select, invest, and manage long-term investments. Domestic institutional investors should be encouraged to supply long-term investments of companies by providing private-public partnerships. In addition, an investment policy framework of long-term investment should be established to enable domestic institutional investors to obtain information on long-term investments and perform valuation assessments on investments. It should also mitigate regulatory frameworks such as accounting systems and capital regulations that are applied to domestic institutional investors with the characteristics of long-term investments.

This study has the following limitations. First, domestic institutional investor data are available only up to 2004. Subsequent studies will analyze the impact of different types of domestic institutional investors on R&D. Additional analysis can be carried out by dividing industries into those with high growth potential or important technology. It will also be possible to analyze the impact of institutional investors on companies' R&D activities after applying the stewardship code introduced in Korea in 2018.

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기업의 혁신활동과정에서 기관투자자의 역할에 대한 연구*

신일항** · 오원정***

〈요 약〉

본 연구는 기관투자자가 기업의 혁신활동과정에 중요한 영향을 미치는지 여부에 대해 검증하고자 한다. 기업의 혁신활동은 연구활동과 개발활동으로 구분될 수 있다. 연구활동은 개발활동보다 불확실한 미래 이익과 관련이 있고 연구활동을 위한 지출은 장기적인 견해를 통해 이루어진다. 따라서 본 연구에서는 기업의 혁신활동과정에 대한 대응치로서 연구비와 개발비를 각각 사용하였다. 기관투자자 유형은 외국인기관투자자와 국내기관투자자로 구분하였다.

2001년부터 2014년까지 한국상장기업을 대상으로 연구를 수행한 결과 외국인기관투자자는 연구비를 유의적으로 증가시키는 것으로 나타난 반면, 개발비에는 영향을 미치지 못하는 것으로 나타났다. 국내기관투자자의 경우 연구비와 개발비 모두에 유의적인 영향을 미치지 못하는 것으로 나타났다. 외국인기관투자자의 내성적인 요인에 초점을 맞춘 2단계 분석에서도 외국인기관투자자는 연구비에 유의적인 영향을 미치는 것으로 나타났다. 이러한 실증분석결과는 기업의 혁신활동과정이 기관투자자의 유형에 따라 달라질 수 있으며, 외국인기관투자자가 장기적인 견해를 갖고 연구활동과 같은 기업의 혁신활동과정을 증가시킨다는 것을 보여준다. 본 연구의 실증분석결과들은 기업의 혁신활동에 과소투자하는 경영자를 감시하지 못하는 기관투자자를 규제하고 기업의 혁신활동을 장려하기 위한 정책에 실무적인 시사점을 제공할 수 있을 것이다.

〈주제어〉 기업의 혁신활동, 연구비, 개발비, 외국인기관투자자, 국내기관투자자

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