“The effect of R&D capitalization on revenue-expense matching: Focusing on the bio-pharmaceutical industries in South Korea”

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THE EFFECT OF R&D CAPITALIZATION ON REVENUE-EXPENSE MATCHING: FOCUSING ON THE BIO-PHARMACEUTICAL INDUSTRIES IN SOUTH KOREA

Abstract

The study aims to investigate the effect of research and development (R&D) capitalization on revenue-expense matching in the pharmaceutical and biotechnology industries, with particular attention to the moderating role of corporate governance and the influence of regulatory intervention. While capitalizing R&D expenditures enhances the relevance of financial information and positively impacts firm value, it also increases the risk of earnings management, potentially disrupting revenue-expense matching. Using a fixed-effects regression model, this study analyzes 1,350 firm-year observations from Korean listed firms in the bio-pharmaceutical sector from 2012 to 2022. The sample includes firms with financial statements, auditor data, and detailed disclosures on R&D expenditures, encompassing capitalized R&D costs, R&D expenses recognized in income statements, and those classified as manufacturing costs. The results indicate that R&D capitalization generally weakens revenue-expense matching in these industries. However, the adverse effects are mitigated by the effective implementation of corporate governance mechanisms. Additionally, the Financial Supervisory Service's thematic supervision of R&D accounting practices has significantly improved revenue-expense matching. Prior to the supervision period (2012–2017), firms exhibited significant discretionary capitalization practices, undermining revenue-expense matching. Following the supervision (2018–2022), improved adherence to accounting standards has enhanced matching quality, underscoring the regulatory intervention's effectiveness. These findings contribute to the literature by demonstrating that while discretionary R&D capitalization can impair revenue-expense alignment, strong corporate governance and adherence to accounting standards can offset these negative effects. The study provides valuable implications for future research and industry practices, particularly in navigating the trade-offs associated with R&D capitalization.

Keywords R&D capitalization, revenue-expense matching, earnings quality, accounting earnings

JEL Classification O32, M41, G32, M40

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INTRODUCTION

The pharmaceutical and biotechnology industries, known for their innovation-driven nature, are characterized by significant investments in research and development (R&D). The performance of these industries is highly dependent on the successful development and commercialization of new products. On average, Korean pharmaceutical and biotechnology companies invest approximately 2 to 3 trillion KRW (approximately 2 billion dollars) over 10 to 15 years to develop a single new drug (Song et al., 2024). A report by the Korea Institute for Advancement of Technology (2023) indicates that, within the manufacturing sector, the pharmaceutical and biotechnology industries ranked second in R&D intensity, highlighting their strategic importance. Consequently, the accounting treatment of R&D expenditures, particularly their capitalization as intangible assets under Korean International Financial Reporting Standards (K-IFRS) No. 1038, has gained considerable attention.

However, R&D capitalization raises concerns about earnings management, especially in industries with lengthy R&D cycles and high uncertainty. Previous studies note that while capitalizing R&D expenditures can improve the revenues-expenses matching, it also provides opportunities for management to manipulate the timing and extent of capitalization for earnings management purposes. Moreover, firms capitalizing R&D expenditures tend to exhibit lower future profitability compared to those expensing R&D, suggesting that R&D capitalization may be employed as a tool for earnings management rather than reflecting the true economic value of R&D activities.

The matching principle, a fundamental concept in accounting, requires that expenses be aligned with the revenues they help generate within the same reporting period, thereby improving the relevance and reliability of financial statements. R&D capitalization affects revenue-expense matching by determining whether expenditures are recognized as development assets to be amortized over future periods or expensed immediately. While appropriate capitalization of R&D expenditures can enhance revenue-expense alignment, opportunistic capitalization practices undermine this principle. Such practices, often linked to earnings management, distort financial information by introducing uncertainty, lowering earnings quality, and exacerbating mismatches between revenues and expenses over time. Consequently, prior studies suggest that the impact of R&D capitalization on revenue-expense matching is inconclusive.

1. LITERATURE REVIEW AND HYPOTHESES

Since 2011, all publicly listed companies in Korea have been mandated to adopt the Korean International Financial Reporting Standards (K-IFRS). Under K-IFRS No. 1038, R&D expenditures can be recognized as intangible assets if they meet specific criteria; otherwise, they must be expensed. To qualify for capitalization as intangible assets, R&D expenditures must satisfy six conditions: (1) technical feasibility, (2) an intention to complete the asset for use or sale, (3) the ability to use or sell the asset, (4) an expectation of future economic benefits, (5) access to adequate technical and financial resources to complete the asset, and (6) the ability to reliably measure the costs incurred during the development phase.

Internally generated intangible assets are identifiable, yet significant uncertainty surrounds the timing of their recognition as assets and the extent to which R&D investment costs should be capitalized. The R&D process is generally divided into two distinct phases: the research phase and the development phase. According to K-IFRS No. 1038, all expenditures incurred during the research phase must be expensed, as it cannot be reliably demonstrated that these expenditures will result in future economic benefits. In contrast, expenditures incurred during the development phase may be recognized as intangible assets, but only if they meet all the specified criteria. Otherwise, these expenditures also need to be expensed.

The pharmaceutical and biotechnology industries underwent extensive thematic supervision by the Financial Service Commission (FSS) in 2018 to evaluate the accounting treatment and recording methods for R&D capitalization. The FSS identified two primary issues during the supervision: the premature capitalization of R&D expenditures and the recognition of impairments on previously capitalized development costs. The supervision focused on industries with a high ratio of R&D capitalization relative to total assets or revenues. To address these issues, the FSS introduced supervisory guidelines aimed at refining R&D accounting practices. (Financial Services Commission of Korea, 2018). These guidelines recommend establishing specific stages at which development costs could be capitalized, determined by the distinct characteristics of each development phase for various drug types and the objective probabilities of obtaining final government approval for sales.

Prior research on the capitalization of R&D expenditures highlights both its positive and negative impact on firms (Callimaci & Landry, 2004; Wyatt, 2005). On the positive side, the capitalization of intangible assets enhances the periodic matching of costs and revenues, particularly for

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firms with high growth rates in intangible asset investments, thereby providing a more accurate representation of firm performance in reported earnings (Lev & Zarowin, 1999). Capitalization also allows intangible assets to be presented on the balance sheet alongside tangible assets, offering valuable information to external stakeholders. For example, recording capitalizable R&D expenditures as development assets, rather than expensing them immediately, signals the firm's potential for future economic benefits. Prior studies support this perspective. Callimaci and Landry (2004) identify a significant positive relationship between future stock prices and capitalized R&D expenditures, indicating that investors respond favorably to the capitalization of R&D. Furthermore, Wyatt (2005) observes that firms operating in industries with long technology cycles, strong technological capabilities, and robust intellectual property rights are more likely to capitalize R&D expenditures, as these characteristics enhance the relevance of capitalized R&D in reflecting a firm's long-term value creation potential.

The capitalization of R&D expenditures signals that the anticipated economic benefits from development costs are expected to materialize in the future while simultaneously reducing current R&D expenses (Lev & Sougiannis, 1996). However, in the United States, R&D expenditures are primarily recognized as expenses, reflecting the lack of reasonable evidence to justify the recognition of future economic benefits. Prior studies have argued that the capitalization of intangible assets, including R&D expenditures, can serve as a tool for earnings management (Lev & Zarowin, 1999; Markarian et al., 2008). This potential for earnings management arises primarily from information asymmetry between firms and external stakeholders. Darrough and Rangan (2005) provide evidence that in environments characterized by heightened information asymmetry, such as during initial public offerings (IPOs), the limited information available to investors regarding R&D expenditures can facilitate managerial discretion in earnings management. These findings highlight the risks associated with R&D capitalization, particularly in contexts where external stakeholders lack the information necessary to assess the credibility of reported figures.

The capitalization of R&D expenditures influences revenue-expense matching through two primary mechanisms. First, the accounting treatment of R&D expenditures plays a crucial role. Portions of R&D expenditures expected to generate future economic benefits are recognized as development assets and subsequently matched with revenue over time through amortization. Conversely, R&D expenditures that do not provide sufficient evidence of future economic benefits or fail to meet the criteria for recognition as intangible assets are recorded as period expenses, directly affecting the revenue-expense matching in the current period. When R&D capitalization is guided by objective and reasonable criteria, such as technical feasibility and the expectation of future economic benefits, rather than opportunistic motives, it can enhance revenue-expense matching. By aligning the recognition of costs with the revenues they help generate, appropriate R&D capitalization improves the accuracy and relevance of financial reporting, contributing to better assessments of firm performance.

Second, when management capitalizes R&D expenditures with opportunistic purposes, it undermines the appropriateness of revenue-expense matching. Earnings management reduces the reliability of accounting information, increases uncertainty about future cash flows, and diminishes both earnings predictability and earnings quality (Son & Choi, 2012; Kim, 2013). Kim (2013) demonstrates that earnings management negatively impacts revenue-expense matching, a finding consistent with Dichev and Tang (2008), who observe that weaker revenue-expense matching leads to increased earnings volatility and reduced earnings persistence. These findings suggest that earnings management contributes significantly to the deterioration of revenue-expense matching. Prior research also highlights a close relationship between discretionary R&D capitalization and earnings management (Han, 2010; Kim, 2016). Kim (2016) provides evidence of a positive relationship between R&D capitalization and discretionary accruals in the pharmaceutical industry, indicating that R&D capitalization is often associated with incentives for earnings management. Similarly, Roychowdhury (2006) demonstrates that management may intentionally reduce R&D expenses as part of real earnings management strategies.

Furthermore, when R&D expenditures are capitalized with opportunistic motives, they often result in significant future impairment losses. These impairments exacerbate long-term mismatches between revenues and expenses, further eroding the quality of financial reporting and revenue-expense matching over time.

The pharmaceutical and biotechnology industry is characterized by extended development periods for new products, substantial R&D expenditures, and relatively low success rates for bringing new products to market (Song et al., 2024). Furthermore, thematic supervision of R&D accounting practices conducted by the FSS identified instances of discretionary capitalization of R&D expenditures within these industries (Yang & Im, 2021). This finding suggests that management in pharmaceutical and biotechnology firms may be inclined to reduce current expenses by capitalizing R&D expenditures and deferring costs through the amortization of development assets. In this context, this study seeks to investigate the relationship between R&D capitalization and revenue-expense matching, premised on the notion that pharmaceutical and biotechnology firms engage in discretionary capitalization of R&D expenditures.

Findings from prior studies suggest that outside directors and major shareholders in corporate governance may play a moderating role in the relationship between R&D capitalization and revenue-expense matching. Corporate governance significantly influences the relationship between the capitalization of R&D expenditures and the level of revenue-expense matching. As a key mechanism, corporate governance addresses conflicts of interest between management and shareholders resulting from the separation of ownership and control (Jensen & Meckling, 1976). Prior research suggests that opportunistic managerial behavior, often arising from agency problems, can adversely affect firms through inefficient resource allocation, ultimately reducing expected future cash flows (Ashbaugh-Skaife et al., 2006). These agency problems can also lead to diminished investment efficiency (Biddle et al., 2009) and a decline in overall firm performance (Core et al., 1999). To mitigate these issues, effective internal and external monitoring mechanisms are essential for minimizing the adverse effects of agency conflicts that stem from the misalignment of interests between management and stakeholders (Fama & Jensen, 1983). Studies have consistently shown that robust corporate governance mechanisms play a critical role in mitigating agency problems (Byrd & Hickman, 1992; Klein, 2002; Badolato et al., 2004; Ashbaugh-Skaife et al., 2006). A strong governance structure enhances oversight and monitoring functions, facilitates efficient managerial decision-making, and constrains opportunistic behavior. By fostering transparency and accountability, corporate governance mechanisms can improve the alignment between managerial actions and stakeholder interests, thereby enhancing the quality of financial reporting and revenue-expense matching. Deutsch (2007) underscores the importance of outside directors in R&D investment decisions, showing that a higher proportion of stock-based compensation for outside directors correlates with an increased proportion of R&D investments.

Moreover, in addition to the role of outside directors, the ownership stake of the largest shareholder – an essential component of corporate governance – can also influence the relationship between R&D capitalization and revenue-expense matching. Yoon and Kim (2008) find that in KOSDAQ (equivalent to NASDAQ in the U.S.)-listed firms, a higher ownership percentage by major shareholders is negatively associated with R&D investment. Furthermore, the study reveals a negative value relevance of R&D investments in such cases, indicating that major shareholders may prioritize private benefits over the firm's long-term value creation. This suggests that concentrated ownership by major shareholders could lead to underinvestment in R&D or opportunistic behavior that undermines the potential economic benefits of R&D activities.

There are two contrasting hypotheses regarding the effects of major shareholder ownership: the convergence of interest hypothesis and the entrenchment hypothesis. Jensen and Meckling (1976) argue that as the ownership of major shareholders increases, their interests

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align more closely with those of external shareholders, a perspective known as the convergence of interest hypothesis. This hypothesis suggests that as major shareholders hold larger stakes, their financial interests become more aligned with those of minority shareholders, increasing the likelihood of decisions aimed at maximizing firm value. Since the wealth of major shareholders is directly tied to the firm's performance, they are incentivized to prioritize long-term growth and financial stability over short-term gains. This perspective highlights a positive outcome where the alignment of interests between major and minority shareholders contributes to enhanced firm value. Conversely, the entrenchment hypothesis, proposed by Morck et al. (1988), posits that high insider ownership can weaken external controls and lead to decisions that prioritize the consolidation of managerial control at the expense of firm value. According to this hypothesis, when major shareholders hold excessive ownership stakes, they may engage in defensive strategies to protect their personal gain, leading to opportunistic behavior. High ownership by major shareholders reduces external oversight, potentially enabling the exploitation of corporate assets for private benefits. This behavior can harm minority shareholders and diminish firm value.

Empirical evidence from Korea largely supports the entrenchment hypothesis, offering a critical perspective on concentrated ownership structures. Prior studies indicate that concentrated ownership by major shareholders is frequently associated with decisions that prioritize private benefits over the interests of minority shareholders, ultimately diminishing firm value (Park, 2003; Lee et al., 2012). These findings underscore the potential risks associated with excessive ownership concentration and highlight the necessity of mechanisms to mitigate opportunistic behavior by entrenched insiders.

The study aims to examine the effect of research and development (R&D) capitalization on revenue-expense matching in the pharmaceutical and biotechnology industries, focusing on the moderating role of corporate governance and the impact of regulatory intervention, particularly the Financial Supervisory Service thematic supervision in 2018.

Study hypotheses are as follows:

H1: Pharmaceutical and biotechnology firms with higher R&D capitalization rates will exhibit lower levels of cost-revenue matching compared to firms with lower R&D capitalization rates.

H2: In pharmaceutical and biotechnology firms with effectively functioning corporate governance, the negative impact of R&D capitalization on cost-revenue matching will be mitigated.

2. METHOD

This study investigates the impact of R&D expenditure capitalization on revenue-expense matching in pharmaceutical and biotechnology firms. The research model adopts the framework proposed by Dichev and Tang (2008), which evaluates the extent to which expenses from prior, current, and subsequent periods align with current revenues, serving as a measure of revenue-expense matching. To enhance this framework, the study integrates the R&D capitalization ratio (*RND*) as a key explanatory variable, following the approach of Cho and Choi (2021). This allows for an in-depth examination of the relationship between R&D capitalization and revenue-expense matching. The research model is formalized as follows in Equation (1):

$$\begin{aligned} REV_{it} &= \beta_0 + \beta_1 RND_{it} + \beta_2 EXP_{it-1} \\ &+ \beta_3 EXP_{it} + \beta_4 EXP_{it+1} + \beta_5 RND_{it} \cdot EXP_{it-1} \\ &+ \beta_6 RND_{it} \cdot EXP_{it} + \beta_7 RND_{it} \cdot EXP_{it+1} \\ &+ \beta_8 SIZE_{it} + \beta_9 SALESVOL_{it} \\ &+ \beta_{10} CFOVOL_{it} + \beta_{11} LOSS_{it} \\ &+ \beta_{12} OPCYCLE_{it} + \beta_{13} SALESGROWTH_{it} \\ &+ \beta_{14} ROA_{it} + \beta_{15} CFO_{it} + \beta_{16} BIG4_{it} \\ &+ \sum YEAR + \varepsilon_t \end{aligned} \quad (1)$$

The dependent variable, *REV*, represents the total revenue of a firm for the current year. The corresponding total expense variable, *EXP*, is decomposed into prior-period expenses (EXP_{it-1}),

current-period expenses (EXP_{it}), and subsequent-period expenses (EXP_{it+1}). According to prior research, the relationship between prior-period expenses (EXP_{it-1}) and current revenues (*REV*) reflects conservative accounting practices, where expenses are recognized early. Conversely, the relationship between subsequent-period expenses (EXP_{it+1}) and current revenues (*REV*) captures delayed expense recognition practices, often associated with inflating current-period earnings (Dichev & Tang, 2008; Donelson et al., 2011). The central focus of this study is the relationship between current-period expenses (EXP_{it+1}) and current revenues (*REV*), as it measures the degree of current revenue-expense matching. The key variable of interest, *RND*, represents the ratio of capitalized R&D expenditures and is calculated as capitalized R&D expenditures divided by total R&D expenditures. Following Han (2010), total R&D expenditures include the increase in capitalized development costs for the current period, R&D expenses reported in the income statement, and R&D costs disclosed in the manufacturing cost statement. The numerator, capitalized R&D expenditures, refers to the disclosed increase in capitalized development costs for the current period. In addition, the research model incorporates various control variables that could influence revenue-expense matching. These control variables include firm size (*SIZE*), sales volatility (*SALESVOL*), volatility of operating cash flows (*CFOVOL*), net loss in the prior year (*LOSS*), operating cycle (*OPCYCLE*), sales growth (*SALESGROWTH*), return on assets (*ROA*), operating cash flows (*CFO*), and the presence of a Big Four auditor (*BIG4*). Finally, given the extensive research period from 2012 to 2022, year-specific control variables were included to account for potential temporal effects. Since the analysis focuses on the pharmaceutical and biotechnology industries, industry-specific control variables were not separately considered.

If the capitalization of R&D expenditures in pharmaceutical and biotechnology firms negatively impacts revenue-expense matching (Hypothesis 1), the coefficient β_6 in Equation (1) is expected to have a negative (–) coefficient. Furthermore, there is a possibility that β_7 will exhibit a positive (+) coefficient. A negative β_6 indicates that firms with higher R&D capitalization ratios exhibit poorer matching between current revenues and current expenses. Meanwhile, a positive β_7 implies that firms with higher R&D capitalization ratios are more likely to defer current expenses to subsequent periods, thereby inflating current revenues – a behavior indicative of earnings management. This suggests that instead of recognizing development costs as assets based on objective and rational justifications satisfying the six prescribed criteria, these firms may have discretionarily capitalized development costs to defer current R&D expenses. Additionally, this study examines the moderating effect of corporate governance on the negative relationship (Hypothesis 2) between R&D capitalization and revenue-expense matching in pharmaceutical and biotechnology firms. The analysis incorporates the ratio of outside directors (*OUT*) and the ownership percentage of the largest shareholder (*LARGEST*) as corporate governance variables. Given the interaction terms in the research model, subgroup tests were conducted to validate Hypothesis 2 based on corporate governance variables.

The sample for this study consists of pharmaceutical and biotechnology firms listed on the KOSPI and KOSDAQ from 2012 to 2022. The firms were selected based on the following criteria: (1) Firms for which financial statements and auditor data are available from FnGuide databases and with a fiscal year-end date of December 31. (2) Firms for which data on R&D expenditures are available from TS2000 provided by the Korea Listed Companies Association, including disclosed amounts for the increase in capitalized development costs, R&D expenses recognized in the income statement, and R&D expenses classified as manufacturing costs.

The sample is limited to pharmaceutical and biotechnology firms that meet above conditions and for which total R&D expenditures exist. Firms without total R&D expenditures are excluded from the sample because such firms are distinct from those with an R&D capitalization ratio of zero. Including firms without total R&D expenditures could lead to distorted statistical analysis results, as these firms cannot be differentiated from those with zero R&D capitaliza-

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Table 1. Sample selection process and annual distribution of samples

Panel A: Sample selection process	
Sample selection process	**Number of samples**
Pharmaceutical and biotech companies listed from 2012 to 2022 (Korean Standard Industrial Classification, Medium Category 21)	1,955
(–) Companies with total R&D expenditures of zero	(353)
(–) Companies with fiscal year-end dates other than December 31	(53)
(–) Companies lacking data necessary for dependent and independent variables	(199)
Total	1,350

Panel B: Annual Distribution of Samples	
Year	**Number of samples**
2012	85
2013	89
2014	91
2015	118
2016	117
2017	129
2018	135
2019	137
2020	145
2021	153
2022	151
Total	1,350

tion ratios. As a result, firms without total R&D expenditures are excluded, and the final sample for this study consists of 1,350 firm-year observations. The detailed sample selection process is summarized in Table 1.

3. RESULTS

Table 2 presents the descriptive statistics for the variables used in the empirical analysis, based on the sample of pharmaceutical and biotechnology firms from 2012 to 2022. The mean value of the R&D capitalization ratio (*RND*) is 0.116, indicating that, on average, pharmaceutical and biotechnology firms capitalize approximately 11.6% of their total R&D expenditures. The dependent variable, current revenue (*REV*), has a mean value of 0.545, while the key expense variable, current expenses (EXP_{it}), has a mean value of 0.558. These results suggest that, on average, current revenues account for approximately 54.5% of total assets, and current total expenses account for approximately 55.8% of total assets. Consequently, the average return on assets (*ROA*) for the sample is

Table 2. Descriptive statistics

Variable	N	Mean	Standard deviation	Median	25%	75%
REV_{it}	1,350	0.545	0.347	0.532	0.282	0.729
RND_{it}	1,350	0.116	0.233	0.000	0.000	0.109
EXP_{it-1}	1,350	0.576	0.339	0.538	0.353	0.748
EXP_{it}	1,350	0.558	0.333	0.525	0.336	0.716
EXP_{it+1}	1,350	0.546	0.329	0.519	0.332	0.710
$SIZE_{it}$	1,350	18.797	1.126	18.690	18.062	19.464
$SALESVOL_{it}$	1,350	0.103	0.107	0.071	0.040	0.130
$CFOVOL_{it}$	1,350	0.058	0.056	0.045	0.027	0.068
$LOSS_{it}$	1,350	0.373	0.484	0.000	0.000	1.000
$OPCYCLE_{it}$	1,350	5.418	0.584	5.411	5.137	5.677
$SALESGROWTH_{it}$	1,350	3.421	56.662	1.071	0.988	1.176
ROA_{it}	1,350	–0.013	0.190	0.018	–0.052	0.066
CFO_{it}	1,350	0.026	0.119	0.034	–0.016	0.082
$BIG4_{it}$	1,350	0.459	0.499	0.000	0.000	1.000

Notes: (1) All variables are defined in the Appendix. (2) All continuous variables were winsorized at the top and bottom 1%.

–0.013, indicating a negative mean value for profitability among the pharmaceutical and biotechnology firms.

Table 3 summarizes the Pearson correlations among the variables used in the research model specified in Equation (1). Current revenue (*REV*) shows a statistically significant positive correlation with prior-period expenses (EXP_{it+1}), current-period expenses (EXP_{it}), and subsequent-period expenses (EXP_{it+1}), indicating matching between revenue and expenses. The R&D capitalization ratio (*RND*) exhibits a negative correlation with current revenue (*REV*) and negative correlations with prior-period expenses (EXP_{it-1}), current-period expenses (EXP_{it}), and subsequent-period expenses (EXP_{it+1}). This suggests that firms with lower current revenues may have a greater tendency to capitalize R&D expenditures. However, the R&D capitalization ratio (*RND*) has a statistically insignificant negative correlation with return on assets (*ROA*). This indicates the need for regression analysis, including control variables, to determine whether the capitalization of R&D expenditures is driven by opportunistic motives.

Table 4 presents the regression analysis results using the research model specified in Equation (1). Column (1) reports the findings for the sample of pharmaceutical and biotechnology firms from 2012 to 2022. The model demonstrates a high explanatory power, with an adjusted R^2 of 0.974, indicating that the independent variables explain 97.4% of the variation in current revenues (*REV*).

This adjusted R^2 is comparable to the 0.987 reported in Paek (2011) for a study covering the period 1983–2008 across all industries. Specifically, Paek (2011) finds that prior-period, current-period, and subsequent-period expenses collectively explained 84.2% of the variation in current revenues ($R^2 = 0.842$) for the pharmaceutical and bio-

Table 3. Correlations (p-values below)

Variables	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) REV_{it}	–0.210	0.768	0.844	0.785	0.155	0.203	–0.071	–0.316	–0.215	0.046	0.345	0.426	0.222
	< .001	< .001	< .001	< .001	< .001	< .001	0.009	< .001	< .001	0.088	< .001	< .001	< .001
(2) RND_{it}		–0.195	–0.201	–0.201	–0.024	–0.046	–0.063	0.060	0.212	–0.020	–0.032	–0.008	–0.074
		< .001	< .001	< .001	0.384	0.092	0.020	0.028	< .001	0.454	0.241	0.770	0.007
(3) EXP_{it-1}			0.783	0.696	–0.052	0.238	–0.009	–0.053	–0.167	–0.014	0.030	0.080	0.133
			< .001	< .001	0.055	< .001	0.735	0.050	< .001	0.597	0.266	0.003	< .001
(4) EXP_{it}				0.807	–0.039	0.163	–0.042	–0.093	–0.165	0.010	–0.211	0.105	0.159
				< .001	0.149	< .001	0.122	< .001	< .001	0.723	< .001	< .001	< .001
(5) EXP_{it+1}					–0.010	0.095	–0.086	–0.080	–0.139	0.018	0.018	0.089	0.150
					0.723	< .001	0.002	0.003	< .001	0.499	0.500	0.001	< .001
(6) $SIZE_{it}$						–0.106	–0.197	–0.374	0.018	–0.037	0.352	0.320	0.319
						< .001	< .001	< .001	0.520	0.174	< .001	< .001	< .001
(7) $SALESVOL_{it}$							0.465	0.025	–0.160	0.120	0.084	0.114	–0.028
							< .001	0.354	< .001	< .001	0.002	< .001	0.308
(8) $CFOVOL_{it}$								0.102	–0.029	0.018	–0.055	–0.001	–0.066
								< .001	0.291	0.500	0.043	0.976	0.015
(9) $LOSS_{it}$									0.076	0.053	–0.415	–0.433	–0.269
									0.006	0.052	< .001	< .001	< .001
(10) $OPCYCLE_{it}$										0.030	–0.104	–0.124	–0.040
										0.276	< .001	< .001	0.142
(11) $SALESGROWTH_{it}$											0.068	–0.039	–0.036
											0.013	0.151	0.188
(12) ROA_{it}												0.593	0.126
												< .001	< .001
(13) CFO_{it}													0.095
													< .001
(14) $BIG4_{it}$													

Notes: (1) All variables are defined in the Appendix. (2) All continuous variables were winsorized at the top and bottom 1%. (3) All *p*-values are based on two-tailed tests.

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Table 4. The effect of R&D capitalization on the revenue-expense matching

Variable	Dependent variable = REV_t					
	(1) Basic model			(2) Model controlling period costs		
	Coef.	t-value		Coef.	t-value	
Intercept	–0.016	–0.45		–0.079	–1.70	*
RND_{it}	0.012	0.84		0.000	–0.01	
EXP_{jt-1}	0.012	1.13		0.025	1.75	*
EXP_{jt}	0.894	64.83	***	0.882	47.01	***
EXP_{jt+1}	0.088	8.01	***	0.107	7.17	***
RND_{it}×EXP_{jt-1}	0.131	3.21	***	0.175	3.24	***
RND_{it}×EXP_{jt}	–0.165	–2.94	***	–0.266	–3.54	***
RND_{it}×EXP_{jt+1}	–0.015	–0.28		0.018	0.24	
$SIZE_{it}$	0.002	1.32		0.007	3.10	***
$SALESVOL_{it}$	0.035	1.96	*	–0.001	–0.06	
$CFOVOL_{it}$	0.028	0.81		0.195	4.34	***
$LOSS_{it}$	0.007	1.66	*	0.010	1.80	*
$OPCYCLE_{it}$	–0.005	–1.61		–0.005	–1.21	
$SALESGROWTH_{it}$	0.002	0.62		0.011	3.20	***
ROA_{it}	1.090	58.12	***	0.983	40.52	***
CFO_{it}	0.017	0.71		–0.111	–3.64	***
$BIG4_{it}$	–0.006	–1.61		0.012	2.74	***
Year fixed effect	YES			YES		
F-value	1,925***			1,118***		
Adj. R^2	0.9737			0.9556		
N	1,350			1,350		

Notes: (1) All variables are defined in the Appendix. (2) All continuous variables were winsorized at the top and bottom 1%. (3) ***, **, and * represent significance at the 1, 5, and 10 percent levels, respectively.

technology industry (Korean Standard Industrial Classification code: 21), without incorporating control variables. The higher adjusted R^2 in the present study reflects the enhanced explanatory power achieved through the inclusion of control variables such as firm size, sales volatility, and other factors that influence cost-revenue matching. These results underscore the robustness of the research model in capturing the dynamics of revenue-expense matching in the pharmaceutical and biotechnology sectors.

In this study, the coefficient for the interaction term between the R&D capitalization ratio (*RND*) and current-period expenses (EXP_{it}), $RND{\times}EXP_{it}$, is –0.165 and statistically significant at the 1% level. As predicted in Hypothesis 1, the findings indicate that R&D expenditure capitalization negatively impacts revenue-expense matching in pharmaceutical and biotechnology firms, suggesting discretionary capitalization practices. Additionally, in the model, the coefficients for current-period expenses (EXP_{it}) and subsequent-period expenses (EXP_{it+1}) exhibit positive relationships with current revenue (*REV*) and are both statistically significant at the 1% level. However, the magnitude of the coefficients for current-period expenses (0.894) and subsequent-period expenses (0.088) indicates that the alignment between current-period expenses and current revenues is stronger than that of subsequent-period expenses.

Column (2) presents the analysis results after controlling for the effects of period costs, using the same research period and sample as Column (1). Prior studies suggest that period costs reduce the appropriateness of revenue-expense matching (Srivastava, 2014; Hyun & Cho, 2018). Srivastava (2014) provides empirical evidence that increasing average intangible capital among newly listed U.S. firms reduces revenue-expense matching. Intangible capital is measured using period costs such as R&D expenses, advertising expenses, and selling and administrative expenses. Additionally, Hyun and Cho (2018) find that the alignment between interest expenses and revenues among U.S. firms has weakened over time. In this study, the effects of period costs that may influence reve-

nue-expense matching are controlled, and the impact of R&D expenditure capitalization on revenue-expense matching is analyzed in Column (2). Specifically, following the research model of Cho and Choi (2021), the analysis adjusted the numerator of the total expense (*EXP*) variable by adding depreciation, amortization of intangible assets, R&D expenses, advertising expenses, and interest expenses. In Column (2), the coefficient for the interaction term between the R&D capitalization ratio (*RND*) and current-period expenses (EXP_{it}), $RND \times EXP_{it}$, is −0.266, which is statistically significant at the 1% level. This result supports Hypothesis 1.

In the above analysis, Hypothesis 1 confirms the negative impact of R&D expenditure capitalization on revenue-expense matching in pharmaceutical and biotechnology firms. In this context, Hypothesis 2 examines whether corporate governance can mitigate this negative effect by testing the moderating effect of corporate governance. Following prior research, this study employs the ratio of outside directors as a variable to measure the level of corporate governance.

Table 5 calculates the annual median value of the outside director ratio (*OUT*) and uses this value to divide the sample into two groups. Column (1) shows the relationship between R&D expenditure capitalization and revenue-expense matching in pharmaceutical and biotechnology firms where the outside director ratio exceeds the median. Column (2) displays the same relationship for firms where the outside director ratio is equal to or below the median.

In Column (1), the interaction term between the R&D capitalization ratio (*RND*) and current-period expenses (EXP_{it}), $RND \times EXP_{it}$, is not statistically significant. However, the interaction term between the R&D capitalization ratio (*RND*) and subsequent-period expenses (EXP_{it+1}), $RND \times EXP_{it+1}$, has a coefficient of −0.155 and is statistically significant at the 5% level. The find-

Table 5. The moderating effect of the outside directors on the relationship between R&D capitalization and revenue-expense matching

Variable	Dependent variable = REV_t					
	(1) Proportion of outside directors (*OUT*) > median			(2) Proportion of outside directors (*OUT*) ≤ median		
	Coef.	t-value		Coef.	t-value	
Intercept	−0.049	−0.85		0.027	0.55	
RND_{it}	0.012	0.56		0.021	1.09	
EXP_{jt-1}	−0.005	−0.32		0.031	2.18	**
EXP_{jt}	0.907	48.11	***	0.878	43.12	***
EXP_{jt+1}	0.106	7.05	***	0.074	4.58	***
$RND_{it} \times EXP_{jt-1}$	−0.009	−0.09		0.118	2.45	**
$RND_{it} \times EXP_{jt}$	0.145	1.30		−0.285	−4.12	***
$RND_{it} \times EXP_{jt+1}$	−0.155	−1.98	**	0.072	0.95	
$SIZE_{it}$	0.002	0.80		0.001	0.63	
$SALESVOL_{it}$	0.058	2.32	**	0.005	0.19	
$CFOVOL_{it}$	0.022	0.39		0.027	0.61	
$LOSS_{it}$	0.012	2.02	**	0.001	0.27	
$OPCYCLE_{it}$	−0.002	−0.53		−0.005	−1.32	
$SALESGROWTH_{it}$	0.005	1.27		−0.001	−0.28	
ROA_{it}	1.061	37.57	***	1.106	43.92	***
CFO_{it}	0.102	2.87	***	−0.039	−1.24	
$BIG4_{it}$	−0.007	−1.34		−0.004	−0.79	
Year fixed effect		YES			YES	
F-value		897.8***			1,072 ***	
Adj. R^2		0.9759			0.9730	
N		576			774	

Notes: (1) All variables are defined in the Appendix. (2) All continuous variables were winsorized at the top and bottom 1%. (3) ***, **, and * represent significance at the 1, 5, and 10 percent levels, respectively.

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ings confirm that while the current-period revenue-expense matching is not statistically significant, it exhibits a positive sign, and the negative effect on revenue-expense matching is deferred to the subsequent period. This suggests a positive moderating effect of outside directors (*OUT*) on the relationship between R&D capitalization and subsequent-period expenses. In Column (2), which examines the group of firms where the outside director ratio (*OUT*) is equal to or below the median, the coefficient for the interaction term between the R&D capitalization ratio (*RND*) and current-period expenses (EXP_{it}), $RND \times EXP_{it}$, is –0.285 and statistically significant at the 1% level. As inferred in Hypothesis 2, when corporate governance is not effectively implemented, the negative impact of R&D expenditure capitalization on revenue-expense matching in pharmaceutical and biotechnology firms becomes more pronounced. This indicates that outside directors play a mitigating role in curbing the discretionary capitalization of R&D expenditures.

Table 6 presents the results of the analysis by dividing the sample based on the annual median value of the ownership percentage of the largest shareholder (*LARGEST*). Column (1) examines the relationship between R&D expenditure capitalization and revenue-expense matching in pharmaceutical and biotechnology firms where the ownership percentage of the largest shareholder exceeds the median. Column (2) reports the results for firms where this percentage is equal to or below the median.

In Column (1), the interaction terms $RND \times EXP_{it}$ and $RND \times EXP_{it+1}$ are both statistically significant at the 1% level, with coefficients of –1.488 and 0.528, respectively. These findings indicate that in firms with a high ownership percentage of the largest shareholder, higher levels of R&D capitalization (*RND*) are associated with a weakened alignment between current expenses (EXP_{it}) and current revenues (*REV*), and a stronger alignment between subsequent expenses (EXP_{it+1}) and cur-

Table 6. The moderating effect of the largest shareholder's ownership on the relationship between R&D capitalization and revenue-expense matching

Variable	Dependent variable = REV_t					
	(1) Proportion of largest shareholder's ownership (*LARGEST*) > median			(2) Proportion of largest shareholder's ownership (*LARGEST*) ≤ median		
	Coef.	t-value		Coef.	t-value	
Intercept	–0.051	–1.72	*	-0.032	–0.55	
RND_{it}	–0.018	–1.36		-0.066	–2.87	***
EXP_{it-1}	–0.047	–4.29	***	0.016	1.13	
EXP_{it}	1.081	64.72	***	0.815	43.02	***
EXP_{it+1}	–0.028	–2.31	**	0.112	7.45	***
$RND_{it} \times EXP_{it-1}$	0.994	19.88	***	-0.100	–1.85	*
$RND_{it} \times EXP_{it}$	–1.488	–20.63	***	0.318	4.16	***
$RND_{it} \times EXP_{it+1}$	0.528	6.86	***	-0.060	–0.87	
$SIZE_{it}$	0.001	0.56		0.005	1.71	*
$SALESVOL_{it}$	0.021	1.33		0.024	0.85	
$CFOVOL_{it}$	0.025	0.77		0.084	1.67	*
$LOSS_{it}$	0.008	2.22	**	0.006	0.91	
$OPCYCLE_{it}$	0.004	1.36		-0.007	–1.58	
$SALESGROWTH_{it}$	0.005	1.72	*	0.001	0.18	
ROA_{it}	1.033	53.05	***	1.067	39.35	***
CFO_{it}	0.015	0.74		0.075	2.01	**
$BIG4_{it}$	–0.002	–0.68		-0.005	–0.97	
Year fixed effect	YES			YES		
F-value	3,182***			537.7***		
Adj. R^2	0.9921			0.9531		
N	662			688		

Notes: (1) All variables are defined in the Appendix. (2) All continuous variables were winsorized at the top and bottom 1%. (3) ***, **, and * represent significance at the 1, 5, and 10 percent levels, respectively.

rent revenues (*REV*). In Column (2), which examines pharmaceutical and biotechnology firms where the ownership percentage of the largest shareholder (*LARGEST*) is equal to or below the median, the interaction term $RND \times EXP_{it}$ is statistically significant at the 1% level, with the coefficient of 0.318. This result indicates that in firms with lower concentrated ownership, a higher R&D capitalization ratio (*RND*) enhances the alignment between current expenses (EXP_{it}) and current revenue (*REV*). This finding supports Hypothesis 2, which posits that effective corporate governance mitigates the negative impact of R&D expenditure capitalization on revenue-expense matching. Firms with dispersed ownership structures appear to engage less in opportunistic R&D capitalization practices, leading to improved revenue-expense matching in the current period and reduced deferral of expenses to subsequent periods.

Hypothesis 1 investigates the overall impact of R&D expenditure capitalization on revenue-expense matching in pharmaceutical and biotechnology firms, utilizing data from the full sample period of 2012 to 2022. However, prior research highlights that the 2018 thematic supervision conducted by the FSS prompted firms in this sector to reduce discretionary R&D capitalization practices (Kang & Choi, 2020; Yang & Im, 2021). To address this regulatory intervention, the present study further examines how the relationship between R&D expenditure capitalization and revenue-expense matching evolved before and after the 2018 thematic supervision.

Table 7 provides the results of this analysis, dividing the sample into two periods based on the timing of the FSS supervision. Column (1) shows result for the pre- supervision period (2012–2017), while Column (2) reports the result for post- supervision period (2018–2022). This division allows for a comparative assessment of the regulatory supervision 's impact on the capitalization practices

Table 7. The effect of R&D capitalization on the revenue-expense matching before and after the thematic supervision by the FSS

Variable	Dependent variable = REV_t					
	(1) 2012–2017 (Period before the thematic supervision by the FSS)			(2) 2018–2022 (Period including and after the thematic supervision by the FSS)		
	Coef.	t-value		Coef.	t-value	
Intercept	0.077	1.55		–0.063	–1.29	
RND_{it}	0.016	0.99		0.007	0.21	
EXP_{jt-1}	0.048	2.63	***	–0.003	–0.24	
EXP_{jt}	0.943	32.35	***	0.875	55.00	***
EXP_{jt+1}	0.011	0.46		0.116	9.27	***
$RND_{it} \times EXP_{jt-1}$	0.147	2.77	***	–0.045	–0.68	
$RND_{it} \times EXP_{jt}$	–0.367	–4.77	***	0.168	1.66	*
$RND_{it} \times EXP_{jt+1}$	0.162	2.09	**	–0.129	–1.52	
$SIZE_{it}$	0.000	–0.14		0.003	1.28	
$SALESVOL_{it}$	–0.047	–1.80	*	0.097	4.01	***
$CFOVOL_{it}$	0.043	0.82		–0.015	–0.33	
$LOSS_{it}$	0.010	1.64		0.006	1.08	
$OPCYCLE_{it}$	–0.008	–1.99	**	–0.002	–0.44	
$SALESGROWTH_{it}$	–0.019	–4.07	***	0.009	2.84	***
ROA_{it}	1.111	36.17	***	1.061	45.91	***
CFO_{it}	–0.075	–2.18	**	0.084	2.73	***
$BIG4_{it}$	0.000	0.05		–0.006	–1.27	
Year fixed effect	YES			YES		
F-value	1,203***			1,400***		
Adj. R^2	0.9757			0.9749		
N	629			721		

Notes: (1) All variables are defined in the Appendix. (2) All continuous variables were winsorized at the top and bottom 1%. (3) ***, **, and * represent significance at the 1, 5, and 10 percent levels, respectively.

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of pharmaceutical and biotechnology firms and its subsequent effects on revenue-expense matching. The analysis aims to determine whether scrutiny through the supervision mitigates opportunistic capitalization practices and improves the revenue-expense matching, thereby enhancing the quality of financial reporting in the post- supervision period. By distinguishing between these two periods, the study provides deeper insights into the role of regulatory interventions in shaping accounting practices and their implications for the pharmaceutical and biotechnology industries.

In Column (1), both the interaction term between the R&D capitalization ratio (*RND*) and current-period expenses (EXP_{it}), $RND \times EXP_{it}$, and the interaction term between *RND* and subsequent-period expenses (EXP_{it+1}), $RND \times EXP_{it+1}$, are statistically significant at the 1% and 5% levels, respectively. The coefficients for these interaction terms are −0.367 and 0.162, indicating that before the FSS thematic supervision, pharmaceutical and biotechnology firms were more likely to engage in opportunistic R&D capitalization practices. Specifically, firms with higher levels of R&D capitalization (*RND*) show weaker alignment between current expenses (EXP_{it}) and current revenue (*REV*) and stronger alignment between subsequent expenses (EXP_{it+1}) and current revenue (*REV*). In contrast, in Column (2), the coefficient for the interaction term $RND \times EXP_{it}$ is 0.168 and statistically significant at the 10% level, while the coefficient for $RND \times EXP_{it+1}$ is −0.129 but not statistically significant. These results indicate a decline in discretionary R&D capitalization practices following the FSS thematic supervision.

4. DISCUSSION

The findings from this study provide significant insights into the relationship between R&D capitalization and revenue-expense matching, particularly in the pharmaceutical and biotechnology sectors. The results confirm the hypothesis that higher levels of R&D capitalization negatively impact the alignment of revenues and expenses. The findings align with prior literature (Han, 2010; Kim, 2016), suggesting that discretionary capitalization practices can distort financial reporting and reduce the relevance and reliability of accounting information. The analysis in Table 4 of Column (2) accounts for period costs that may affect revenue-expense matching by incorporating adjustments such as depreciation, amortization, and various expenses, following the framework of Cho and Choi (2021). The findings indicate that the interaction term between the R&D capitalization ratio and current-period expenses has a coefficient of −0.266, statistically significant at the 1% level. These results align with Hypothesis 1, confirming the negative impact of R&D expenditure capitalization on revenue-expense matching.

The moderating effect of corporate governance, as explored through the ratio of outside directors, reveals an essential mechanism in mitigating the adverse impact of R&D capitalization. Specifically, pharmaceutical and biotechnology firms with more outside directors demonstrate a reduced tendency to defer expenses to subsequent periods for earnings management purposes when the R&D capitalization ratio is high. This suggests that firms with more outside directors tend to capitalize on R&D expenditures based on objective and rational justifications rather than discretionary accounting practices. Furthermore, these firms exhibit greater appropriateness in revenue-expense matching, indicating a higher quality of financial reporting. Conversely, firms with a low proportion of outside directors face an exacerbated negative impact. These findings confirm the positive moderating effect of outside directors on the relationship between R&D capitalization and revenue-expense matching, underscoring the importance of robust corporate governance in enhancing the quality of financial reporting (Peasnell et al., 2005; Srinivasan, 2005; Deutsch, 2007; Chen et al., 2020).

The ownership structure is critical in shaping the relationship between R&D capitalization and revenue-expense matching. Firms with concentrated ownership, characterized by high ownership percentages of the largest shareholder, are more likely to engage in discretionary capitalization practices, as evidenced by the weaker alignment between current expenses and revenues and the stronger alignment between subsequent expenses and revenues. These results suggest that firms with concentrated ownership structures may en-

gage in discretionary R&D capitalization practices, which reduce the alignment of current expenses with current revenue. Instead, these firms appear to defer expenses to subsequent periods, likely as a form of earnings management. This behavior reflects an attempt to inflate current-period earnings at the expense of future earnings quality, highlighting the potential for opportunistic practices in firms with concentrated ownership. In contrast, firms with dispersed ownership structures appear to engage less in opportunistic R&D capitalization. These contrasting results confirm the moderating effect of dispersed ownership structures on the relationship between R&D capitalization and revenue-expense matching. Moreover, the findings in Table 6 align with the entrenchment hypothesis within the Korean pharmaceutical and biotechnology industry context. Dispersed ownership structures contribute positively to corporate governance by reducing managerial entrenchment and fostering healthier financial practices. This highlights the role of ownership dispersion in promoting more transparent and accountable accounting behaviors, ultimately enhancing the quality of financial reporting (Park, 2003; Lee et al., 2012).

Finally, the additional analysis surrounding the 2018 thematic supervision by the FSS provides valuable evidence of the regulatory impact on R&D capitalization. Prior to the supervision, firms in the pharmaceutical and biotechnology sectors exhibited significant discretionary behavior, with a weaker alignment between current expenses and revenues and a stronger alignment between subsequent expenses and revenues. However, following the FSS supervision, these opportunistic practices declined, as evidenced by improved alignment between current expenses and revenues. The findings suggest that R&D expenditures are capitalized more objectively and in accordance with rational criteria, leading to an improvement in the alignment between current expenses and current revenue. Furthermore, during the thematic supervision, the FSS issued specific guidelines and supervisory instructions related to R&D expenditure accounting in the pharmaceutical and biotechnology industry. Remedial measures for 10 firms also contributed to reducing opportunistic R&D capitalization, highlighting the effectiveness of the FSS audit in enhancing financial reporting practices (Kang & Choi, 2020; Yang & Im, 2021).

CONCLUSION

The study aims to investigate the effects of R&D expenditure capitalization on revenue-expense matching in pharmaceutical and biotechnology firms, with a particular focus on the moderating role of corporate governance. The findings indicate that discretionary R&D capitalization practices weaken current revenue-expense matching, thereby compromising the quality of financial reporting. However, firms with robust governance structures – characterized by a higher proportion of outside directors and dispersed ownership – demonstrate stronger revenue-expense matching, as these mechanisms enhance oversight and curtail opportunistic behaviors. The results also show the significant impact of the FSS thematic supervision in 2018 on R&D capitalization practices. Prior to the supervision, discretionary practices significantly decreased revenue-expense matching. In contrast, post-supervision, stricter adherence to accounting standards led to improved revenue-expense matching, highlighting the effectiveness of regulatory intervention in enhancing financial reporting quality.

The findings of this study offer valuable implications for industry practices and regulatory policy. They emphasize the importance of robust corporate governance mechanisms in the pharmaceutical and biotechnology sectors, such as increasing the proportion of outside directors and fostering dispersed ownership structures, to mitigate the adverse effects of discretionary R&D capitalization on revenue-expense matching. These governance structures enhance oversight, curtail opportunistic behavior, and improve the quality of financial reporting. Additionally, the study highlights the critical role of regulatory intervention, demonstrated by the FSS's thematic supervision in 2018, which significantly improved revenue-expense matching. By comparing the pre-supervision period (2012–2017) with the post-supervision period (2018–2022), the analysis illustrates the impact of FSS oversight on R&D capi-

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talization practices. While discretionary capitalization during the pre-supervision period weakened the matching between current expenses and revenues, the post-supervision period exhibited significant improvements in revenue-expense matching, affirming the effectiveness of regulatory measures in enhancing financial reporting quality. These findings underscore the necessity of combining strong corporate governance with effective regulatory oversight to ensure the transparency, reliability, and integrity of financial reporting, particularly in R&D-intensive industries.

AUTHOR CONTRIBUTIONS

Conceptualization: Dongjoon Choi.
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APPENDIX A

Table A1. Variable definition

Variable	Definition
Dependent Variable	
REV	Revenue ÷ average total assets
Independent Variables	
RND	Capitalized R&D expenditures ÷ total R&D expenditures
EXP	Total expenses (= revenue – income before tax) ÷ average total assets
Control Variables	
SIZE	Natural logarithm of total assets
SALESVOL	Standard deviation of revenue over the past 5 years ÷ average total assets (only includes firms with at least 3 years of revenue data)
CFOVOL	Standard deviation of operating cash flows over the past 5 years ÷ average total assets (only includes firms with at least 3 years of operating cash flow data)
LOSS	Indicator variable that equals 1 if the firm's net income is negative in the previous year and zero otherwise
OPCYCLE	Natural logarithm of the operating cycle (calculated as the average of the sum of accounts receivable turnover period and inventory turnover period over the past 5 years, including only firms with at least 3 years of operating cycle data)
SALESGROWTH	Current year revenue ÷ previous year revenue
ROA	Net Income ÷ average total assets
CFO	Operating cash flow ÷ average total assets
BIG4	Indicator variable that equals 1 if the firm is audited by a Big 4 accounting firm, and 0 otherwise

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