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R&D Disclosures and Informativeness of Future Earnings

This study examines the effect of research and development (R&D)-related disclosures on the informativeness of share prices about future earnings. Considering the importance of R&D to companies, but mindful of its inherently uncertain nature, R&D disclosure is an important source of information for investors to assess the future prospects of the firm. Using a sample of 6,490 firm-year observations reporting under IFRS from 15 countries over a 10-year period, we show that R&D disclosure conveys information about future earnings, which is incorporated in current returns. Thus, R&D disclosure allows investors to better anticipate future earnings. We find that this result is driven by disclosures in the narratives section of the annual report, which includes the management discussion section. In additional tests, we *inter alia* show that these findings are primarily driven from firms capitalizing development costs and they are not dependent on the level of stringency of national regulations about R&D disclosures in the narrative section of the annual reports. This is the first study to consider whether R&D-related disclosure assists investors in better anticipating future earnings and, thus, contributes to the accounting literature and raises important policy implications.

Key words: Research and development; R&D; Disclosures; IAS 38; IFRS.

In this study, we examine the association between research and development (R&D) disclosures and the informativeness of stock prices. We effectively test

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whether R&D disclosure conveys information that assists investors to better predict future earnings and reflect this information into current returns.

Investment in R&D facilitates growth and is a necessary expenditure for firms, especially those in R&D-intensive sectors, to remain competitive (Lev, 1999; Jaruzelski *et al.*, 2005; Curtis *et al.*, 2020). This is recognized by buy- and sell-side analysts who have been quoted to state that 'R&D is absolutely fundamental to the future of any commercial organization' and 'it determines for many companies, whether it will be around in the future' (Mazzi *et al.*, 2022, p. 10). Consistent with this, prior archival research shows that R&D expenditure is positively associated with a firm's future operating performance (Mazzi *et al.*, 2019a; Curtis *et al.*, 2020; Hou *et al.*, 2022), market values (Hall, 1993; Sougiannis, 1994), and subsequent stock returns (Lev, 1999; Lev and Sougiannis, 1996; Chan *et al.*, 2001; Duqi *et al.*, 2015; Hou *et al.*, 2022).

However, despite the importance of R&D, the related future payoffs are well recognized as being inherently uncertain (Hussinger and Pacher, 2019). Consistently, prior literature shows that R&D expenditure is positively associated with greater volatility in future earnings (Kothari *et al.*, 2002; Amir *et al.*, 2007; Johnston, 2012; Dargenidou *et al.*, 2021) or volatility of market returns (Chan *et al.*, 2001; Chambers *et al.*, 2002; Amir *et al.*, 2007). Additionally, outsiders cannot infer relevant information only by observing the productivity of R&D projects in other firms or by referring to an organized R&D market (Aboody and Lev, 2000). This is further amplified by the fact that firms bundle together 'unknown expenditures with unknown links to future benefits' (Wyatt, 2008, p. 224). Thus, R&D expenditure causes information asymmetry between insiders and outsiders.

Management has information that can help investors to estimate future payoffs (Barker *et al.*, 2022) and, inevitably, investors 'will look around for further information that will allow them to make better inferences' (Dargenidou *et al.*, 2018, p. 485). Indeed, both Entwistle (1999) and, more recently, Mazzi *et al.* (2022) report on their respective interviews with analysts that R&D disclosure assists in valuing a firm's stock. For example, Mazzi *et al.* (2022, p. 17) quote analysts stating that R&D disclosure 'gives you a sense as to whether that [R&D] expenditure is in the shareholders' interests or not' and allows one to 'understand what the inputs are, so they can better ... forecast the outputs'. Similar evidence is also reported in the UK Endorsement Board (UKEB) 2023 report, which explores the views of UK stakeholders with respect to accounting for intangibles. More specifically, investors were quoted to state that more disclosure about intangibles in general 'is incredibly useful when it gives you information on non-cash items' (UKEB, 2023, p. 79).¹ From the foregoing, we hypothesize that greater levels of disclosure around R&D would allow investors to better anticipate future earnings and reflect this information into current prices. In other words, R&D disclosure would result in more informative stock prices about future earnings.

¹ The importance of R&D disclosure has also been highlighted by preparers of accounting reports in the UK (Nixon, 1997).

To measure R&D disclosure, as in Merkley (2014) and Oh *et al.* (2024), we developed a dictionary of 119 R&D-related key words. Using a computerized content analysis approach, we identified the number of times each firm made reference to each of the key words in our list in the annual report. Our sample comprises 6,490 firm-year observations of R&D-active firms, over a 10-year period, from the top 15 countries based on listed firms' R&D intensity.

The key finding from our empirical analysis is that R&D disclosures in the annual report are indeed informative to investors for anticipating future earnings. As the frequency of R&D disclosure increases, current returns reflect more future earnings information. However, this finding holds only for R&D disclosure from the narratives section of the annual report that contains the management discussion section. The observed low levels of R&D disclosure in the financial statements section of the annual report reflect the lack of mandatory disclosure requirements in IAS 38 *Intangible Assets* (cf, Dionysiou *et al.*, 2023; Mazzi *et al.*, 2022) and, as such, are not informative. This is also reflective of the findings reported by the UK Endorsement Board that the most common source of R&D-related information is the 'front half' of the annual report (UKEB, 2024). Overall, these findings suggest that R&D disclosures affect 'the mix of current versus future information that is reflected in the current stock return' (Lundholm and Myers, 2002, p. 810). Thus, such disclosures indeed serve their primary purpose 'to inform investors about the amount, timing, and uncertainty of future cash flows' (Gelb and Zarowin, 2002, p. 34).

In additional tests, we first explore whether our findings are affected by the topic of R&D disclosure. Specifically, we classify the key words into broad topics based on their nature, namely: *Research Phase*; *Development Phase*; *Conditions for Capitalization*; and *Intellectual Property*. Our results show that disclosures with regards to *Research Phase* and *Intellectual Property* communicate information that assists investors to better anticipate future earnings and incorporate this information into current market prices across the full sample. When we repeat this analysis separately for firms that expense all R&D expenditure (expensers) and those that capitalize some or part of the R&D expenditure for the year (capitalizers), we find that our findings mostly hold for capitalizers. In fact, we find that R&D-related disclosures are informative for capitalizers for three of the four topics examined. These findings provide support to the conjecture by Dinh *et al.* (2020) that R&D disclosures can act as a complement to R&D capitalization. R&D disclosure in relation to the *Conditions for Capitalization* is the only one for which we observe minimal disclosures. Not surprisingly, it is therefore not informative to investors to predict future earnings. Further, we explore the potential moderation of these findings from the stringency of national disclosure requirements around R&D activities in the narratives section of the annual report. We find that R&D-related disclosures assist investors to better anticipate future earnings of capitalizers, irrespective of the strength of national regulation. Subsequently, we examine the potential impact that two country-level institutions have on our findings: corruption and accounting and audit enforcement. The results from these tests show that our key finding that R&D disclosures are indeed informative about future earnings holds only

for the sub-sample of firms headquartered in countries with lower levels of corruption and in countries with strong accounting and audit enforcement. Thus, these findings indicate that higher-quality formal and informal institutional mechanisms play a significant role in whether R&D disclosure assists investors to anticipate future earnings.

This study contributes to the literature in a number of ways. First, it is the first study to examine the effect of R&D disclosure on the relationship between current stock returns and future earnings and whether this result differs across topics of R&D disclosures. This setting allows us to directly assess a primary objective of disclosures to ‘help investors to predict the future’ (Gelb and Zarowin, 2002, p. 34). Prior literature has thus far examined whether R&D-related disclosures are associated with market values (Xu *et al.*, 2007; Chen *et al.*, 2017; Cao *et al.*, 2018; Dinh *et al.*, 2020; Yu *et al.*, 2022), information asymmetry (Guo *et al.*, 2004; Merkley, 2014), analysts’ forecast dispersion and accuracy (Jones, 2007; Merkley, 2014), and cost of equity financing (La Rosa and Liberatore, 2014). In contrast to these studies, we focus on how well stock returns incorporate information about future earnings. This allows us to examine the informational efficiency of stock prices. This is important because more informationally efficient prices facilitate more efficient resource allocation (Durnev *et al.*, 2003). Further, the US setting in Guo *et al.* (2004), Jones (2007), Xu *et al.* (2007), Merkley (2014), and Cao *et al.* (2018) does not allow for considering the role of the capitalized development costs specified under IAS 38 and any influence this may have on related disclosures. In contrast to these US-based studies, we employ an international sample of firms from 15 countries reporting under IFRS.

Second, this study is related to the stream of literature that examines whether capitalization of development costs improves the market’s ability to anticipate future earnings. Specifically, Oswald and Zarowin (2007) use a sample of UK firms prior to the adoption of IFRS and show that the capitalization of R&D results in share prices incorporating more forward-looking earnings information. Nevertheless, Dargenidou *et al.* (2021) show that the findings in Oswald and Zarowin (2007) only holds for the pre-IFRS adoption period. However, in addition to the lack of a significant effect of capitalization on the informativeness to future earnings under IFRS in Dargenidou *et al.* (2021), none of the two studies examines or even controls for the potential informativeness of R&D-related disclosures. Hence, our research design is more complete in that we examine the informativeness of R&D disclosures, while also controlling for capitalization of development costs. Thus, our differential findings across capitalizers and expensers bring new insights in the literature, given the mixed evidence in the single-country studies of Chen *et al.* (2017) and Dinh *et al.* (2020) about the influence of R&D-related disclosures on the association of capitalized development costs and firm value.

Finally, we contribute to the stream of literature that examines the effect of corporate disclosures more broadly on the share price anticipation of future earnings. For instance, prior studies employ disclosure indexes based on AIMR ratings (e.g., Gelb and Zarowin, 2002; Lundholm and Myers, 2002) or the transparency and disclosure (T&D) index prepared by Standard and Poor (S&P) (Dargenidou *et al.*, 2011) and show that these disclosure indexes assist investors to

better anticipate future earnings. Further, this stream of literature shows that forward-looking disclosures in the annual report enhance investors' ability to anticipate future earnings (e.g., Schleicher *et al.*, 2007; Wang and Hussainey, 2013; Athanasakou and Hussainey, 2014). In addition, this stream of literature documents similar effects with respect to voluntary risk disclosures (Moumen *et al.*, 2016) and the revelation of additional business segments (Ettredge *et al.*, 2005). However, despite its importance, this literature has not examined whether R&D disclosure in particular assists investors to better anticipate future earnings. This study fills this void.

Our findings have important policy implications and contribute to the ongoing debate on accounting for intangibles. First, this study provides timely evidence to the International Accounting Standards Board (IASB) which, in April 2022, added the accounting for, and disclosure of, intangible assets to its work plan for 2022 to 2026 (IASB, 2022) and commenced work during 2024 (UKEB, 2024). The IASB has indicated that a review of IAS 38 would be a complex and time-consuming project and suggested that the project should be undertaken in stages, with the first stage being on 'the development of enhanced disclosure requirements, including disclosures about unrecognised intangible assets' (IASB, 2022, para. 37). Our evidence supports this project given that such disclosures (and especially on key aspects of R&D disclosure of capitalizers (*Research Phase, Development Phase, and Intellectual Property*)) are indeed informative to investors. In contrast, IAS 38 currently specifies minimal mandatory disclosures despite calls from investors for additional disclosures (e.g., Mazzi *et al.*, 2022; UKEB, 2024). Finally, our findings also inform the Financial Accounting Standards Board's (FASB) Accounting for and Disclosure of Intangibles project, which 'will consider potential ways to improve the accounting for and disclosure of intangibles, including internally developed intangibles and research and development'.²

BACKGROUND AND LITERATURE REVIEW

IAS 38 and R&D Disclosures

IAS 38 was issued in 1998, and remaining in place with no substantial changes requires firms to recognise an internally generated intangible asset if, and only if, an entity can demonstrate that the investment meets the criteria stipulated in Paragraph 57.³ Expenditure not meeting these criteria should be expensed as incurred. Further, the standard requires firms to disclose separately the R&D

² <https://www.fasb.org/projects/current-projects/objective-research>

³ Specifically, management needs to demonstrate: the technical feasibility of completing the intangible asset; the intention to complete the intangible asset; the ability to sell (or use) the intangible asset; that the asset will generate future economic benefits; the availability of adequate resources (technical, financial, or other), to complete the asset; and, the ability to reliably measure the expenditure.

capitalized and/or expensed amounts, on the condition that this information is material. Moreover, as for any class of intangible asset that firms decide to report separately, Paragraph 118 of IAS 38 requires them to disclose: 1) whether the useful life of the asset is indefinite or finite and, if finite, the useful life or the amortisation rate; 2) the amortisation method for assets with finite life; 3) the gross carrying amount and any accumulated amortisation; 4) the line item(s) of the statement of comprehensive income in which any amortisation of intangible assets is included; and 5) reconciliation of the carrying amount at the beginning and end of the period. These are the only mandatory disclosure requirements. Outside of these, the only non-financial disclosure companies are *encouraged*, but not *required*, to disclose is ‘a brief description of significant intangible assets ... not recognised as assets because they did not meet the recognition criteria’ (para. 128). The lack of mandatory disclosure requirements in IAS 38, and in particular non-financial/qualitative, is despite the preferences from the investment community and the pressure from International Organisation of Securities Commissions (IOSCO) for more enhanced disclosures at the time the standard was issued (Cairns, 1999, p. 390; Entwistle, 1999; Mazzi *et al.*, 2022). In fact, the preamble to IAS 9 *Research and Development Costs* (revised in 1993), the predecessor to IAS 38, set out that ‘further information which might usefully be provided could include a general description of the project, the stage which the project has reached, and the estimated future costs to complete it’ (para. 14). This was not part of the standard itself but rather served as an indication as to the potential importance of additional disclosures to users of financial statements. Such a statement is absent from IAS 38.

Reflective of the growing importance of R&D (and despite the minimal mandatory disclosure requirements in IAS 38), an annual report contains R&D-related information outside the financial statements. In many cases, such disclosures are reflective of local regulations but consequently will vary significantly across jurisdictions. For example, since 2002, Article 2428 point 1 of the Italian Civil Code requires management to discuss R&D activities in *relazione sulla gestione*, which is the management discussion and analysis of the annual report. However, despite the mandatory treatment of capitalized development costs in IAS 38, the Article provides little guidance with respect to further quantitative or qualitative disclosures with regards to capitalization (Markarian *et al.*, 2008a, 2008b). More widely, other European firms are required to ‘give an indication of ... activities in the field of research and development’ according to Section 9 Article 46 of the Fourth Directive 78/660/EC, which refers to the contents of management report (see also La Rosa and Liberatore, 2014).⁴ Notably, the Directive is not very detailed and allows member states to decide whether to impose additional disclosure requirements. For example, in the UK, since 2007, Disclosure and Transparency Rule (DTR) 4.1.11R requires listed firms to provide disclosures with respect to ‘activities in the field of research and development’ in the management report (FCA 2023a: 54). Similar to the Italian

⁴ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:1978L0660:20090716:EN:PDF>

Article, the requirement is not prescriptive and makes no explicit reference to financial-related disclosures (Dionysiou *et al.*, 2023). However, German Accounting Standard (GAS) 15 *Management Reporting* effective from 2005, and the predecessor to GAS 20 *Non-Financial Reporting*, effective from 2012, both mandate R&D disclosures (Dinh *et al.*, 2020). Specifically, firms are required to disclose inputs and outputs of R&D activities along with R&D-related co-operations and employees (ASCG, 2004; Dinh *et al.*, 2020).

A notable example outside of the EU is China. Since 2012, the China Securities Regulatory Commission (CSRC) has also required more detailed R&D disclosures in the narratives section of annual reports. Specifically, Article 27(c) in the ‘Standards Concerning the Content and Formats of Information Disclosure by Companies Offering Securities to Public No. 2—Contents’ mandates both financial and non-financial R&D disclosures (Dionysiou *et al.*, 2023; Li and Zou, 2024). In Appendix A, we summarize the national requirements for R&D-related disclosures in annual reports for the 15 countries in our sample.

Against this backdrop, it is not surprising that users of financial statements would need to rely on management’s disclosure of R&D-related activities at the front-end of the annual report, which consists largely of voluntary narrative information (Stark, 2008; Wyatt, 2008; Lev, 2018). Thus, in this study, we capture R&D-related disclosures across the entire annual report and examine whether these disclosures assist investors to better anticipate future earnings and reflect this information in current returns.

Literature Review and Hypothesis Development

Disclosures and informativeness of future earnings In general, prior literature on price anticipation of future earnings documents that various types of disclosures assist investors to better anticipate future earnings and reflect this information in current returns. For instance, Gelb and Zarowin (2002) and Lundholm and Myers (2002) use a sample of US firms and show that disclosures, measured by AIMR disclosure ratings, assist investors to better incorporate future earnings information in current returns. Outside the US context, Dargenidou *et al.* (2011) use the transparency and disclosure (T&D) index prepared by Standard and Poor’s (S&P) across a sample of European firms and report that the index assists investors to better anticipate future earnings information in current returns.⁵ Athanasakou and Hussainey (2014), Schleicher *et al.* (2007), and Wang and Hussainey (2013) all find that voluntary forward-looking narrative disclosures in annual reports of UK firms enhances investors’ ability to anticipate future earnings.

Prior literature has also examined the impact of more specific disclosures on the market’s ability to anticipate future earnings. In the US context, Ettredge *et al.* (2005) show that revealing additional business segments as a result of adopting SFAS No. 131 assists investors to better anticipate future earnings. Finally, using a

⁵ Similar to AIMR disclosure ratings, S&P’s T&D index includes both financial and non-financial as well as voluntary and mandatory disclosures.

sample of firms from emerging markets in the Middle East and Asia, Moumen *et al.* (2016) show that voluntary risk disclosures allow investors to better predict future earnings. Overall, this evidence supports Gelb and Zarowin's (2002, p. 34) statement that disclosures serve their primary purpose 'to inform investors about the amount, timing, and uncertainty of future cash flows'.

Hypothesis development Prior archival studies document favourable market reactions of R&D-related disclosures. For instance, Guo *et al.* (2004) focus on product-related disclosures in IPO prospectuses of US biotech firms and examine whether these disclosures are informative to investors. The results show that the disclosures are indeed informative and are associated with lower information asymmetry. Jones (2007) argues that R&D disclosure decreases analysts' uncertainty about the future economic benefits associated with R&D and shows that such disclosures lead to lower forecast errors for R&D-intensive firms. Xu *et al.* (2007) argue that disclosures regarding the uncertainty associated with R&D should enhance investors' understanding of R&D expenditure. Consistently, they show, using a sample of US biotech firms, that R&D disclosures, such as the number of drugs in the drug portfolio, alliance intensity, the number of granted/ filed patents, and whether the company targets high-profile diseases, are priced by investors. While focusing on R&D disclosures in the 10-K filings of US firms, Merkley (2014) argues that such disclosures allow managers to provide investors with contextual information about their firms and examine whether they are informative. He shows that R&D disclosure improves analyst following, earnings forecast accuracy, earnings forecast dispersion, and the information content of 10-K filings. He further documents that such disclosures are associated with a decrease in information asymmetry. Cao *et al.* (2018) document positive market reactions to product development press releases for US firms, consistent with the notion that such disclosures reduce investors' uncertainty.

In contrast to the US setting, there is limited and in fact conflicting evidence for firms reporting under IFRS. Chen *et al.* (2017) and Dinh *et al.* (2020) show that R&D disclosure is informative for investors and such disclosures are positively related to firm value in the Israeli and German settings respectively. However, Dinh *et al.* (2020) show that capitalized development costs weaken the positive association between R&D disclosure and firm value, while Chen *et al.* (2017) show that capitalizing development costs enhances the positive association between R&D disclosure and firm value. Further, contrary to the argument that R&D disclosure leads to positive market outcomes, La Rosa and Liberatore (2014) focus on biotech and chemical firms from eight European countries and show that R&D disclosures in the annual report increase the cost of the equity financing. This effect is driven by those R&D disclosures that provide sensitive information such as strategic aspects and discussion on patents, which could harm the competitive advantage of a firm.

Overall, these findings suggest that R&D disclosures are an important source of information for investors and that disclosures, in general, tend to assist investors to predict future earnings. On reflection of this and the evidence from archival

(e.g., Hall, 1993; Sougiannis, 1994; Lev and Sougiannis, 1996; Lev, 1999; Chan *et al.*, 2001; Duqi *et al.*, 2015; Hou *et al.*, 2022) as well as qualitative research (i.e., Entwistle, 1999; Mazzi *et al.*, 2022; UKEB, 2023) cited in the introduction on the importance of R&D expenditure and related disclosures to investors, we conjecture that R&D disclosure enables investors to better understand the value and future benefits arising from R&D and, therefore, assists them to better anticipate future earnings. Thus, we develop the following testable hypothesis:

H1: The association between current stock returns and firm future earnings increases as R&D disclosure levels increase.

METHODS AND DATA

Measuring R&D Disclosure

As in Merkley (2014) and Oh *et al.* (2024), we capture the quantity of R&D-related disclosures using a computerised content analysis of annual reports. Specifically, we use a dictionary of 119 R&D-related key words and terms (hereafter key words) and the MaxDictio application in MaxQDA to search each annual report and to identify the number of times each firm makes reference to each of the key words in our list. The sum of these frequencies for each key word results in the total disclosure score. The key benefit of such an approach is that it allows us to analyse a large sample of companies' annual reports (Merkley, 2014). Additionally, using a computerized approach to content analysis ensures that the results are reliable in terms of reproducibility, stability, and accuracy (Weber, 1990; Sekaran, 1992; Jones and Shoemaker, 1994). We focus on annual reports because it is well known that professional investors, and in particular buy-side and sell-side analysts, use the available information in them for R&D active firms (Mazzi *et al.*, 2022).

In substance, our key words list is the one used in Mazzi *et al.* (2019b),⁶ augmented by three additional key words. The main advantages of using this list are the following. First, the list includes the key words used in Merkley (2014). However, Merkley (2014) focuses on the US setting where US GAAP does not permit the capitalization of development costs and hence his list consists of 68 words.⁷ Given that, as in this research, Mazzi *et al.* (2019b) focus on an international sample of firms reporting under IFRS, they supplement Merkley's

⁶ Available in their Appendix II: https://www.accaglobal.com/content/dam/ACCA_Global/professional-insights/Intangibles/pi-intangibles-R%26D.pdf

⁷ Specifically, FASB Accounting Standards Codification (ASC) Topic 730, formerly Statement of Financial Accounting Standards (SFAS) No. 2 (1974), requires the immediate expensing of all R&D expenditure. The only exemption is FASB's ASC Topic 985, formerly SFAS No. 86 (1985), which permits the conditional capitalization of software development expenditures.

(2014) list and include key words related to the terms referred to in IAS 38, including references to the development phase of the R&D process and the criteria of development costs capitalization. To do so, Mazzi *et al.* (2019b) rely on prior related studies (Guo *et al.*, 2004; Jones, 2007; La Rosa and Liberatore, 2014; Nekhili *et al.*, 2016; Chen *et al.*, 2017; Dinh *et al.*, 2020) and their own thorough reading of IAS 38. They also consulted two independent experts who are professional accountants with significant experience.⁸ These experts commented on the constituents of this list and hence effectively the semantic validity (Weber, 1990; Jones and Shoemaker, 1994) of the key words list. Further, the results related to the determinants of the disclosure levels reported in Mazzi *et al.* (2019b) confirm the construct and hypothesis validity (Weber, 1990; Jones and Shoemaker, 1994) of the key words list. Nevertheless, to further ensure the validity of the research instrument that we use, we also performed several additional validity tests. These are discussed in Appendix C.

In addition, a unique feature of this study is that we explore the themes around R&D that firms refer to and the extent to which these reflect the themes discussed in IAS 38.⁹ Specifically, having accommodated feedback received from experienced professionals, an anonymous reviewer, and the discussants at the IASB Research Forum, we classify the key words across four broad topics: *Research Phase*; *Development Phase*; *Conditions for Capitalization*; and *Intellectual Property*.¹⁰ This allows us to gauge the nature/topics of R&D disclosure that firms concentrate on and subsequently whether it is certain clusters of disclosures that affect the market's ability to anticipate future earnings. *Research Phase* includes words associated with the early stage of R&D and contains 40 key words such as 'research program' or 'research finding'. *Development Phase* includes 55 key words relating to development of a product or service and includes key words such as 'product development', 'development cost', or 'developing technology' that are mentioned across paragraphs 58 to 64 in IAS 38. Reflecting on the conditions stated in paragraph 57 of IAS 38 for the capitalization of development costs as an asset on the balance sheet, *Conditions for Capitalization* includes 15 key words such as 'ability to sell' or 'existence of a market'. The remaining nine key words, such as 'patent' or 'possible alliance' are arguably not directly related to any of the other three topics and hence have been classified in the final

⁸ Richard Martin (former Head of Corporate Reporting, ACCA) and Alan Teixeira (Global Director of IFRS Research, Deloitte).

⁹ It is common for prior literature to identify topics within the overall theme of disclosures of interest. For instance, Bao and Datta (2014) focus on risk disclosures and create 30 topics, while Friberg and Seiler (2017) create two topics, namely risk and ambiguity.

¹⁰ We are grateful to James Baird (*inter alia*, Chair of Audit Committee in the Macfarlane Group plc and former Deloitte Managing Partner), Andrew Lennard (former Director of Research, Financial Reporting Council), Aaron Saw (Head of Corporate Reporting Insights—Financial, ACCA), members of the UK Endorsement Board Secretariat, Chuan Yu (University of Sydney), and Ann Tarca (IASB Board member). Their comments and suggestions assisted us in the formation of these four topics. It is noted that the views of these individuals on this specific issue represent their own views and not the views of their organizations.

topic, *Intellectual Property*. Effectively these key words capture the various stages and outcomes of the R&D process as well as the related necessary considerations from an accounting point of view. Appendix B lists all 119 key words across the four topics, along with their frequencies in the annual reports analysed in this research.

Considering the lack of mandatory disclosure requirements in IAS 38 and the varying levels of country regulations/guidance for disclosures of often unaudited R&D-related disclosures in the narratives section of an annual report across countries, we split each report in two parts manually: namely the financial statements (FS) part, which consists of the financial statements (including the notes to the accounts) and auditors' report; and the narratives (NR) part, effectively the remaining sections of the annual report. The sum of these frequencies results in the total disclosure score in the annual report. Having computed separate scores for each of the two sections of the annual report allows us to explore not only the effect of the total R&D-related disclosures on assisting investors to better predict future earnings but also whether management's R&D-related disclosures across the two sections have a differential effect on assisting investors to better predict future earnings.

R&D-related Disclosures and Share Price Anticipation of Future Earnings

To test our hypothesis that R&D disclosure assists investors to better anticipate future earnings, we use the model developed by Collins *et al.* (1994) and subsequently modified by Lundholm and Myers (2002). This model is based on the premise that current returns relate to changes in expectations about future earnings and due to the unexpected portion of the current year's earnings realisation; thus it expresses current returns as a function of future, current, and past earnings. It has been extensively used by prior literature to examine whether firm disclosures affect the market's ability to anticipate future earnings on a number of settings. For instance, Lundholm and Myers (2002) examine whether firms' disclosures based on the AIMR 'bring the future forward', by revealing relevant news about future earnings which investors impounded into current returns. Subsequent literature has used this model in a number of settings to examine whether various type of disclosures and other information assist investors to better anticipate future earnings, such as credit ratings (Chou, 2013), segmental information (Ettredge *et al.*, 2005), capitalization of development costs (Oswald & Zarowin, 2007; Dargenidou *et al.*, 2021), risk disclosures (Moumen *et al.*, 2016), forward-looking disclosures (Athanasakou and Hussainey, 2014), or more broadly other voluntary disclosures (Gelb and Zarowin, 2002; Hussainey & Walker, 2009; Dargenidou *et al.*, 2011). In line with this literature, we employ the following model:

$$R_{i,t} = a_0 + b_1 E_{i,t+1} + b_2 E_{i,t} + b_3 E_{i,t-1} + b_4 R_{i,t+1} + \varepsilon_{i,t} \quad (1)$$

where $R_{i,t}$ represents the annual stock return of firm i in year t , measured from nine months before the year-end to three months after the year-end (*CURR_R*),

$E_{i,t+1}$ represents firm's i earnings in year $t+1$ (FUT_E), $E_{i,t}$ represents firm's i earnings in year t ($CURR_E$), $E_{i,t-1}$ represents firm's i earnings in year $t-1$ (LAG_E), and $R_{i,t+1}$ represents the annual stock return of firm i in year $t+1$ (FUT_R). Earnings are scaled by the market value of equity measured at the firm's year-end.

In line with Collins *et al.* (1994), the coefficient of $E_{i,t+1}$ captures the information about future earnings incorporated in current returns not already captured by current and past earnings. It is known as the future earnings response coefficient (FERC) and is expected to be positive, indicating that current returns reflect future earnings information. Following Ettredge *et al.* (2005), Dargenidou *et al.* (2011), and Dargenidou *et al.* (2021), we use one-year-ahead earnings.¹¹ This is motivated by the investment practices of investors who rely on one-year forecasts (Imam *et al.*, 2008; Demirakos *et al.*, 2010). Further, if realized earnings in time $t+1$ are higher (lower) than expected, returns should increase (decrease) accordingly leading to a negative coefficient for $R_{i,t+1}$ (Tucker and Zarowin, 2006). The coefficient of $E_{i,t-1}$ is expected to be negative and it captures the already anticipated portion of current earnings, $E_{i,t}$, (Lundholm and Myers, 2002). The coefficient of $E_{i,t}$ is commonly referred as the earnings response coefficient and is expected to be positive.

Then, in line with the studies mentioned earlier, we extend equation (1) by introducing $LN_DISC_{i,t}$, which is the natural logarithm of the frequency of R&D-related terms (see 'Multivariate Analysis' section for details). We include $LN_DISC_{i,t}$ both as a main effect and also as an interaction with all other independent variables, as follows:

$$R_{i,t} = a_0 + b_1 E_{i,t+1} + b_2 E_{i,t} + b_3 E_{i,t-1} + b_4 R_{i,t+1} + b_5 E_{i,t+1} * LN_DISC_{i,t} + b_6 E_{i,t} * LN_DISC_{i,t} + b_7 E_{i,t-1} * LN_DISC_{i,t} + b_8 R_{i,t+1} * LN_DISC_{i,t} + LN_DISC_{i,t} + CONTROLS + \varepsilon_{i,t} \quad (2)$$

In this case, the coefficient of $E_{i,t+1}$ captures the information about future earnings incorporated in current returns for firms with low R&D disclosure. The coefficient of interaction between future earnings and R&D disclosure, $E_{i,t+1} * LN_DISC_{i,t}$, captures the information about future earnings incorporated in current returns for firms with a higher level of R&D-related disclosures and it is the focal variable of interest. In line with Hypothesis 1, we expect the coefficient to be positive and significant, indicating that R&D disclosure improves the relation between current stock returns and future earnings. This would suggest that R&D-related disclosure 'brings the future forward' by revealing to investors relevant news about future earnings which they impound into current returns.

Further, we estimate equation (2) separately for the key words referred to in the narratives section of the annual report and those referred to in the financial

¹¹ We acknowledge that the future economic benefits arising from R&D may take longer to unravel. Our conclusions remain unchanged when we use earnings three years ahead as an alternative, similar to Oswald and Zarowin (2007). See 'Sensitivity Tests' section.

statements section of the annual report. This enables us to identify a differential effect of R&D disclosure across the two sections of the annual report.

With respect to control variables, first, we control for the volume of information provided in an annual report by including the total number of words in the annual report and each separate section accordingly (*LENGTH*). Effectively, this variable controls for the overall information disclosed in the annual report and, thus, we avoid our key variable of interest being a proxy for overall disclosure. Further, IAS 38 mandates the capitalization of development costs meeting certain criteria and prior literature shows that the accounting treatment of R&D has valuation consequences (Dargenidou *et al.*, 2021; Oswald and Zarowin, 2007; Shah *et al.*, 2013). Thus, we include an indicator variable, *CAP*, that equals one for firms that capitalize development costs, and zero otherwise. Additionally, we apply the estimation technique of Heckman (1979) and Lee (1979) to control for the endogenous decision to capitalize development costs (Oswald and Zarowin, 2007; Dinh *et al.*, 2020; Dargenidou *et al.*, 2021). Specifically, we include the inverse mills ratio (*IMR*) estimated from a probit model that examines the determinants of a firm's decision to capitalize development costs. The variables used in this probit model are drawn from prior related research (e.g., Dinh *et al.*, 2016; Mazzi *et al.*, 2019a) and the results of this test are reported in Appendix D.

Considering that we use an international sample, we also include a number of country-level variables motivated by Mazzi *et al.* (2019a), namely: *AUDENF*, an index capturing the quality of audit function and degree of accounting enforcement in each country developed by Brown *et al.* (2014); *RD_DIVERGENCE*, an indicator variable that takes the value one if capitalization of development or research costs was permitted or required prior to the adoption of IFRSs, and zero if no such capitalization was permitted; *ANTISELF_DEAL*, a measure of investor protection of minority shareholders against expropriation by insiders developed by Djankov *et al.* (2008); *CivCom*, an indicator variable that takes the value one for civil law countries and zero if the country is common law (Porta *et al.*, 1998), and *CORRUPTION*, calculated as the inverse of the Corruption Perceptions Index (CPI) score and thus a higher value indicates higher corruption. Moreover, and particularly relevant to our hypothesis, based on the information we summarize in Appendix A, we include a time-varying country control variable (*RD_LAW*). This is an indicator variable that equals zero if there is no national regulation requiring companies to explicitly discuss R&D activities, one if national regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level and two if national regulation provides more detailed requirements for quantitative and/or qualitative disclosures around R&D activities.¹²

¹² It is noted that, although *RD_LAW* may be equal to zero for some countries, local regulations indirectly imply that firms provide some disclosures around R&D activities if R&D activities form part of material information about the entity's business model and value creation. Australia and Canada are countries that fall into this category.

Finally, all models include year and industry fixed effects based on the Industry Classification Benchmark (ICB) Level 1 industry classification and, standard errors are clustered at the firm level. All continuous variables are winsorized at the 1% level of their distribution. Appendix E presents the definitions of all variables used in the analysis.

Sample Selection

This section provides details of the sample selection process we followed. This is summarized in Table 1. Given the significant effort required to identify and download annual reports in English across several countries and then split them manually into two parts, we chose to ‘constrain’ the sample to the top 15 countries, based on listed firms’ R&D intensity. Additionally, we set the condition for these countries to have adopted IFRS or have their accounting standards converged to IFRS or permitted firms to report under IFRS in 2005 up to and including 2013. To identify these countries, we relied on the IFRS Foundation guide on the use of IFRS by jurisdiction.¹³ Then, we collected firm-level data using the Worldscope lists containing the population of active and ‘dead’ corporations for all countries that met the above criteria. From these lists, we only considered equity (stock) listings (Datastream item TYPE to be EQ), with a primary listing being the country of investigation and retained firms that reported a non-missing positive R&D expenditure, defined as the sum of R&D expense and capitalized development costs during the year (i.e., are R&D active) (Dargenidou *et al.*, 2021; Dionysiou *et al.*, 2023). Subsequently, we identified the 15 countries with the highest R&D intensity based on the median value of the firm-level ratio of R&D expenditure (i.e., the sum of R&D expensed and capitalized development costs for the year) to sales for the period between 2006 and 2015. This allowed us to measure the sum of future earnings for three years after the year-end to conduct the predictive validity tests of the research instrument (see Appendix C). As such, our firm-year observations have available data up to 2018.

From that point onwards, we applied several necessary selection criteria that are commonly applied in the relevant literature. We started by eliminating firm-year observations that either did not report under IFRS or the data item, indicating that the accounting standard was missing, to ensure that the accounting information was comparable and also R&D disclosures were better aligned with IAS 38 *recognition* requirements.¹⁴ Subsequently, to ensure that the earnings in equation (1) were reported for periods of similar length, we retained firm-year observations with accounting periods of less than 380 or greater than 350 days (Andronoudis *et al.*, 2025; Tsalavoutas and Tsoligkas, 2021). We also eliminated firms that either had missing

¹³ <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/>.

¹⁴ In line with Daske *et al.* (2013) and Dionysiou *et al.* (2021), we identify the accounting standards that a firm uses in a given year using the Worldscope item WC07536 ‘accounting standards followed’. Further, we note that for many companies in countries that had their accounting standards converged to IFRS, Datastream reports that they apply ‘Local standards’. We consider these firms to report under IFRS as well.

industry classifications or belonged in the Energy industry based on the ICB classification.¹⁵ Subsequently, we eliminated firm-year observations with missing firm data in Datastream/Worldscope. From this pool of firm-year observations, we collected the corresponding annual reports. We specifically required the narratives and/or the financial statement sections of the annual report to be available in the English language and in editable format, to allow for character recognition. This process yielded a sample of 6,490 firm-year observations, corresponding to 1,495 unique firms, for the period 2006 to 2015. Despite the significant effort in downloading and splitting the annual reports manually, this sample is significantly larger than that used in prior literature outside the US setting (e.g., Guo *et al.*, 2004; Jones, 2007; La Rosa & Liberatore, 2014; Nekhili *et al.*, 2016; Chen *et al.*, 2017; Dinh *et al.*, 2020).¹⁶

Panels A and B of Table 2 present the sample distribution by country and ICB industry, respectively. We observe a variation of firm-year observations across countries (e.g., UK (2,647), Germany (1,157), Australia (647), and France (537)). We note that companies from the UK dominate our sample. Perhaps this is not surprising given the requirement in the sample selection for the annual report to be available in English and the large number of listed firms in London more broadly.¹⁷ Nevertheless, the distribution of the sample across countries is similar to that of prior literature using an international sample of firms (Mazzi *et al.*, 2019a; Hou *et al.*, 2022; Anagnostopoulou *et al.*, 2023). We also observe a variation of firm-year observations across industries. Consistent with prior literature (e.g., Mazzi *et al.*, 2019a; Dargenidou *et al.*, 2021), our sample is highly represented by firms from Industrials (1,600), Technology (1,488), and Health Care (1,130).

FINDINGS

Univariate Analysis

Panel A of Table 3 includes the descriptive statistics of R&D-related disclosures in the annual report as a whole, the financial statements section of the annual report,

¹⁵ Informed by Mazzi *et al.* (2019a) and Dargenidou *et al.* (2021), we removed firms in the Energy industry, formerly Oil & Gas, because Worldscope/Datastream could report exploration and evaluation expenses (assets) as R&D expenses (development asset). The accounting treatment of exploration and evaluation costs is governed by IFRS 6 *Exploration for and Evaluation of Mineral Resources* and allows firms significant leeway on how to account for and report such costs (Constantatos *et al.*, 2021; Dionysiou *et al.*, 2023). This contrasts with the accounting for development costs under IAS 38 that we focus on in this study.

¹⁶ For instance, Chen *et al.* (2017) employ a sample of 711 firm-year observations, Dinh *et al.* (2020) use a sample of 699 firm-year observations, La Rosa and Liberatore (2014) use a sample of 309 firm-year observations, while Nekhili *et al.* (2016) use 490 firm-year observations.

¹⁷ In sensitivity tests, we eliminate UK firms from our analysis and our conclusions remain unchanged. We obtain similar results when we instead eliminate firm-year observations from countries with less than 100 observations.

TABLE 1

SAMPLE SELECTION

Firms in top 15 countries by R&D intensity. The sample period is 2006 to 2015.	23,936
We set the condition for these countries to have adopted IFRS or have their accounting standards converged to IFRS or permit firms to report under IFRS in 2005 up to and including 2013	
Exclude firm-year observations:	
For which the data item indicating the accounting standards following is either missing or yields a non-IFRS code	(2,409)
That had their financial year-end changed	(1,765)
Belonging in the Energy industry or the industry classification is missing	(252)
With missing firm-level data	(3,377)
With non-downloadable and non-processable annual report in English in PDF format	(9,643)
Final sample [$t = 2006, 2015$] [firms = 1,495]	6,490

and the narratives section of the annual report. The mean (median) count of frequency of R&D disclosure in the annual report is 58 (36), while the mean (median) length of the annual report is 55,506 (43,348) words. We note that the distribution of the frequencies of R&D-related terms in the annual report varies significantly across firms, with the standard deviation being 266. Further, as expected, the mean frequency of R&D key words is significantly higher in the narratives section of the annual report (mean 39; median 19) than that in the financial statements section of the annual report (mean 20; median 14). These results are not surprising given that, firstly, the mandatory disclosure requirements in IAS 38 are minimal and, secondly, some countries mandate R&D disclosure in the narratives section (see the ‘Methods and Data’ section). Further, the narratives section of the annual report offers management the opportunity to discuss their projects and products (or services), which is an important source of information for users (UKEB, 2024).

Panel B of Table 3 presents the descriptive statistics of R&D-related disclosures across topics of R&D. This indicates that most key words featuring in firms’ annual reports relate to the *Development Phase* and the *Research Phase* topics (means (medians) of 36 (23) and 12 (5), respectively). Further, consistent with Panel A, the frequency of R&D key words is significantly higher in the narratives part of the annual report, with the mean and median frequencies for the *Research Phase*, *Development Phase*, and *Intellectual Property* topics being significantly higher in this part, compared to the financial statements part of the annual report. However, the frequency of R&D key words related to *Conditions for Capitalization* is significantly higher in the financial statements part of the annual report, perhaps reflective of the boiler plate disclosures in the accounting policy note to the financial statements. Further, we note that this topic exhibits the least frequency of R&D-related disclosures (mean (median) 1 (1), respectively), compared to the remaining three topics, concluding that the use of such terms overall is minimal. This, at first glance, may appear counter intuitive given that

TABLE 2

SAMPLE DISTRIBUTION

Panel A: Distribution of observations by country and year

Country	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Australia	39	56	58	69	84	71	75	68	73	54	647
Belgium	12	12	13	12	12	13	9	10	12	13	118
Canada	0	0	0	0	0	14	27	27	32	26	126
China	0	2	5	4	6	6	10	7	11	17	68
Denmark	15	20	19	17	18	25	16	16	14	13	173
Finland	27	36	37	38	32	27	28	19	19	14	277
France	45	51	61	51	62	60	51	46	50	60	537
Germany	94	119	114	120	127	124	113	111	118	117	1,157
Israel	0	0	3	3	3	6	2	4	3	5	29
Japan	0	0	0	0	1	1	1	2	1	3	9
Netherlands	12	14	13	23	20	23	18	19	15	14	171
Norway	7	12	12	17	13	15	15	13	14	11	129
Sweden	31	34	40	40	37	44	46	37	43	39	391
Switzerland	1	1	1	1	2	1	1	1	1	1	11
UK	179	230	315	310	319	310	276	247	242	219	2,647
Total	462	587	691	705	736	740	688	627	648	606	6,490

Panel B: Distribution of observations by industry and year

Industry	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Basic Materials	46	60	70	71	78	79	67	61	53	51	636
Consumer	56	64	69	66	81	88	71	69	70	65	699
Discretionary											
Consumer Staples	25	33	37	44	44	44	41	40	35	33	376
Financials	7	11	13	12	14	15	11	8	9	9	109
Health Care	75	96	119	119	119	114	115	117	132	124	1,130
Industrials	113	138	167	179	186	187	170	149	158	153	1,600
Real Estate	0	0	0	1	0	0	0	0	1	1	3
Technology	107	140	167	167	168	162	165	142	144	126	1,488
Telecommunications	21	34	36	35	30	34	32	29	34	34	319
Utilities	12	11	13	11	16	17	16	12	12	10	130
Total	462	587	691	705	736	740	688	627	648	606	6,490

The 10 industries are those defined by the Industry Classification Benchmark (ICB) prepared by FTSE Russel.

45% of our sample capitalizes development costs (2,950 firm-year observations). However, as discussed earlier, IAS 38 lacks mandated disclosures for companies recognizing such assets.

Panel C of Table 3 presents the frequencies of the 10 most frequently discussed R&D key words in the annual report, along with the topic to which each key word belongs. We also present the frequency with which each key word is found in the financial statements and narratives sections of the annual report, separately. In line with the statistics in Panel B of Table 3, eight of the most frequently used key words are related to *Development Phase*, one is related to *Research Phase*, and one is related to *Intellectual Property*. The most frequently used key words include ‘research and development’, ‘innovation’, ‘patent’, ‘development cost’, and

TABLE 3
R&D DISCLOSURE

Panel A: Descriptive statistics of R&D-related disclosures							
Variable	Mean	SD	25 th percentile	Median	75 th percentile		
Annual report							
LENGTH	55,506	75,883	29,316	43,348	68,289		
DISC	58	266	18	36	66		
LN_DISC	3.551	1.037	2.944	3.611	4.205		
Financial statements							
LENGTH	28,427	23,002	16,836	23,301	33,527		
DISC	20	29	8	14	24		
LN_DISC	2.641	0.904	2.197	2.708	3.219		
Narratives							
LENGTH	27,078	56,864	10,831	19,426	34,485		
DISC	39	244	8	19	44		
LN_DISC	2.934	1.235	2.197	2.996	3.807		
Test of differences	Mean diff.	t-stat		Median diff.	z-stat		
LENGTH_NR- LENGTH_FS	-1,349***	-2.586		-3,875***	-16.123		
DISC_NR- DISC_FS	19***	6.912		5***	32.208		
LN_DISC_NR- LN_DISC_FS	0.293***	23.485		0.288***	24.167		
Panel B: Descriptive statistics of R&D-related disclosures across topics of R&D							
Variable	AR			FS			Comparison
	Mean	SD	Median	Mean	SD	Median	
Research Phase							
DISC	12	23	5	1.5	5	4	4.000***
LN_DISC	1.778	1.226	1.792	0.497	0.734	1.609	1.609***
Development Phase							
DISC	36	191	23	14	19	11	1.000***
LN_DISC	3.120	0.989	3.178	2.364	0.853	2.485	0.087***
(Continues)							

(Continues)

TABLE 3
CONTINUED

Panel B: Descriptive statistics of R&D-related disclosures across topics of R&D											
Variable	AR			FS			NR			Comparison	
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median		t-test
<i>Conditions for Capitalization</i>											
<i>DISC</i>	1	3	1	1	3	0	0	1	0	-0.615***	0.000***
<i>LN_DISC</i>	0.529	0.605	0.693	0.431	0.558	0.000	0.136	0.346	0.000	-0.295***	0.000***
<i>Intellectual Property</i>											
<i>DISC</i>	9	61.5	2	3	11	1	6	57	1	2.500***	0.000***
<i>LN_DISC</i>	1.321	1.248	1.099	0.822	0.969	0.693	0.921	1.132	0.693	0.099***	0.000***
Panel C: Top 10 keywords based on frequency in the annual report											
Keyword	Topic						AR		FS	NR	
	<i>Development Phase</i>						67,161	31,507	35,654		
	<i>Research Phase</i>						60,031	6,384	53,647		
	<i>Intellectual Property</i>						59,024	21,555	37,469		
	<i>Development Phase</i>						41,630	9,186	32,444		
	<i>Development Phase</i>						36,709	29,728	6,981		
	<i>Development Phase</i>						19,227	4,165	15,062		
	<i>Development Phase</i>						16,212	2,339	13,873		
	<i>Development Phase</i>						7,102	694	6,408		
	<i>Development Phase</i>						5,357	319	5,038		
<i>Development Phase</i>						5,000	4,697	303			
Panel D: Top 5 keywords based on frequency in annual report, by R&D topic											
Topic	Key word			AR			FS	NR			
<i>Research Phase</i>	innovation			60,031			6,384	53,647			
	research center*			2,369			333	2,036			
<i>(Continues)</i>											

(Continues)

TABLE 3
CONTINUED

Panel D: Top 5 keywords based on frequency in annual report, by R&D topic				
Topic	Key word	AR	FS	NR
Development Phase	invention	2,335	268	2,067
	new project	2,315	256	2,059
	research project*	2,041	459	1,582
	research and development*	67,161	31,507	35,654
	R&D*	41,630	9,186	32,444
Conditions for Capitalization	development cost	36,709	29,728	6,981
	product development*	19,227	4,165	15,062
	clinical trial	16,212	2,339	13,873
	technical feasibility	2,151	2,025	126
	ability to use	1,416	1,288	128
Intellectual Property	commercial success	1,313	150	1,163
	generate future economic benefit	947	941	6
	intention to complete	936	930	6
	patent*	59,024	21,555	37,469
	intellectual capital	329	59	270
	applications pending*	71	6	65
	announced a collaboration*	27	8	19
	existing alliance	22	1	21

*indicates R&D keywords used in Merkley (2014). Variable definitions are reported in Appendix E.

*** indicates statistical significance at the 0.01 level.

‘product development’. As indicated from the statistics in Panels A and B of Table 3, the frequency of these key words in the narratives section of the annual report is significantly higher than that in the financial statements section of the annual report, except for the terms ‘development cost’ and ‘internally generated’ that feature more frequently in the financial statements part of the annual report. This is perhaps as expected given the direct relevance of these terms to the accounting treatment for capitalization under IAS 38, while firms often use the terms from the standard in boilerplate disclosures.

Panel D of Table 3 presents the five most frequently discussed R&D key words for each of the four topics. Like the previous panels, we present the frequency that each key word is used in the annual report as a whole as well as the financial statements and narratives sections. We note that key words relating to *Development Phase* and *Research Phase* are the most frequently used. This is followed by key words in *Intellectual Property*. Lastly, key words relating to *Conditions for Capitalization* is the least frequently used, as discussed earlier.¹⁸

The descriptive statistics of the remaining variables used in our analysis are presented in Table 4. We find that mean values of earnings (*FUT_E*, *CURR_E* and *LAG_E*) are negative (means -0.042 , -0.018 , and -0.042 , respectively), while the median value is positive (medians 0.044 , 0.046 and 0.046 , respectively). Thus, earnings are left-skewed, consistent with the evidence in prior literature (Haw *et al.*, 2012; Dargenidou *et al.*, 2021; Tsalavoutas & Tsoligkas, 2021). Further, the mean values of current and future returns (*CURR_R*, *FUT_R*) (means 0.119 and 0.131 , respectively) are higher than the corresponding median values (medians 0.043 and 0.056 , respectively). Thus, returns are right-skewed consistent with prior literature (Haw *et al.*, 2012; Dargenidou *et al.*, 2021; Tsalavoutas and Tsoligkas, 2021).

Table 5 presents the Pearson correlation coefficients among all the variables used in the multivariate analysis. As expected, we find a significantly positive correlation between current returns (*CURR_R*) and future earnings (*FUT_E*) and current earnings (*CURR_E*). Additionally, we find, as expected, a significantly positive correlation between R&D-related disclosures in the annual report (*LN_DISC_AR*) with R&D disclosure in narratives (*LN_DISC_NR*) and financial statements (*LN_DISC_FS*) sections of the annual report. Overall, we do not observe any strong correlation among the firm-level variables that would indicate the presence of multicollinearity (i.e., correlation above 0.8). However, we observe strong correlations among certain country-level variables. Specifically, the correlation between *AUDENF*, the index capturing the quality of audit function and the degree of accounting enforcement, and *CIVCOM*, the indicator variable that equals one for civil law and zero for common law, is -0.854 . Further, the correlation between *ANTISELF_DEAL*, the index measuring legal protection of minority shareholders against expropriation by corporate insiders, and *CIVCOM*,

¹⁸ Interested readers are directed to the Online Appendix, which reports extracts from firms’ annual reports. These extracts are indicative examples of disclosures across the four topics of R&D-related disclosures from our sample firms.

TABLE 4

DESCRIPTIVE STATISTICS OF THE REMAINING VARIABLES

Variable	Mean	SD	25 th percentile	Median	75 th percentile
<i>CURR_R</i> ^w	0.119	0.552	−0.238	0.043	0.342
<i>FUT_E</i> ^w	−0.042	0.313	−0.025	0.044	0.073
<i>CURR_E</i> ^w	−0.018	0.228	−0.018	0.046	0.075
<i>LAG_E</i> ^w	−0.009	0.192	−0.020	0.046	0.075
<i>FUT_R</i> ^w	0.131	0.560	−0.224	0.056	0.353
<i>CAP</i>	0.455	0.498	0.000	0.000	1.000
<i>IMR</i>	0.901	0.297	0.695	0.851	1.067
<i>CORRUPTION</i>	20.003	7.707	14.000	21.000	23.000
<i>AUDENF</i>	48.145	6.771	44.000	52.000	54.000
<i>RD_LAW</i>	0.988	0.618	1.000	1.000	1.000
<i>RD_DIVERGENCE</i>	0.805	0.396	1.000	1.000	1.000
<i>ANTISELF_DEAL</i>	0.645	0.289	0.333	0.757	0.950
<i>CIVCOM</i>	0.469	0.499	0.000	0.000	1.000

Variable definitions are reported in Appendix E. ^w Variables are winsorized at 1% and 99%.

the indicator variable that equals one for civil law and zero if common law, is −0.942. In light of this, in sensitivity analyses, we remove all country-level variables and instead use country fixed effects (see ‘Sensitivity Tests’ section).¹⁹

Multivariate Analysis

Table 6 presents the results of the empirical implementation of equation (1) and equation (2). Column (1) presents the results of equation (1). Starting with the theoretical expectations on the key variables of the model, the results are as expected and consistent with those reported in prior related literature (e.g., Lundholm and Myers, 2002; Ettredge *et al.*, 2005; Haw *et al.*, 2012; Dargenidou *et al.*, 2021; Tsalavoutas and Tsoligkas 2021). Specifically, the coefficient of future earnings, *FUT_E*, is positive and significant, indicating that the market positively anticipates the information in future earnings that is not reflected in current or past earnings (coefficient 0.239; *p*-value <0.01). The coefficient of current earnings, *CURR_E*, is also positive and significant, indicating the favourable market response to the unexpected portion of current earnings (coefficient 0.573; *p*-value <0.01). Further, the coefficient of previous year’s earnings, *LAG_E*, is negative and significant as expected, since it captures the already anticipated portion of current earnings (coefficient −0.353; *p*-value <0.01). Lastly, the coefficient of future returns, *FUT_R*, is negative, albeit significant, indicating that realized future earnings contain a measurement error and it is removed by including future returns in the model (coefficient −0.013; *p*-value >0.10).

¹⁹ In addition, in unreported tests, we obtain qualitatively similar results when we remove both variables from our analysis or use either of them interchangeably in the model.

TABLE 5

CORRELATION MATRIX

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
<i>CURR_R^w</i> (1)	1															
<i>LN_DISC_AR</i> (2)	0.001	1														
<i>LN_DISC_FS</i> (3)	-0.011	0.822***	1													
<i>LN_DISC_NR</i> (4)	0.009	0.924***	-0.034***	1												
<i>FUT_E</i> (5)	0.219***	0.019	-0.052***	0.052***	1											
<i>CURR_E^w</i> (5)	0.225***	-0.002	-0.062***	0.032***	0.413***	1										
<i>LAG_E^w</i> (7)	-0.001	0.011	-0.048***	0.042***	0.289***	0.442***	1									
<i>FUT_R^w</i> (8)	-0.011	0.004	0.007	0.002	0.257***	0.005	0.038***	1								
<i>CAP</i> (9)	0.016	0.005	0.100***	-0.048***	-0.003	0.057***	0.052***	0.008	1							
<i>IMR</i> (10)	0.051***	0.064***	-0.035***	0.098***	0.032*	0.006	0.005	-0.074***	-0.312***	1						
<i>CORRUPTION</i> (11)	0.005	0.079***	0.041***	0.093***	0.044***	0.036***	0.041***	0.048***	-0.012	0.058***	1					
<i>AUDENF</i> (12)	-0.024*	-0.253***	-0.179***	-0.261***	-0.077***	-0.082***	-0.095***	-0.014	0.042***	-0.122***	0.217***	1				
<i>RD_LAW</i> (13)	0.01	0.177***	0.053***	0.247***	0.082***	0.088***	0.081***	0.017	0.016	-0.053***	0.317***	-0.184***	1			
<i>RD_DIVERGENCE</i> (14)	-0.012	-0.170***	-0.070***	-0.208***	-0.069***	-0.076***	-0.077***	-0.005	0.073***	-0.226***	-0.210***	0.319***	-0.741***	1		
<i>ANTISELF_DEAL</i> (15)	-0.024*	-0.337***	-0.220***	-0.352***	-0.072***	-0.076***	-0.090***	-0.012	0.037***	-0.100***	0.193***	0.797***	-0.420***	0.557***	1	
<i>CIVCOM</i> (16)	0.02	0.347***	0.238***	0.365***	0.090***	0.093***	0.106***	0.013	-0.022*	0.059***	-0.077***	-0.854***	0.470***	-0.501***	-0.942***	1

Variable definitions are reported in Appendix E.^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

ABACUS

TABLE 6

EFFECT OF R&D-RELATED DISCLOSURES ON INFORMATIVENESS OF FUTURE EARNINGS

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
Constant	−0.325** (−2.39)	−0.071 (−0.41)	−0.138 (−0.82)	−0.220 (−1.44)
<i>FUT_E</i> ^w	0.239*** (7.40)	0.081 (0.95)	0.194** (2.39)	0.102 (1.44)
<i>CURR_E</i> ^w	0.573*** (14.98)	0.609*** (5.16)	0.506*** (4.50)	0.656*** (6.93)
<i>LAG_E</i> ^w	−0.353*** (−6.12)	−0.408** (−2.37)	−0.428*** (−2.68)	−0.391*** (−2.89)
<i>FUT_R</i> ^w	−0.013 (−0.97)	−0.098** (−2.28)	−0.104*** (−2.84)	−0.052 (−1.65)
<i>FUT_E</i> ^w * <i>LN_DISC</i>		0.048** (2.12)	0.017 (0.66)	0.054** (2.34)
<i>CURR_E</i> ^w * <i>LN_DISC</i>		−0.009 (−0.29)	0.026 (0.69)	−0.029 (−0.98)
<i>LAG_E</i> ^w * <i>LN_DISC</i>		0.019 (0.39)	0.031 (0.52)	0.016 (0.36)
<i>FUT_R</i> ^w * <i>LN_DISC</i>		0.024** (2.12)	0.034*** (2.65)	0.014 (1.43)
<i>LN_DISC</i>		0.002 (0.25)	−0.001 (−0.10)	0.003 (0.35)
<i>LENGTH</i>		−0.028** (−2.31)	−0.021* (−1.87)	−0.015 (−1.53)
<i>CAP</i>	0.029** (2.55)	0.026** (2.28)	0.026** (2.33)	0.026** (2.31)
<i>IMR</i>	0.323*** (8.59)	0.339*** (8.85)	0.333*** (8.77)	0.337*** (8.76)
<i>CORRUPTION</i>	−0.002** (−2.55)	−0.002** (−2.05)	−0.002** (−2.19)	−0.002** (−2.39)
<i>AUDENF</i>	0.002 (1.16)	0.003 (1.42)	0.002 (1.30)	0.003 (1.35)
<i>RD_LAW</i>	0.062*** (3.52)	0.065*** (3.76)	0.062*** (3.58)	0.067*** (3.83)
<i>RD_DIVERGENCE</i>	0.147*** (5.38)	0.158*** (5.78)	0.153*** (5.63)	0.155*** (5.69)
<i>ANTISELF_DEAL</i>	−0.113 (−1.55)	−0.135* (−1.87)	−0.121* (−1.68)	−0.126* (−1.74)
<i>CIVCOM</i>	−0.024 (−0.45)	−0.019 (−0.37)	−0.017 (−0.33)	−0.023 (−0.44)
Year/Industry fixed effects	Yes	Yes	Yes	Yes
<i>FUT_E</i> ^w * <i>LN_DISC</i> + <i>FUT_R</i> ^w * <i>LN_DISC</i>		0.072***	0.051**	0.068***
Partial F-test		6.49***	4.61**	5.02***
Observations	6,490	6,490	6,490	6,490
Adjusted R ²	0.260	0.262	0.262	0.262
F	43.66	33.26	31.33	32.65

Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

The results presented in column (2) present the results of equation (2) testing the effect of R&D-related disclosures in the annual report on the market's ability to anticipate future earnings and impound this in prices. Consistent with our Hypothesis 1, the coefficient of interaction between future earnings and the frequency of R&D disclosure in the annual report, $FUT_E^w * LN_DISC$, is positive and significant (coefficient 0.048; p -value < 0.05). This result indicates that R&D-related disclosures in the annual report indeed assist market participants to better anticipate future earnings and reflect this information into current returns. Further, we find that the coefficient of the main effect of future earnings, FUT_E , is positive, albeit insignificant (coefficient 0.081; p -value > 0.10). This finding indicates that investors' ability to anticipate future earnings is impaired when R&D disclosure is minimal or non-existent. Taken together, R&D disclosure is indeed informative to investors and as the frequency of R&D-related disclosures increases, the informativeness about future earnings increases. This is in line with the evidence in the interview-based study by Mazzi *et al.* (2022) who report that investors advocated greater levels of more general R&D disclosure (especially in view of the minimal mandatory disclosure required under IAS 38) that would improve the decision-usefulness of R&D accounting information to them.

Columns (3) and (4) present the results when we focus on R&D disclosure in the financial statements and narratives sections of the annual report, separately. We find that the coefficient of the interaction between future earnings and R&D-related disclosures ($FUT_E^w * LN_DISC$), is significant only in the case of disclosures in the narratives section of the annual report (coefficient 0.054; p -value < 0.05). In contrast, we find that the effect of future earnings, FUT_E^w , is positive, albeit insignificant as in column (2) (coefficient 0.102; p -value > 0.10), indicating that investors' ability to anticipate future earnings is impaired when there is little or no R&D disclosure in the narratives section of the annual report. With respect to R&D-related disclosures in the financial statements, we find that the coefficient of interaction between future earnings and R&D disclosure, $FUT_E^w * LN_DISC$, is insignificant (coefficient 0.017; p -value > 0.10), while the main effect of future earnings, FUT_E^w , is positive and significant (coefficient 0.194; p -value < 0.05).

Lundholm and Myers (2002) argue that, because both future earnings and future returns together proxy for revealed future earnings, a potentially more powerful test should examine the joint significance of (R&D-related) disclosures interacted with future earnings (i.e., $FUT_E^w * LN_DISC$) and future returns (i.e., $FUT_R^w * LN_DISC$). Reflecting on this, we perform Wald tests and partial F-tests to examine the joint significance of these interacted variables. The results show that the joint effect of these variables is positive and significant in the case of the R&D-related disclosures in the annual report as a whole (coefficient 0.072; partial F-test 6.49; p -value < 0.01) and narratives alone (coefficient 0.068; partial F-test 5.02; p -value < 0.01). These results also show that R&D-related disclosures indeed improve investors' ability to anticipate future earnings.

Taken together, these findings suggest that the R&D-related disclosures in the narratives part of the annual report are informative and assist investors to better incorporate future earnings information into current prices. This is consistent with

the argument in Barker *et al.* (2022) that management has information that can help investors to estimate a firm's future performance and of Mazzi *et al.* (2022) on the potential decision-usefulness of R&D-related disclosures. Hence, R&D-related disclosures serve their primary purpose to 'inform investors about the amount, timing, and uncertainty of future cash flows' (Gelb and Zarowin, 2002, p. 34). The lack of mandatory disclosure requirements for the financial statements section of the annual report (Mazzi *et al.*, 2022; Dionysiou *et al.*, 2023) and the low levels of R&D-related disclosures in that section (see Table 3) are not informative. To provide additional granularity to our results, we perform several additional tests that we discuss in following section.

*Additional Analysis*²⁰

R&D-related disclosure topics As we discussed above, beyond computing an overall score of R&D disclosure, we also classify these key words into four broad topics based on their nature: *Research Phase*; *Development Phase*; *Conditions for Capitalization*; *Intellectual Property*. For each topic, we calculate the sum of the frequencies for each key word that a company refers to and explore whether the effect of R&D disclosure to assist investors to better anticipate future earnings information is distinct. Considering the uncertain nature of the future economic benefits associated with R&D and that disclosures 'inform investors about the amount, timing, and uncertainty of future cash flows' and thus help 'investors to predict the future' (Gelb and Zarowin, 2002, p. 34), disclosures that are more (less) likely to communicate information with greater certainty are more (less) likely to assist investors to anticipate future earnings. Against this background, disclosures that relate to *Development Phase*, *Conditions for Capitalization*, and *Intellectual Property* could arguably be more likely to communicate R&D information of greater certainty/confidence that the R&D projects will deliver the future economic benefits compared to disclosures around *Research Phase* (albeit this still involves use of shareholder funds). We present the results of this analysis in Panel A of Table 7. This shows the main effect of future earnings, FUT_E^w , and the interaction between future earnings and R&D-related disclosures, $FUT_E^w * LN_DISC$, for each topic separately.

The results of these tests show that the coefficients of interaction between future earnings and R&D-related disclosures for the topics *Research Phase* and *Intellectual Property*, $FUT_E^w * LN_DISC$, are positive and significant in relation to the annual report (coefficients 0.066 and 0.039; p -values <0.01 and <0.10 , respectively) and the narratives section (coefficients 0.077 and 0.069; p -values <0.01 , respectively). As far as the corresponding coefficient for *Development Phase*, is concerned, this is also positive and significant, albeit only in relation to the annual report as a whole (coefficient 0.048; p -value <0.10). Perhaps not surprisingly, given the relatively low levels of related disclosure for the particular topic (see Table 3), the coefficient of

²⁰ For brevity, we only present the coefficients for the variables of interest in the tables that accompany the tests discussed in this section.

TABLE 7

THE EFFECT OF R&D RELATED DISCLOSURES ON THE INFORMATIVENESS OF FUTURE EARNINGS, ACROSS TOPICS OF R&D KEYWORDS

Panel A: Full sample					
Topic of R&D disclosure	Coefficient	AR	FS	NR	
<i>Research Phase</i>	$\beta_1 \text{ FUT_E}^w$	0.155*** (3.00)	0.234*** (5.64)	0.150*** (3.06)	
	$\beta_5 \text{ FUT_E}^{w*} \text{ LN_DISC}$	0.066*** (2.63)	0.017 (0.31)	0.077*** (3.07)	
<i>Development Phase</i>	$\beta_1 \text{ FUT_E}^w$	0.099 (1.13)	0.136 (1.64)	0.154*** (2.27)	
	$\beta_5 \text{ FUT_E}^{w*} \text{ LN_DISC}$	0.048* (1.78)	0.045 (1.50)	0.040 (1.46)	
<i>Conditions for Capitalization</i>	$\beta_1 \text{ FUT_E}^w$	0.241*** (5.52)	0.243*** (5.64)	0.231*** (6.59)	
	$\beta_5 \text{ FUT_E}^{w*} \text{ LN_DISC}$	-0.000 (-0.01)	-0.003 (-0.05)	0.066 (0.99)	
<i>Intellectual Property</i>	$\beta_1 \text{ FUT_E}^w$	0.191*** (4.15)	0.232*** (5.38)	0.188*** (4.50)	
	$\beta_5 \text{ FUT_E}^{w*} \text{ LN_DISC}$	0.039* (1.77)	0.007 (0.22)	0.069*** (2.97)	
Panel B: Expensers and capitalizers					
Topic of R&D disclosure	Coefficient	Expensers			Capitalizers
		AR	FS	NR	
Total R&D disclosure (<i>DISC</i>)	$\beta_1 \text{ FUT_E}^w$	0.158 (1.16)	0.270* (1.95)	0.190* (1.80)	0.106 (1.09)
	$\beta_5 \text{ FUT_E}^{w*} \text{ LN_DISC}$	0.031 (0.87)	-0.001 (-0.03)	0.027 (0.82)	0.039 (1.16)

(Continues)

TABLE 7
CONTINUED

Panel B: Expensers and capitalizers		Expensers			Capitalizers		
Topic of R&D disclosure	Coefficient	AR	FS	NR	AR	FS	NR
Research Phase	$\beta_1 FUT_E^v$	0.140* (1.65)	0.258*** (3.72)	0.127 (1.64)	0.143** (2.23)	0.204*** (4.24)	0.142** (2.26)
	$\beta_5 FUT_E^w * LN_DISC$	0.092** (2.24)	0.038 (0.40)	0.111*** (2.94)	0.052* (1.66)	0.004 (0.07)	0.059* (1.75)
Development Phase	$\beta_1 FUT_E^v$	0.211 (1.53)	0.221 (1.63)	0.245** (2.47)	-0.016 (-0.14)	0.043 (0.42)	0.068 (0.76)
	$\beta_5 FUT_E^w * LN_DISC$	0.020 (0.43)	0.022 (0.44)	0.010 (0.23)	0.077** (2.36)	0.069* (1.90)	0.068** (2.04)
Conditions for Capitalization	$\beta_1 FUT_E^v$	0.217*** (3.23)	0.219*** (3.37)	0.253*** (4.49)	0.262*** (5.02)	0.267*** (5.18)	0.203*** (4.59)
	$\beta_5 FUT_E^w * LN_DISC$	0.105 (1.46)	0.127 (1.50)	0.102 (1.01)	-0.086 (-1.30)	-0.107 (-1.43)	0.019 (0.22)
Intellectual Property	$\beta_1 FUT_E^v$	0.248*** (2.91)	0.276*** (3.51)	0.244*** (3.28)	0.129*** (2.64)	0.183*** (3.90)	0.126*** (2.69)
	$\beta_5 FUT_E^w * LN_DISC$	0.013 (0.38)	-0.011 (-0.22)	0.026 (0.77)	0.072** (2.38)	0.027 (0.64)	0.138*** (4.02)

Variable definitions are reported in Appendix E. Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

interaction between earnings and R&D-related disclosures with respect to *Conditions for Capitalization* is insignificant. Taken together, these findings indicate that R&D-related disclosures, and particularly those disclosures relating to *Research Phase*, *Development Phase*, and *Intellectual Property*, communicate information that assists investors to better anticipate future earnings and incorporate this information into current market prices.

Expensers vs capitalizers Prior literature shows that capitalized development costs are indeed value relevant, both for equity and debt holders (e.g., Tsoligkas and Tsalavoutas, 2011; Shah *et al.*, 2013; Dinh *et al.*, 2016; Kreß *et al.*, 2019). Further, Oswald and Zarowin (2007) show that capitalization relative to expensing, specifically, assists investors to better anticipate future earnings firms that capitalize development costs using a sample of UK firms prior to the adoption of IFRS. Building on this, Dargenidou *et al.* (2021) show that this finding no longer holds under IFRS. Additionally, Chen *et al.* (2017, p. 699) find that ‘the credibility of the voluntary R&D disclosure is enhanced by the capitalized development costs’. In contrast to this, Dinh *et al.* (2020, p. 29) find that the interaction between R&D disclosure and development costs capitalized decreases market values and increases the cost of equity. They conclude that the ‘disclosures of capitalizers are treated with suspicion’ (Dinh *et al.*, p. 44). Drawing upon these findings, we explore whether our finding that R&D disclosure assists investors to better anticipate future earnings differs across capitalizers and expensers. Specifically, Panel B of Table 7 repeats the analysis presented for the overall score as well as across each R&D-related topic, by splitting the sample across firms that expense all R&D expenditure (expensers) and those that capitalize some or part of the R&D expenditure for the year (capitalizers).

The results show that R&D-related disclosures for capitalizers assist investors to better anticipate future earnings. Specifically, the coefficient of interaction between future earnings and the frequency of R&D-related disclosures in the annual report as a whole as well as the narratives section alone, $FUT_E^{w*}LN_DISC$, is positive and significant (coefficients: 0.067 and 0.079; p -values <0.01, respectively) for capitalizers, while the corresponding coefficients are insignificant for expensers.²¹ In fact, this finding is persistent when we delve into the topics of R&D disclosure. Specifically, the coefficients of interaction between future earnings and R&D-related disclosures in the narratives section, $FUT_E^{w*}LN_DISC$, are positive and significant across *Research Phase*, *Development Phase*, and *Intellectual Property* in relation to the annual report as a

²¹ In unreported tests, we also explore whether this finding is dependent on a firm’s capitalization intensity. Like Chen *et al.* (2017), we too focus on capitalizers only (see their Table 7, columns (2) and (3)) and examine whether our findings differ across the sub-samples of firms with low and high magnitude of capitalization, defined as the proportion of development costs capitalized in the year relative to the total R&D expenditure. Specifically, we split the sample of capitalizers based on the median value of capitalization intensity. We find no significant differences across the two groups, suggesting that R&D-related disclosures assist investors to better anticipate future earnings of capitalizers, irrespective of the magnitude of capitalization intensity.

whole (coefficients 0.052, 0.077, and 0.072, respectively; p -values <0.10 , <0.05 , and <0.05 , respectively) as well as the narratives section alone (coefficients: 0.059, 0.068, and 0.138, respectively; p -values <0.10 , <0.05 , and <0.01 , respectively).

With respect to expensers, we find that the coefficient of interaction between earnings and R&D-related disclosures, $FUT_E^w * LN_DISC$, is significant only for R&D-related disclosures in relation to *Research Phase* in the entire annual report (coefficient 0.092; p -value <0.05) and the narratives section alone (coefficient 0.111; p -value <0.01).²² Arguably, this reflects signalling to the market about the use of shareholder funds for R&D projects, albeit relevant expenditure not capitalized due to not meeting one or more of the conditions. Overall, these findings suggest that R&D-related disclosures indeed assist investors to anticipate future earnings, albeit this is mostly driven by capitalizers. This suggests that our findings are more in line with those in Chen *et al.* (2017) in the Israeli context, addressing the tension in the literature.

R&D-related disclosures, anticipation of future earnings, and the role of country-level regulation on R&D-related disclosures As discussed earlier, countries impose national-level requirements for R&D-related disclosures in annual reports. In our sample, we observe that there is variation across time and across countries with respect to the level of regulation. For example, in Australia and Canada, there is no explicit regulation requiring companies to discuss R&D activities. For most EU countries, due to enacting into national regulations Section 9 Article 46 of the Fourth Directive 78/660/EC, there is a requirement to discuss R&D activities. Nevertheless, there is significant variation across EU countries. For example, in the UK, since 2007, the national regulation requires companies to discuss or report financial information about R&D activities, albeit at a very generic level. Germany, on the other hand, is one of the countries that have mandated very detailed disclosures about R&D activities.

We consider that the existence of such regulations and the details they may require firms to provide may have an influence on the level of R&D-related disclosures provided in annual reports (and primarily the narratives section). Consequently, this may result in a differential effect of the R&D-related disclosures on the anticipation of future earnings across countries, depending on the level of stringency of the regulations in place. Thus, we replicate our analysis across firms that are headquartered in countries with no or minimal disclosure requirements around R&D activities (i.e. $RD_LAW = 0$ or 1) and those headquartered in countries with stricter disclosure requirements (i.e. $RD_LAW = 2$; effectively observations from Germany and China).

We present the results of the analysis in columns (1) to (6) in Table 8. These results indicate that our findings are driven from firms headquartered in countries

²² Using a Wald test, we find no evidence that the coefficients for expensers are statistically significantly different from the corresponding coefficients for capitalizers in the case of R&D-related disclosures with respect to *Research Phase* (chi-squared: 1.08; p -value: 0.2987).

TABLE 8

EFFECT OF R&D-RELATED DISCLOSURES ON THE INFORMATIVENESS OF FUTURE EARNINGS, ACROSS COUNTRIES WITH NO OR MINIMAL VS STRICTER NATIONAL R&D-RELATED DISCLOSURE REGULATIONS

	Full sample						Capitalizers					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	No or Minimal	Stricter	No or Minimal	Stricter	No or Minimal	Stricter	No or Minimal	Stricter	No or Minimal	Stricter	No or Minimal	Stricter
	AR	FS	NR	AR	FS	NR	AR	FS	NR	AR	FS	NR
<i>FUT_E^w</i>	0.068 (0.71)	0.204* (1.93)	0.210** (2.19)	0.174* (1.71)	0.091 (1.20)	0.238** (2.14)	-0.013 (-0.10)	0.101 (1.00)	0.131 (1.14)	0.131 (1.21)	0.013 (0.13)	0.119 (1.10)
<i>FUT_E^w*LN_DISC</i>	0.048* (1.86)	0.031 (1.01)	0.006 (0.20)	0.055 (1.29)	0.055** (2.13)	0.024 (0.70)	0.061* (1.83)	0.091** (2.31)	0.020 (0.51)	0.113** (2.08)	0.073** (2.22)	0.096** (2.41)
<i>LN_DISC</i>	-0.000 (-0.02)	0.011 (0.78)	-0.006 (-0.66)	0.016 (1.19)	0.001 (0.10)	0.012 (0.91)	0.007 (0.47)	0.035 (1.02)	-0.001 (-0.07)	0.009 (0.28)	0.010 (0.74)	0.043 (1.18)
Firm/Country controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,288	1,202	5,288	1,202	5,288	1,202	2,494	456	2,494	456	2,494	456
Adjusted <i>R</i> ²	0.245	0.413	0.245	0.415	0.245	0.414	0.251	0.464	0.250	0.463	0.251	0.467
F	29.31	11.95	27.78	11.81	28.55	11.73	18.46	4.399	18.95	4.226	17.43	4.458

Variable definitions are reported in Appendix E.^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

with low or minimal disclosure requirements around R&D activities. However, we also reflect on our earlier findings about the differential role of R&D-related disclosures in the anticipation of future earnings across the sub-sample of capitalizers and expensers and so we delve into the characteristics of the data across the two sub-samples of high vs low *RD_LAW* in this respect. This indicates that the proportion of capitalizers is much lower in countries with stricter disclosure requirements (38% vs 47%). Further, observations in settings with stricter disclosure requirements show that they capitalize smaller amounts of development costs, scaled by market values (mean: 0.009 vs 0.015; difference significant at the 1% level) and a smaller proportion of the total R&D expenditure (mean 0.121 vs 0.245; difference significant at the 1% level). Reflecting on this and that our conclusions are mainly driven by capitalizers, we also repeat this analysis by retaining only the sub-sample of capitalizers.

The results of this analysis are presented in columns (7) to (12) in Table 8 and show that R&D-related disclosures assist investors to better anticipate the future earnings of capitalizers, irrespective of the strength of national regulation. Further, in unreported Wald tests, when we compare the coefficients across the two sub-samples, we find that these are not significantly different with respect to R&D disclosures in the annual report as a whole (chi-squared 0.35; p -value = 0.5526) or narratives section alone (chi-squared 0.20; p -value = 0.6512).

R&D-related disclosures, anticipation of future earnings, and the role of country level corruption Country-level corruption, which is defined as the ‘abuse of entrusted power for private gain’ (Transparency International, 2024), is a permeable informal institutional characteristic that affects firms’ actions that leads to adverse accounting outcomes in prior literature (see Mazzi *et al.*, 2019a; Leventis *et al.*, 2023).²³ With regards to disclosures in particular, prior literature shows that firms headquartered in countries with higher levels of corruption provide more opaque information (Ioannou and Serafeim, 2012; Baldini *et al.*, 2018; Mazzi *et al.*, 2018; Elamer *et al.*, 2019). Similarly, Xu *et al.* (2020) show that the readability of financial statements for firms from US states with higher levels of corruption is impaired. Overall, this evidence indicates that corruption fosters an environment lacking transparency, which subsequently causes information asymmetry (DiRienzo *et al.*, 2007; Malagueño *et al.*, 2010; Mazzi *et al.*, 2018) and leads to higher costs of equity (Banerjee *et al.*, 2021; Hossain and Kryzanowski, 2021). With regard to the treatment of development costs under IFRS in particular, Mazzi *et al.* (2019a) find that the amount of development costs capitalized in a given year is positively correlated with country-level corruption.

²³ In fact, Isidro *et al.* (2020), who examine 72 informal and formal institutional country-level characteristics, stress the importance of controlling for multiple informal and formal institutional characteristics and highlight problems associated inferences drawn from empirical research due to causal densities and co-dependencies of institutions. They, *inter alia*, perform factor analysis and show that the factor loading for control of corruption and corruption are ranked first and eight, respectively (see their Appendix C).

R&D DISCLOSURES AND INFORMATIVENESS

They also show that the contribution of capitalized development costs in a given year to future profitability is lower in countries with higher the levels of corruption.

Against this background, we expect that our finding that R&D-related disclosures assist investors to better anticipate future earnings to be stronger in the sub-sample of firms headquartered in countries with lower levels of corruption. Table 9 shows the results of this analysis by estimating equation (2) separately for firms headquartered in countries with lower and higher levels of corruption, based on the yearly median value of the CPI of all the countries in the sample.

The results in Table 9 show that the coefficient of interaction between future earnings and R&D-related disclosures, $FUT_E^w * LN_DISC$, is positive and significant in the case of R&D disclosures in the annual report (coefficient 0.073; p -value <0.10) and the narratives section alone (coefficient 0.100; p -value <0.01), only for the subset of firms headquartered in countries with lower corruption levels. For this subset of firms, we also find that the coefficient of the main effect of future earnings, FUT_E^w , is insignificant in the case of R&D disclosures in the annual report (coefficient -0.150; p -value >0.10) and in the case of R&D disclosures in the narratives section of the annual report (coefficient -0.150; p -value >0.10). With respect to the sub-set of firms in countries with higher corruption, the main effect of future earnings, FUT_E^w , is positive and significant in all three specifications (coefficients 0.295, 0.303, and 0.344, respectively; p -values <0.01), while the coefficients of interaction between future earnings and R&D disclosures, $FUT_E^w * LN_DISC$, are insignificant in all specifications.

TABLE 9

EFFECT OF R&D DISCLOSURE ON THE INFORMATIVENESS OF FUTURE EARNINGS, ACROSS COUNTRIES WITH HIGH VS LOW LEVELS OF CORRUPTION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Base line</i>		<i>AR</i>		<i>FS</i>		<i>NR</i>	
	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
FUT_E^w	0.083 (1.63)	0.350*** (10.56)	-0.150 (-1.08)	0.295*** (3.35)	0.064 (0.45)	0.303*** (3.58)	-0.150 (-1.52)	0.344*** (5.15)
$FUT_E^w * LN_DISC$			0.073* (1.80)	0.016 (0.69)	0.008 (0.18)	0.018 (0.59)	0.100** (2.54)	0.003 (0.14)
LN_DISC			0.001 (0.07)	0.004 (0.46)	-0.012 (-0.88)	0.005 (0.57)	0.006 (0.49)	0.002 (0.22)
Firm/Country controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,068	4,422	2,068	4,422	2,068	4,422	2,068	4,422
Adjusted R^2	0.272	0.263	0.275	0.264	0.272	0.264	0.278	0.264
F	17.492	42.904	14.309	30.245	12.973	30.512	14.404	30.120

Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. t -statistics are presented in parentheses and are based on standard errors clustered at the firm level.

Taken together, these findings suggest that R&D-related disclosures have become an important source of information that assists investors to anticipate future earnings when corruption is low, that is, in environments that exhibit greater transparency and higher quality of earnings information.²⁴

R&D-related disclosures, anticipation of future earnings, and the role of accounting enforcement Prior literature shows that the quality of accounting information is positively related to enforcement (Leuz *et al.*, 2003; Burgstahler *et al.*, 2006; Lang *et al.*, 2006; Windisch, 2021) given that in the absence of ‘proper enforcement, legal rules remain largely ineffective’ (Burgstahler *et al.*, 2006, p. 988). When enforcement is strong, insiders have fewer opportunities to enjoy private control benefits and obfuscate a firm’s performance (Leuz *et al.*, 2003). This subsequently leads to environments with better information (Li *et al.*, 2019). Consistently, Glaum *et al.* (2018) show that firms headquartered in countries with higher enforcement tend to recognize goodwill impairments in a timelier fashion than firms headquartered in countries with lower enforcement, while Mazzi *et al.* (2017) show that such firms disclose more mandatory goodwill-related information. Windisch (2021) shows that managerial discretion in accruals declines after the introduction of stricter enforcement. Tsilavoutas *et al.* (2014) find that enforcement is positively associated with higher compliance with mandatory disclosure requirements with respect to intangible assets (IAS 38), impairment of assets (IAS 36), and business combinations (IFRS 3).

Prior literature also documents that stronger enforcement leads to positive capital market effects. For instance, Christensen *et al.* (2013) show that the introduction of stricter enforcement has a significant impact on stock liquidity, while DeFond *et al.* (2007) show that stronger enforcement is associated with more informative earnings announcements. Finally, Hope (2003, p. 240) shows that stronger enforcement is associated with greater analyst forecast accuracy given that adherence to rules makes ‘the task of forecasting earnings relatively easier’.²⁵

Against this background, we expect our findings that R&D-related disclosures assist investors to better anticipate future earnings to be more pronounced among firms in countries with stronger enforcement. Table 10 shows the results of this analysis by estimating equation (2) for firms headquartered in countries with low and high enforcement separately, based on the median value of the sum of the quality of audit function and degree of accounting enforcement, following Brown *et al.* (2014).

The results in Table 10 show that the coefficient of interaction between future earnings and R&D disclosure, $FUT_E^{w*}LN_DISC$, is positive and significant in the

²⁴ Particularly in relation to incentives to manage earnings using accruals earnings management in the context of R&D, as expected (cf. Mazzi *et al.*, 2019), we find that the incidence of earnings management is higher for firms headquartered in countries with higher corruption levels (difference: 0.054, significant at 1%).

²⁵ Prior literature, however, shows that enforcement brings significant costs to firms as it is associated with higher audit fees (e.g. Florou *et al.*, 2020), while more recent literature challenges the conventional view that enforcement always leads to better outcomes (c.f., Christensen *et al.*, 2020; Leventis and Humphrey, 2021).

R&D DISCLOSURES AND INFORMATIVENESS

TABLE 10

EFFECT OF R&D DISCLOSURE ON THE INFORMATIVENESS OF FUTURE EARNINGS,
ACROSS COUNTRIES WITH HIGH VS LOW LEVELS OF ENFORCEMENT

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>Base line</i>		<i>AR</i>		<i>FS</i>		<i>NR</i>	
	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>	<i>Low</i>	<i>High</i>
<i>FUT_E</i> ^w	0.287*** (3.70)	0.228*** (6.66)	0.216* (1.86)	0.042 (0.42)	0.104 (0.60)	0.223** (2.49)	0.285*** (2.69)	0.075 (0.97)
<i>FUT_E</i> ^w * <i>LN_DISC</i>			0.021 (0.70)	0.057** (2.21)	0.072 (1.44)	0.002 (0.06)	0.001 (0.03)	0.064*** (2.62)
<i>LN_DISC</i>			0.010 (0.83)	0.001 (0.13)	0.014 (1.27)	-0.005 (-0.52)	0.008 (0.66)	0.003 (0.28)
Firm/Country controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,191	4,299	2,191	4,299	2,191	4,299	2,191	4,299
Adjusted <i>R</i> ²	0.397	0.221	0.398	0.222	0.400	0.221	0.396	0.223
<i>F</i>	16.912	33.339	12.841	25.717	13.584	23.338	12.798	25.530

Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

case of R&D-related disclosures in the annual report (coefficient 0.057; *p*-value <0.05) and the narratives section of the annual report (coefficient 0.064; *p*-value <0.01), only for the subset of firms headquartered in countries with high enforcement. Further, for this subset of firms, we find that the coefficient of the main effect of future earnings, *FUT_E*^w, is insignificant in the case of R&D-related disclosures in the annual report (coefficient 0.042; *p*-value >0.10) and in the narratives section alone (coefficient 0.075; *p*-value >0.10). With respect to the subset of firms headquartered in countries with lower enforcement, the main effect of future earnings, *FUT_E*^w, is positive and significant in nearly all specifications (coefficients 0.216, 0.104, and 0.223, respectively; *p*-values <0.10, >0.10, and <0.01, respectively), while the coefficients of interaction between future earnings and R&D disclosure, *FUT_E*^w**LN_DISC*, are insignificant in all specifications.

Consistent with the findings discussed in the previous section, these results indicate that R&D-related disclosures have become an important source of information that assists investors to anticipate future earnings in the presence of higher enforcement. Taken together, the findings indicate that higher-quality institutional mechanisms play a significant role on whether R&D disclosure assists investors to anticipate future earnings.²⁶

²⁶ We note that in relation to incentives to manage earnings using accruals earnings management in the context of R&D, we find no evidence that the incidence of earnings management in relation to incentives to capitalize development costs differs across the sub-samples. Thus, enforcement is unlikely to capture the propensity to manage earnings in relation to the capitalization of development costs for our sample firms.

SENSITIVITY TESTS

To ensure the robustness of our results, we perform several sensitivity checks, the results of which are presented in Tables 11 and 12.²⁷ Overall, the results from these tests suggest that our conclusions remain unchanged.

First, we recognize that R&D is a continuum from the research phase through to the development phase, leading to potential capitalization of relevant costs. Further, some key words/terms may be difficult to categorize in a single category. They may span several categories depending on the context in which they appear in the annual report. Moreover, some key words may be identified in both *Research Phase* and *Development Phase*, depending on the stage of advancement of the relevant processes. Finally, *Conditions for Capitalization* can be considered as part of the wider *Development Phase*, as indicated in IAS 38 Paragraphs 57 to 64. Against this backdrop, we merge the following pairs of topics a) *Research Phase* and *Development Phase* and b) *Conditions for Capitalization* and *Development Phase* and repeat our analysis. We present the results of this analysis in Table 11. Overall, our conclusions remain unchanged in that R&D-related disclosures improve the market's ability to anticipate future earnings and this result is driven by capitalizers.

Second, as discussed in the 'Multivariate Analysis' section, our model includes firm-level control variables, namely, *LENGTH*, *CAP*, and *IMR* and country-control variables, namely *CORRUPTION*, *AUDENF*, *RD_LAW*, *RD_DIVERGENCE*, *ANTISELF_DEAL*, and *CIVCOM*. We note, however, that prior studies employing sample firms from one country tend not to include firm-level variables other than those of interest to the topic being examined (e.g., Lundholm and Myers, 2002; Ettredge *et al.*, 2005; Schleicher *et al.*, 2007; Dargenidou *et al.*, 2021). Similarly, most prior studies using multi-country settings do not employ country-level control variables other than those of interest to the topic being examined (e.g., Haw *et al.*, 2012). To this end, we replicate our analysis by excluding firm- and country-level control variables but instead including only country fixed effects (instead of country-level variables). Subsequently, we add firm-level control variables. The results are presented in Panels A and B of Table 12, respectively.

Third, to alleviate potential concerns over omitted firm-specific characteristics, we follow the methodological approach that prior studies frequently employ as additional analysis (Lundholm and Myers, 2002; Ettredge *et al.*, 2005; Dargenidou *et al.*, 2021). Specifically, we include additional control variables both as a main effect and as an interaction term with past, current, and future earnings and future returns. These variables control for the firm's information environment using: 1) firm size by including *SizeD*, a dummy variable taking the value of one if the firm's market value of equity is above the yearly median for firms in our sample, and zero otherwise; 2) earnings persistence by including *Losses*, a dummy variable taking the value one if a company reports profit in the following year, and zero

²⁷ For brevity, we only present the coefficients for the variables of interest.

R&D DISCLOSURES AND INFORMATIVENESS

TABLE 11

AGGREGATION OF R&D-RELATED DISCLOSURE TOPICS

Panel A: Full sample

R&D disclosure topic	Coefficient	AR	FS	NR
<i>Research & Development</i>	$\beta_1 FUT_E^w$	0.069 (0.76)	0.142 (1.64)	0.116 (1.63)
	$\beta_5 FUT_E^w * LN_DISC$	0.055** (2.13)	0.041 (1.34)	0.052** (2.05)
<i>Development Phase & Conditions for Capitalization</i>	$\beta_1 FUT_E$	0.102 (1.17)	0.142* (1.67)	0.154** (2.25)
	$\beta_5 FUT_E^w * LN_DISC$	0.047* (1.75)	0.041 (1.36)	0.040 (1.47)

Panel B: Expensers and capitalizers

R&D disclosure topic	Coefficient	Expensers			Capitalizers		
		AR	FS	NR	AR	FS	NR
<i>Research & Development</i>	$\beta_1 FUT_E$	0.144 (1.00)	0.226 (1.58)	0.185* (1.73)	-0.018 (-0.16)	0.050 (0.48)	0.046 (0.50)
	$\beta_5 FUT_E^w$	0.039	0.019	0.032	0.074**	0.065*	0.070**
	$*LN_DISC$	(0.89)	(0.37)	(0.80)	(2.33)	(1.77)	(2.25)
<i>Development Phase & Conditions for Capitalization</i>	$\beta_1 FUT_E^w$	0.188 (1.35)	0.182 (1.30)	0.242** (2.44)	0.005 (0.05)	0.081 (0.82)	0.069 (0.78)
	$\beta_5 FUT_E^w$	0.027	0.038	0.011	0.068**	0.051	0.067**
	$*LN_DISC$	(0.59)	(0.74)	(0.25)	(2.16)	(1.45)	(2.01)

Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

otherwise; 3) earnings variability by including *EarnVol*, a dummy variable taking the value one if the firm's standard deviation of earnings is below the yearly median for all firms in the sample, and zero otherwise; and 4) firm growth by including *BM*, the book-to-market ratio. Adding these variables controls for those circumstances in which investors' ability to predict future earnings may be impaired (i.e., small firms, loss-making firms, firms with high earnings volatility, and high growth firms). The results of this analysis are presented in Panel C of Table 12.

Fourth, to alleviate potential concerns that our results may be driven by firms from countries with very few observations, we repeat our analysis when excluding countries with less than 100 observations. The results of this analysis are presented in Panel D of Table 12.

Fifth, firms from the UK represent a large proportion of our sample. To ensure that our results are not driven by the high representation of UK firms, we repeat

TABLE 12

SUMMARY RESULTS OF SENSITIVITY TESTS

Panel A: No firm controls and country fixed effects

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
<i>FUT_E</i> ^w	0.256*** (8.12)	0.117 (1.37)	0.224*** (2.75)	0.128* (1.82)
<i>FUT_E</i> ^w x <i>LN_DISC</i>		0.042* (1.86)	0.012 (0.46)	0.050** (2.18)
<i>LN_DISC</i>		−0.003 (−0.48)	−0.006 (−0.88)	−0.000 (−0.04)
Firm/Country controls	No	No	No	No
Year/Industry/Country fixed effects	Yes	Yes	Yes	Yes
Observations	6,490	6,490	6,490	6,490
Adjusted <i>R</i> ²	0.247	0.248	0.248	0.248
F	118.041	59.840	57.945	58.181

Panel B: Firm controls and country fixed effects

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
<i>FUT_E</i> ^w	0.242*** (7.56)	0.085 (1.00)	0.197** (2.43)	0.105 (1.50)
<i>FUT_E</i> ^w x <i>LN_DISC</i>		0.047** (2.13)	0.017 (0.66)	0.054** (2.35)
<i>LN_DISC</i>		0.003 (0.41)	−0.001 (−0.09)	0.004 (0.57)
Firm controls	Yes	Yes	Yes	Yes
Country controls	No	No	No	No
Year/Industry/Country fixed effects	Yes	Yes	Yes	Yes
Observations	6,490	6,490	6,490	6,490
Adjusted <i>R</i> ²	0.257	0.258	0.258	0.258
F	80.741	46.413	44.043	45.646

Panel C: Inclusion of additional control variables both as a main effect and as an interaction term with past, current, and future earnings and future returns

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
<i>FUT_E</i> ^w	0.3915*** (4.97)	0.2697*** (2.63)	0.3612*** (3.47)	0.2835*** (3.01)
<i>FUT_E</i> ^w x <i>LN_DISC</i>		0.0406* (1.88)	0.0133 (0.53)	0.0473** (2.32)
<i>LN_DISC</i>		−0.0013 (−0.17)	−0.0054 (−0.70)	0.0007 (0.10)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes

(Continues)

R&D DISCLOSURES AND INFORMATIVENESS

TABLE 12

CONTINUED

Panel C: Inclusion of additional control variables both as a main effect and as an interaction term with past, current, and future earnings and future returns

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
Observations	6,490	6,490	6,490	6,490
Adjusted R^2	0.295	0.297	0.296	0.296
F	40.1794	35.8856	34.7354	36.1820

Panel D: Exclude countries with less than 100 firm-year observations

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
FUT_E^w	0.240*** (7.38)	0.082 (0.95)	0.195** (2.38)	0.102 (1.44)
$FUT_E^w \times LN_DISC$		0.048** (2.11)	0.017 (0.65)	0.054** (2.34)
LN_DISC		-0.000 (-0.06)	-0.003 (-0.34)	0.000 (0.02)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes
Observations	6,373	6,373	6,373	6,373
Adjusted R^2	0.258	0.259	0.259	0.259
F	43.107	32.801	30.876	32.235

Panel E: Exclude UK firms

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
FUT_E^w	0.198*** (4.21)	-0.061 (-0.52)	0.045 (0.39)	0.001 (0.01)
$FUT_E^w \times LN_DISC$		0.076*** (2.65)	0.057 (1.64)	0.074** (2.56)
LN_DISC		0.018** (1.98)	0.015* (1.72)	0.018** (2.04)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes
Observations	3,843	3,843	3,843	3,843
Adjusted R^2	0.310	0.314	0.312	0.314
F	20.378	19.820	16.765	18.310

Panel F: Exclude firm-year observations with earnings management incentives

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
FUT_E^w	0.310*** (6.62)	0.138 (0.90)	0.378*** (2.70)	0.116 (1.05)

(Continues)

TABLE 12

CONTINUED

Panel F: Exclude firm-year observations with earnings management incentives

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
$FUT_E^w \times LN_DISC$		0.055 (1.26)	-0.027 (-0.50)	0.084** (2.21)
LN_DISC		0.012 (0.93)	0.009 (0.73)	0.012 (1.03)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes
Observations	2,603	2,603	2,603	2,603
Adjusted R^2	0.257	0.262	0.259	0.263
F	28.535	20.369	20.270	20.835

Panel G: Substitute one-year ahead earnings and returns with three-year ahead earnings and returns

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
FUT_E^w	0.097*** (6.52)	-0.036 (-0.63)	-0.032 (-0.57)	0.046 (1.32)
$FUT_E^w \times LN_DISC$		0.040*** (2.61)	0.049** (2.58)	0.020* (1.82)
LN_DISC		0.006 (0.68)	0.004 (0.46)	0.003 (0.41)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes
Observations	5,987	5,987	5,987	5,987
Adjusted R^2	0.258	0.261	0.261	0.259
F	37.411	29.411	27.607	28.536

Panel H: Substituting LN_DISC with the proportion of R&D words to total number of words in percentage terms ($DISC_PROP$)

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
FUT_E^w	0.239*** (7.40)	0.233*** (4.00)	0.262*** (4.35)	0.238*** (4.29)
$FUT_E^w \times DISC_PROP$		0.005* (1.72)	0.002 (0.66)	0.003* (1.80)
$DISC_PROP$		0.000 (0.00)	0.001 (0.86)	0.000 (0.50)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes
Observations	6,490	6,490	6,490	6,490
Adjusted R^2	0.257	0.278	0.278	0.278
F	43.661	37.260	37.394	35.205

R&D DISCLOSURES AND INFORMATIVENESS

Panel I: Inclusion of corporate governance controls

	(1)	(2)	(3)	(4)
	<i>Base line</i>	<i>AR</i>	<i>FS</i>	<i>NR</i>
<i>FUT_E</i> ^w	0.273*** (5.95)	0.089 (0.79)	0.169 (1.40)	0.147* (1.79)
<i>FUT_E</i> ^w x <i>LN_DISC</i>		0.055* (1.85)	0.040 (1.05)	0.047* (1.71)
<i>LN_DISC</i>		-0.003 (-0.37)	-0.005 (-0.54)	-0.006 (-0.64)
<i>DIVERSITY</i>	-0.003 (-0.06)	0.027 (0.54)	0.018 (0.38)	0.013 (0.26)
<i>BSIZED</i>	0.028* (1.66)	0.027 (1.57)	0.027 (1.57)	0.029* (1.71)
Firm/Country controls	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes
Observations	4,658	4,658	4,658	4,658
Adjusted <i>R</i> ²	0.260	0.262	0.262	0.262
<i>F</i>	21.12	17.11	16.02	16.96

Panel J: Cross-sectional tests across firms with unusually small or large boards or otherwise

	(1)	(2)	(3)	(4)	(5)	(6)
	<i>Usual</i>	<i>Unusual</i>	<i>Usual</i>	<i>Unusual</i>	<i>Usual</i>	<i>Unusual</i>
	<i>AR</i>		<i>FS</i>		<i>NR</i>	
<i>FUT_E</i> ^w	0.021 (0.16)	0.416** (2.33)	0.118 (0.83)	0.471** (2.38)	0.075 (0.76)	0.408*** (3.34)
<i>FUT_E</i> ^w x <i>LN_DISC</i>	0.064* (1.67)	-0.002 (-0.04)	0.046 (0.99)	-0.023 (-0.34)	0.060* (1.70)	-0.000 (-0.01)
<i>LN_DISC</i>	-0.013 (-1.21)	0.029* (1.70)	-0.013 (-1.15)	0.016 (0.92)	-0.016 (-1.61)	0.036** (2.23)
<i>DIVERSITY</i>	0.026 (0.43)	0.029 (0.24)	0.018 (0.30)	0.033 (0.28)	0.002 (0.04)	0.042 (0.36)
Firm/Country controls	Yes	Yes	Yes	Yes	Yes	Yes
Year/Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,553	1,105	3,553	1,105	3,553	1,105
Adjusted <i>R</i> ²	0.254	0.328	0.253	0.326	0.253	0.329
<i>F</i>	15.03	7.993	13.59	7.995	14.98	9.044

Diversity is the percentage of non-executive directors. *BSIZED* is a dummy variable taking the value one if there are between five and 12 directors on the board, zero otherwise (cf. Lara *et al.*, 2017). All other variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

our analysis when excluding firms from the UK. Panel E of Table 12 presents the results of this analysis.

Sixth, to alleviate concerns that our results are affected by firms with incentives to manage earnings using real or accruals earnings management in the context of R&D, we repeat our analysis after excluding firm-year observations that are more

likely to have managed earnings in either of these ways. Similar to Dinh *et al.* (2016) and Kreß *et al.* (2019), we exclude firms that either cut R&D relative to the previous year's R&D expenditure or capitalized development costs as a means of beating earnings benchmarks. Panel F of Table 12 presents the results of this analysis.

Seventh, we acknowledge that the future economic benefits of R&D may take longer to accrue (Lev and Sougiannis, 1996; Mazzi *et al.*, 2019a). To minimize potential concerns that using one-year-ahead earnings may not fully capture the future economic benefits associated with R&D, as an alternative, we use the sum of earnings over the three years between $t + 1$ and $t + 3$.²⁸ The results of this analysis are presented in Panel G of Table 12.

Eighth, arguably, the R&D-related disclosures that we use in our empirical analysis may act as a proxy for overall disclosure levels. Moreover, disclosure levels in annual reports increase over time. Considering this, despite controlling for the total words in our main tests, in the spirit of Chen *et al.* (2017), we use the proportion of R&D-related key words to total words in percentage terms (*DISC_PROP*), as an alternative relative measure of R&D disclosure. Panel H of Table 12 presents the results of this analysis.

Ninth, we consider the conjecture in Dargenidou *et al.* (2021) that strong governance is expected to strengthen the reliability of R&D reporting as well as the findings in Enache and Hussainey (2020) of a substitutive relationship between mostly R&D-related disclosure and board characteristics around the valuation of biotechnology firms. On reflection of these, we repeat our main analysis by adding two additional control variables from Boardex: board diversity (*DIVERSITY*), which is the proportion of non-executive directors in the board (Boutchkova *et al.*, 2021; Almaghrabi *et al.*, 2024), and following Lara *et al.* (2017), a dummy variable indicating whether the firm has a usual board size (i.e., between five and 12 members) or otherwise (*BSIZED*, a dummy variable taking the value one if the board size is between five and 12 directors, zero otherwise). The results from these tests are presented in Panel I and are consistent with the main results presented earlier, despite the decreased sample size due to missing data from Boardex.

Finally, we consider that, in the results presented in Panel I, *BSIZED* reports a significantly positive coefficient in the baseline model and in the model that explores the role of R&D-related disclosures in the narratives section of the annual report. Thus, we perform an additional test where we split our sample across firms with an unusually small or large board (*BSIZED* = 0) and otherwise (*BSIZED* = 1). As expected, the findings reported in Panel J indicate that the earlier results are driven by those firms with a usual board size and thus, potentially stronger corporate governance mechanisms. For example, Lara *et al.*

²⁸ Collins *et al.* (1994) and Lundholm and Myers (2002) show that the explanatory power of the model does not improve if additional years of future earnings are considered. Thus, we did not attempt to add more years.

(2017) note that in firms with unusually small or large boards monitoring may suffer and consequently lead to greater earnings management.

CONCLUSION

Using an international sample of firms from 15 countries that report under IFRS over a 10-year period, we examine the effect of R&D-related disclosures on the informativeness of share prices about future earnings. We measure R&D disclosure by counting the number of times each firm makes reference to any of the 119 key words in our list. We show that R&D disclosure conveys information about future earnings that assists investors to better predict future earnings and reflect this information into current returns. We find that this result is driven by disclosures in the narratives section of the annual report, in line with conjectures that the minimal mandatory disclosure in IAS 38 does not serve the decision usefulness of annual reports to users. In additional tests, we find that disclosures regarding the *Research Phase* and *Intellectual Property* topics communicate information that assists investors to better anticipate future earnings across the full sample. When we repeat this analysis separately for expensers and capitalizers, we find that our findings mostly hold for capitalizers. In fact, we find that R&D-related disclosures are informative for capitalizers for three of the four topics examined. Further, we explore the potential moderation of these findings from the stringency of national disclosure requirements around R&D activities in the narratives section of the annual report. We find that R&D-related disclosures assist investors to better anticipate the future earnings of capitalizers, irrespective of the strength of national regulation. Subsequently, we examine the potential impact that country-level corruption and accounting and audit enforcement have on our findings. The results from these tests show that our key finding that R&D disclosures are indeed informative about future earnings holds only for the sub-sample of firms headquartered in countries with lower levels of corruption and in countries with strong accounting and audit enforcement.

To the best of our knowledge, this is the first study to show that R&D disclosure is associated with stock prices that are more informationally efficient and reflect more information about future earnings. The findings of this study could also inform standard-setters. For example, the IASB announced that its work plan for 2022 to 2026 would include work around the accounting for, and disclosure of, intangible assets (IASB, 2022). Our evidence directly informs the stage of that project regarding the disclosures of intangible assets. Our evidence also informs the Accounting for and Disclosure of Intangibles project led by the FASB, which aims to improve disclosures of intangible assets.

The findings presented in this study are also subject to a number of caveats. First, given the manual data selection involved, we have restricted our sample to IFRS-reporting firms from the top 15 countries based on listed firms' R&D intensity. Thus, our findings may not be generalizable to firms from countries with

lower R&D intensity. However, our analysis includes all firms with available annual reports in English and no exclusion criteria have been applied with respect to a firm's R&D intensity. Second, we acknowledge that to ensure that we have sufficient data in subsequent accounting periods to validate the disclosure index (see Appendix C), the sample selection for the main analysis ends in 2015. Future research could examine whether our inferences hold in other countries and more recent periods (although earnings and returns and their association post 2019 may be affected by the impact of the COVID-19 pandemic in stock markets). Finally, future research could examine the role of R&D-related disclosures in firms that are considered as R&D inactive, given that they do not report separately an amount of R&D expense or development cost capitalized (c.f., Dionysiou *et al.*, 2023).

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APPENDIX A SUMMARY OF NATIONAL REGULATIONS ON R&D-RELATED DISCLOSURES

Country	Regulation effective	Source	Regulation in place	RD_Law*
Australia		Regulatory Guide RG 247	No national regulation requiring companies to explicitly discuss R&D activities	0
Belgium	Prior to sample selection	CBN advice 138-4	National regulation requiring companies to discuss or report financial information R&D activities, albeit at a very generic level	1
Canada		Canadian Securities Administrations 52-109	No national regulation requiring companies to explicitly discuss R&D activities	0
China	Prior to sample selection and subsequently to 2012	No. 2 Standard on the Content and Format of Information Disclosure for Publicly Issued Securities Companies—Content and Format of Annual Reports Article 27f	From 2001, companies to discuss or report financial information R&D activities, albeit at a very generic level.	1 up to 2012
Denmark	Prior to sample selection	LBK no. 196 of 23/03/2004	From 2012, national regulation provides more detailed requirements for quantitative and/or qualitative disclosures around R&D activities National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	2 from 2012
Finland	2016	Accounting Act 1336/1997	National regulation requires companies to provide information on the scope and extent of the R&D activities	0
France	Prior to sample collection	CNC 138-4 and L232-1 Code du Commerce	National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	1
Germany	Prior to sample selection	German Accounting Standard (GAS) 15		2

(Continues)

Country	Regulation effective	Source	Regulation in place	RD_Law*
Israel ⁺⁺ Japan	NA 2018	NA Corporate governance code	National regulation provides more detailed requirements for quantitative and/or qualitative disclosures around R&D activities N/A National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	0 0
Netherlands	Prior to sample selection	RJ 400.123-127, RJ 400.125, RJ 400.126	National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level. In fact, companies should make a distinction between fundamental research and applied research	1
Norway	Prior to sample selection	National accounting law schedule 3-3a	National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	1
Sweden	Prior to sample collection	Article 19 nr. 2 letter b Årsredovisningslagen (Annual Accounts Act), chapter 6, 1§, second part, point 4 Art. 961c	National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	1
Switzerland	2015		Prior to 2015, no national regulation requiring companies to explicitly discuss R&D activities. Post 2015, national regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	0 up to 2014
UK	2007	Disclosure and Transparency Rule (DTR) 4.1.11R	Prior to 2007, no national regulation requiring companies to explicitly discuss R&D activities. Post 2007, national regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level	1 from 2015 0 up to 2006
				1 from 2007

*RD_Law proxies for the level of detail of R&D-related disclosure requirements in national regulations during our sample period. ⁺⁺Information inferred from Chen *et al.* (2017). We are grateful to the colleagues who pointed us to the sources of regulations that we were not able to source ourselves: Mitchell Bryce (Australia), Tami Dinh (Switzerland), Antti Fredriksson (Finland), Niclas Hellman (Sweden), Philip Joos (Netherlands and Belgium), Ann Jorissen (Belgium), Erlend Kvaal (Norway), Michel Magnan (Canada), Stefan Schaper (Denmark), Alain Schatt (Switzerland), Frank Thinggaard (Denmark), and Anne Jeny (France).

APPENDIX B

R&D-RELATED KEYWORDS

<i>Research Phase (n = 40)</i>	Annual report	Financial statements	Narratives
applied research	249	79	170
basic research	349	55	294
clinical candidate*	82	10	72
collaborative research*	213	53	160
conduct research*	120	30	90
evaluating the potential of	2	0	2
experimental phase	18	0	18
experimental study	2	0	2
in process research	379	321	58
innovation	60,031	6,384	53,647
invention	2,335	268	2,067
joint research*	300	50	250
new knowledge	161	34	127
new medicine	538	41	497
new project	2,315	256	2,059
pilot study*	181	25	156
planned investigation	30	27	3
planned trial	4	1	3
preclinical data*	138	11	127
research and evaluation project*	0	0	0
research center*	2,369	333	2,036
research collaboration*	642	170	472
research engineering and development*	0	0	0
research facility*	573	122	451
research finding	391	316	75
research initiative*	87	14	73
research operation*	84	20	64
research phase	637	542	95
research pipeline*	34	0	34
research program*	1,329	240	1,089
research project*	2,041	459	1,582
research unit	153	9	144
research venture*	9	0	9
safety study*	191	15	176
technology acquisition	116	10	106
test data	42	2	40
testing phase	98	32	66
training activity	321	64	257
transformative medicine	0	0	0
trial result	355	45	310
<i>Development Phase (n = 55)</i>	Annual report	Financial statements	Narratives
breakthrough in*	332	15	317
clinical data*	803	90	713
clinical development*	4,158	571	3,587
clinical program*	517	62	455
clinical research	869	182	687
clinical study*	3,533	411	3,122

(Continues)

R&D DISCLOSURES AND INFORMATIVENESS

<i>Research Phase (n = 40)</i>	<i>Annual report</i>	<i>Financial statements</i>	<i>Narratives</i>
clinical trial	16,212	2,339	13,873
completion of key milestones*	2	2	0
continuing development of*	225	22	203
design of jig	0	0	0
design of mould	2	0	2
design of tool	1	0	1
develop technology*	201	8	193
developing new process	23	1	22
developing new product*	826	127	699
developing new technology*	131	8	123
developing process	72	9	63
developing product	799	91	708
developing technology	241	14	227
development cost	36,709	29,728	6,981
development of new process	47	10	37
development of new product*	1,605	363	1,242
development of process	64	10	54
development of product	898	164	734
development of proprietary technology*	3	0	3
development phase	1,730	966	764
development process	2,640	429	2,211
device development	127	9	118
drug candidate*	2,802	507	2,295
drug development	1,707	283	1,424
entering development*	7	0	7
in process development	13	13	0
internally generated	5,000	4,697	303
joint venture to develop*	22	5	17
new technology*	7,102	694	6,408
pilot plant	587	65	522
platform development	81	10	71
preclinical development*	360	70	290
process development	668	109	559
product candidate*	5,357	319	5,038
product development*	19,227	4,165	15,062
product engineering*	179	22	157
projects in development*	51	7	44
prototype	2,611	398	2,213
R&D*	41,630	9,186	32,444
research and development*	67,161	31,507	35,654
research and product development*	249	71	178
research development*	4,509	1,547	2,962
scientific breakthrough	20	1	19
service development	183	24	159
technical development*	754	173	581
technological breakthrough*	162	31	131
technology breakthrough*	24	0	24
technology development*	1,448	313	1,135
technology milestone*	15	3	12
<i>Conditions for Capitalization (n = 15)</i>	<i>Annual report</i>	<i>Financial statements</i>	<i>Narratives</i>
ability to sell	269	149	120
ability to use	1,416	1,288	128
availability of financial resource	6	3	3

(Continues)

<i>Research Phase (n = 40)</i>	Annual report	Financial statements	Narratives
commercial resource	41	5	36
commercial success	1,313	150	1,163
existence of a market	130	122	8
financial availability	0	0	0
generate future cashflow	0	0	0
generate future economic benefit	947	941	6
generate future value	4	0	4
intention to complete	936	930	6
resource availability	16	2	14
resources to demonstrate the economic value	0	0	0
technical availability	8	0	8
technical feasibility	2,151	2,025	126
<i>Intellectual Property (n = 9)</i>	Annual report	Financial statements	Narratives
announced a collaboration*	27	8	19
application pending	13	2	11
applications pending*	71	6	65
collaborative initiative*	2	0	2
established a collaboration*	2	0	2
existing alliance	22	1	21
intellectual capital	329	59	270
patent*	59,024	21,555	37,469
possible alliance	0	0	0

*indicates R&D keywords used in Merkley (2014).

APPENDIX C

VALIDATION OF R&D DISCLOSURE INDEX

'Validity relates to how well the results of a study mirror reality' (Jones and Shoemaker, 1994, p. 5). In our case, this translates to how well the research instrument adequately measures the concept of interest (c.f., Tsalavoutas *et al.*, 2020), that is, whether the R&D disclosure we capture reflects actual R&D activity levels and hence related discussion. Weber (1990, p. 19) states that four types of external validity are pertinent (Weber, 1990, p. 19): construct validity; hypothesis validity; predictive ability; and semantic validity. Construct validity refers to the extent that the constructed instrument is correlated with other measures of the same construct. Hypothesis validity refers to the correspondence between an instrument and theory. Thus, an instrument has hypothesis validity if it behaves as it is expected to. Predictive ability ensures that the instrument can predict future, past, or concurrent events. Finally, semantic validity refers to 'when persons familiar with the language and texts examine lists of words (or other units) placed in the same category and agree that these words have similar meanings or connotations' (Weber, 1990, p. 21). Below, we discuss the steps we followed to establish the validity of the research instrument, in relation all four aspects.

TABLE C1
VALIDITY TESTS

Panel A: R&D disclosure score determinants			
	(1)	(2)	(3)
	AR	FS	NR
Constant	-6.510*** (-11.62)	-5.170*** (-10.04)	-5.612*** (-10.66)
CAP	0.081** (2.42)	0.184*** (5.48)	-0.011 (-0.29)
BM ^w	-0.205*** (-8.02)	-0.179*** (-6.86)	-0.193*** (-6.93)
RD_VALUE ^w	-0.000*** (-6.06)	-0.000*** (-4.53)	-0.001*** (-6.82)
RD_INT ^w	0.031*** (4.42)	0.023*** (3.88)	0.036*** (4.75)
SIZE	-0.060*** (-5.56)	-0.074*** (-7.21)	-0.043*** (-3.75)
BETA ^w	0.023 (0.90)	0.002 (0.10)	0.034 (1.28)
LEV ^w	-0.586*** (-5.41)	-0.598*** (-5.68)	-0.424*** (-3.74)
FOR_SALES ^w	0.002*** (4.64)	0.001** (2.49)	0.004*** (6.37)
BENCHBEAT	0.255*** (10.91)	0.225*** (9.82)	0.270*** (10.58)
AUDIT	0.023 (0.71)	0.042 (1.37)	0.020 (0.55)
LENGTH	0.982*** (21.07)	0.781*** (19.63)	0.893*** (24.15)
CORRUPTION	0.002 (0.89)	-0.001 (-0.36)	0.008** (2.51)
AUDENF	0.002 (0.30)	0.011** (2.00)	-0.005 (-0.78)

(Continues)

TABLE C1
CONTINUED

Panel A: R&D disclosure score determinants			
	(1)	(2)	(3)
	AR	FS	NR
<i>RD_LAW</i>	-0.042 (-0.82)	-0.200*** (-4.39)	0.077 (1.06)
<i>RD_DIVERGENCE</i>	0.086 (1.08)	-0.070 (-0.96)	0.254** (2.33)
<i>ANTISELF_DEAL</i>	-0.152 (-0.71)	0.354* (1.79)	-0.275 (-1.05)
<i>CIVCOM</i>	0.422*** (2.71)	0.752*** (5.19)	0.374* (1.91)
Year/Industry fixed effects	Yes	Yes	Yes
Observations	6,490	6,490	6,490
Adjusted <i>R</i> ²	0.498	0.394	0.568
F	97.05	53.82	138.1
Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. <i>t</i> -statistics are presented in parentheses and are based on standard errors clustered at the firm level.			
Panel B: Testing construct and hypothesis validity			
	(1)	(2)	(3)
	AR	FS	NR
Constant	1.614*** (2.97)	1.716*** (3.61)	1.126*** (2.72)
<i>LN_DISC</i>	0.136*** (3.23)	0.118*** (3.16)	0.121*** (3.29)
<i>CAP</i>	-0.204*** (-4.96)	-0.215*** (-5.09)	-0.190*** (-4.77)
<i>BM</i> ^w	-0.094***	-0.096***	-0.101***

(Continues)

TABLE C1
CONTINUED

Panel B: Testing construct and hypothesis validity				
	(1)	(2)	(3)	
	AR	FS	NR	
<i>RD_VALUE^w</i>	(-3.22) -0.000	(-3.22) -0.000	(-3.52) -0.000	
<i>RD_INT^w</i>	(-0.52) 0.489***	(-1.26) 0.490***	(-0.55) 0.488***	
<i>SIZE</i>	(14.20) -0.021*	(14.33) -0.015	(14.20) -0.031***	
<i>BETA^w</i>	(-1.80) 0.103**	(-1.40) 0.108**	(-2.98) 0.098**	
<i>LEV^w</i>	(2.34) -0.330**	(2.44) -0.317**	(2.23) -0.374***	
<i>FOR_SALES^w</i>	(-2.44) -0.002**	(-2.36) -0.002**	(-2.76) -0.002**	
<i>BENCHBEAT</i>	(-2.18) 0.072	(-2.01) 0.080*	(-2.29) 0.073	
<i>AUDIT</i>	(1.56) -0.030	(1.70) -0.028	(1.60) -0.038	
<i>LENGTH</i>	(-0.62) -0.128**	(-0.57) -0.132***	(-0.78) -0.063	
<i>CORRUPTION</i>	(-2.08) -0.004*	(-2.70) -0.003	(-1.53) -0.005**	
<i>AUDENF</i>	(-1.84) 0.000	(-1.31) -0.000	(-2.24) 0.001	
<i>RD_LAW</i>	(0.10) 0.037	(0.08) 0.051	(0.24) 0.013	
<i>RD_DIVERGENCE</i>	(0.70) 0.010	(0.98) 0.031	(0.23) -0.009	
<i>ANTISELF_DEAL</i>	(0.17) -0.026	(0.49) -0.116	(-0.15) 0.033	

(Continues)

TABLE C1
CONTINUED

Panel B: Testing construct and hypothesis validity								
	(1)	(2)	(3)					
	AR	FS	NR					
CIVCOM	(-0.12)	(-0.53)	(0.16)					
	-0.138	-0.173	-0.103					
	(-0.99)	(-1.22)	(-0.75)					
Year/Industry fixed effects	Yes	Yes	Yes					
Observations	6,463	6,463	6,463					
Adjusted R ²	0.484	0.484	0.484					
F	22.71	23.81	21.21					
The dependent variable is R&D intensity one year ahead. The sample is reduced by 27 observations due to the unavailability of data regarding the dependent variable. Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. <i>t</i> -statistics are presented in parentheses and are based on standard errors clustered at the firm level.								
Panel C: R&D disclosure score—Predictive validity								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FutInc _{<i>t</i>+1}			FutInc _{Σ<i>t</i>+1,<i>t</i>+3}				
	AR	FS	NR	AR	FS	NR	FS	NR
Constant	-0.159** (-2.23)	-0.075 (-1.06)	-0.068 (-0.96)	-0.074 (-1.04)	-0.383* (-1.69)	-0.100 (-0.44)	-0.079 (-0.34)	-0.078 (-0.34)
RDE ^w	0.422*** (6.65)				1.477*** (7.06)			
LN_DISC		0.005 (1.27)	0.003 (0.59)	0.008** (2.20)		0.024* (1.81)	0.021 (1.40)	0.024** (2.15)
CAP	0.011 (1.57)	0.013* (1.76)	0.013* (1.74)	0.014* (1.84)	0.054** (2.40)	0.058** (2.48)	0.056** (2.39)	0.061** (2.57)
(Continues)								

(Continues)

TABLE C1
CONTINUED

Panel C: R&D disclosure score—Predictive validity								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	FutInc _{t+1}			FutInc _{Σt+1,t+3}				
	AR	FS	NR	AR	FS	NR	AR	NR
CAPEX ^w	0.436*** (5.55)	0.523*** (6.54)	0.521*** (6.48)	0.523*** (6.59)	2.016*** (8.98)	2.325*** (9.95)	2.326*** (9.87)	2.323*** (9.98)
SIZE	0.011*** (5.56)	0.004* (1.88)	0.004** (2.12)	0.003* (1.65)	0.023*** (3.76)	-0.002 (-0.38)	-0.001 (-0.13)	-0.003 (-0.51)
LEV ^w	0.059** (2.22)	0.076*** (2.62)	0.076*** (2.60)	0.076*** (2.62)	0.232*** (2.84)	0.293*** (3.18)	0.293*** (3.17)	0.291*** (3.17)
FOR_SALES ^w	0.000 (0.32)	0.000 (0.73)	0.000 (0.84)	0.000 (0.58)	0.000 (0.81)	0.000 (1.13)	0.000 (1.23)	0.000 (1.04)
BENCHBEAT	0.019*** (3.10)	0.042*** (6.84)	0.043*** (6.93)	0.041*** (6.74)	0.044** (2.54)	0.117*** (6.85)	0.119*** (6.89)	0.116*** (6.85)
AUDIT	0.021*** (2.73)	0.020** (2.53)	0.021*** (2.61)	0.020** (2.43)	0.079*** (3.31)	0.077*** (3.05)	0.079*** (3.14)	0.076*** (3.00)
CORRUPTION	0.000 (0.59)	0.000 (0.66)	0.000 (0.81)	0.000 (0.52)	0.000 (0.36)	0.001 (0.40)	0.001 (0.56)	0.001 (0.37)
AUDENF	0.000 (0.11)	0.000 (0.03)	0.000 (0.03)	0.000 (0.07)	0.000 (0.04)	-0.000 (-0.11)	-0.001 (-0.14)	-0.000 (-0.06)
RD_LAW	0.020** (2.15)	0.023** (2.39)	0.024** (2.45)	0.021** (2.16)	0.060* (1.91)	0.072** (2.21)	0.077** (2.38)	0.066** (2.00)
RD_DIVERGENCE	-0.007 (-0.55)	-0.001 (-0.08)	-0.000 (-0.02)	-0.003 (-0.19)	-0.033 (-0.75)	-0.011 (0.103)	-0.006 (-0.14)	-0.014 (-0.31)
ANTISELF_DEAL	0.025 (0.60)	0.018 (0.42)	0.012 (0.29)	0.023 (0.54)	0.124 (0.96)	0.103 (0.77)	0.078 (0.59)	0.110 (0.83)
CIVCOM	0.018 (0.59)	0.019 (0.65)	0.018 (0.61)	0.021 (0.72)	0.062 (0.65)	0.065 (0.69)	0.053 (0.56)	0.072 (0.76)
Year/Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,482	6,482	6,482	6,482	5,987	5,987	5,987	5,987
(Continues)								

(Continues)

TABLE C1
CONTINUED

Panel C: R&D disclosure score—Predictive validity								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$FutInc_{t+1}$				$FutInc_{\sum t+1,t+3}$			
		AR	FS	NR		AR	FS	NR
Adjusted R^2	0.157	0.118	0.118	0.119	0.265	0.206	0.206	0.206
F	19.34	14.03	14.26	14.09	24.28	17.85	18.10	17.83

The sample is reduced due to the unavailability of data regarding the dependent variable. Variable definitions are reported in Appendix E.^w Variables winsorised at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. *t*-statistics are presented in parentheses and are based on standard errors clustered at the firm level.

Starting from the last, semantic validity, we note that Mazzi *et al.* (2019b) discuss the content of the research instrument and received feedback from two professional accountants with significant experience. Additionally, we received and considered detailed feedback from six experienced professionals (see discussion in ‘Measuring R&D Disclosure’ section).

Then, to assess construct and hypothesis validity, we first tested the association of R&D disclosure levels with common variables identified in prior relevant literature as significant determinants of R&D-related disclosures in other settings (e.g., La Rosa and Liberatore, 2014; Merkley, 2014; Nekhili *et al.*, 2016; Chen *et al.*, 2017; Dinh *et al.*, 2020). The results presented in Panel A of Table C1 show that R&D disclosure levels are indeed positively correlated with the size of the total number of words, *LENGTH*, similar to Merkley (2014), and negatively correlated with firm size, *SIZE*, similar to Nekhili *et al.* (2016). Additionally, the coefficient of book-to-market ratio, *BM*, is negative and significant in all specifications in line with the positive association of the market-to-book ratio in Chen *et al.* (2017). Further, R&D disclosure levels are positively correlated with *CIVCOM*, the indicator variable for civil law countries, in line with La Rosa and Liberatore (2014). Importantly, in line with Ding *et al.* (2004), Merkley (2014), and Nekhili *et al.* (2016), we find the coefficients of R&D intensity (*RD_INT*) to be positive and significant when the dependent variable is our measure of R&D disclosure in the annual report (coefficient 0.031; *p*-value <0.01), narratives section of the annual report (coefficient 0.036; *p*-value <0.01) and financial statements (coefficient 0.023; *p*-value <0.01). This is intuitive because higher R&D intensity would indicate that such expenditure is indeed material and of particular relevance to a firm’s strategy. Thus, management is expected to discuss R&D to a greater extent as R&D is becoming more important.

Second, we considered prior R&D literature indicating that R&D exhibits high levels of persistence and is stable over the years (Childs and Triantis, 1999; Mañez and Love, 2020). Therefore, a firm’s R&D-related disclosures in a given year (*t*) should not only be correlated with R&D intensity in that year but should also be positively correlated with next year’s R&D intensity (*t* + 1). To test this, we replaced the dependent variable in the model presented in Panel A with one-year-ahead R&D intensity instead, and repeated our analysis. We present these results in Panel B of Table C1. Consistent with prior literature, we find that the coefficients of the current year’s R&D intensity are positively and significantly associated with next year’s R&D intensity in all specifications (coefficients 0.489, 0.490, and 0.488; *p*-value <0.01). Importantly, we find that the coefficients of R&D disclosure are also positive and significant in line with our expectation, with respect to such disclosures in the annual report (coefficient 0.136; *p*-value <0.01), narratives section of the annual report (coefficient 0.121; *p*-value <0.01), or financial statements (coefficient 0.118; *p*-value <0.01). These results support the construct and hypothesis validity of our instrument.

Finally, in relation to the predictive ability of the instrument, we considered prior literature showing that R&D expenditure can predict future earnings as indicated by its positive association with future earnings (Sougiannis, 1994; Mazzi *et al.*, 2019a;

Curtis *et al.*, 2020). To this end, and considering the positive association between R&D intensity and R&D disclosure (see above), we examined the association between R&D disclosure and future earnings to assess its predictive ability. Specifically, the tests in columns (1) to (4) of Panel C of Table C1 employ the earnings one year ahead ($t + 1$) while columns (5) to (8) employ the sum of future earnings for three years ahead as the dependent variable ($t + 1$ to $t + 3$), respectively. The results from these tests do confirm that our research instrument exhibits predictive ability given that the coefficient of R&D disclosure in the narratives section of the annual report is positive and significant in both specifications (coefficients: 0.008 and 0.024, respectively; p -values < 0.05 and < 0.05 , respectively). Similarly, we find that the coefficient of R&D disclosure in the annual report is positive and significant only when the dependent variable is the sum of earnings of a three-year period ahead (coefficient 0.024; p -value < 0.10).

APPENDIX D DETERMINANTS OF DECISION TO CAPITALIZE R&D

	CAP	
	Coefficient	t -statistic
Constant	-2.263***	(-2.96)
BM^w	0.094*	(1.79)
RD_VALUE^w	-0.000	(-1.59)
RD_INT^w	-0.044***	(-3.62)
$SIZE$	-0.028	(-1.53)
$BETA^w$	0.013	(0.28)
LEV^w	0.371*	(1.84)
FOR_SALES^w	0.002**	(2.08)
$BENCHBEAT$	0.392***	(8.89)
$AUDIT$	-0.130**	(-1.98)
$CORRUPTION$	-0.006	(-1.04)
$AUDENF$	0.020*	(1.67)
RD_LAW	0.197*	(1.82)
$RD_DIVERGENCE$	0.563***	(3.25)
$ANTISELF_DEAL$	0.023	(0.05)
$CIVCOM$	0.275	(0.88)
Year fixed effects	Yes	
Industry fixed effects	Yes	
Observations	6,490	
Pseudo R^2	0.078	
Wald Chi	224.3	

Variable definitions are reported in Appendix E. ^w Variables winsorized at 1% and 99%. *, **, and *** indicate statistical significance at the 0.10, 0.05, and 0.01 levels, respectively. t -statistics are presented in parentheses and are based on standard errors clustered at the firm level.

APPENDIX E

DEFINITION OF VARIABLES

Name	Description
<i>DISC</i>	Number of words in each firm's annual report (AR) from the R&D words list in Appendix B. This is calculated as the sum of the number of words in each firm's narratives section of the annual report (AN) and financial statements (FS)
<i>LN_DISC</i>	Logarithmic transformation of 1 plus <i>DISC</i>
<i>LENGTH</i>	Total number of words in each firm's AR calculated as the sum of total number of words in the AN and FS section of the annual report. In the multivariate analysis, we use the corresponding total number of words
<i>CURR_R</i>	One-year compounded firm stock returns, measured from nine months prior the end of each firm's financial year-end to three months after the year-end (return index: RI)
<i>FUT_E</i>	Net income (WC01551) scaled by firm market value (WC08001) measured at time $t + 1$
<i>CURR_E</i>	Net income (WC01551) scaled by firm market value (WC08001) measured at time t
<i>LAG_E</i>	Net income (WC01551) scaled by firm market value (WC08001) measured at time $t-1$
<i>FUT_R</i>	One-year compounded firm stock returns, measured from three months after the end of each firm's financial year-end onwards (RI)
<i>CAP</i>	Indicator variable that equals one if a company capitalizes development costs during the year, and zero otherwise. Capitalized amount of development costs is measured as the change in net R&D assets (WC02504) plus amortization of R&D (WC01153)
<i>IMR</i>	Inverse Mills Ratio calculated from the probit model examining the determinants of capitalizing R&D with <i>CAP</i> is the dependent variable (see Appendix D)
<i>BM</i>	Book-to-market ratio calculated as common equity (WC03501) scaled by market capitalization (WC08001)
<i>RD_VALUE</i>	R&D value measured as the difference between the market value of equity (WC08001) and the book value of equity (WC03501) less the amount of R&D capitalized during the year divided by the sum of current and lagged annual R&D expenditure. R&D expenditure is defined as the sum of R&D expense for the year (WC01201) and the amount of capitalized development during the year which is measured as the change in net R&D assets (WC02504) plus amortization of R&D (WC01153)
<i>RD_INT</i>	R&D expenditure scaled by sales (WC01001). R&D expenditure is defined as the sum of R&D expense for the year (WC01201) and the amount of capitalized development during the year which is measured as the change in net R&D assets (WC02504) plus amortization of R&D (WC01153)
<i>SIZE</i>	Natural logarithm of market capitalization (WC08001)
<i>BETA</i>	A firm's beta estimated using 12 months returns over each firm local index (Datastream)
<i>LEV</i>	Total debt (WC03255) divided by total assets (WC02999)
<i>FOR_SALES</i>	Percentage of international sales to total sales (WC07101)
<i>BENCHBEAT</i>	Indicator variable that equals one if a firm is suspected of capitalizing R&D in order to beat or meet earnings benchmarks and zero otherwise. We consider last year's earnings and the zero earnings threshold

(Continues)

ABACUS

Name	Description
<i>AUDIT</i>	Indicator variable that equals one if the annual report is audited by a Big4 firm, and zero otherwise (BSAAuditorCode)
<i>FutInc_{t+1}</i>	Earnings at year $t + 1$, scaled by the market value of equity (WC08001). Earnings are defined as income before extraordinary items (WC01551) plus R&D expense (WC01201) and depreciation and amortization (WC01151)
<i>FutInc_{∑t+1,t+3}</i>	Sum of future earnings year $t + 1$ to year $t + 3$, scaled by the market value of equity (WC08001). Earnings are defined as income before extraordinary items (WC01551) plus R&D expense (WC01201) and depreciation and amortization (WC01151)
<i>CORRUPTION</i>	The reverse of the CPI and the higher the corruption the more corrupt a country is perceived (Transparency International)
<i>CAPEX</i>	Capital expenditure (WC04601) for year t scaled by the market value of equity (WC08001)
<i>RDE</i>	R&D expenditure for the year scaled by the market value of equity. R&D expenditure is defined as the sum R&D expense for the year (WC01201) and the amount of capitalized development during the year which is measured as the change in net R&D assets (WC02504) plus amortization of R&D (WC01153)
<i>AUDENF</i>	An index capturing the quality of audit function and degree of accounting enforcement in each country measured in 2008 (Brown <i>et al.</i> , 2014)
<i>RD_LAW</i>	Indicator variable equal to zero if there is no national regulation requiring companies to explicitly discuss R&D activities, one if national regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level and two if national regulation provides more detailed requirements for quantitative and/or qualitative disclosures around R&D activities (see also Appendix A)
<i>RD_DIVERGENCE</i>	Indicator variable that equals one if capitalization of development or research costs was allowed or required prior to the adoption of IFRS and zero if no such capitalization was permitted
<i>ANTISELF_DEAL</i>	Anti self-dealing index measuring legal protection of minority shareholders against expropriation by corporate insiders (La Porta <i>et al.</i> , 2008)
<i>CIVCOM</i>	Indicator variable that equals one for civil law and zero for common law (Porta <i>et al.</i> , 1998)