# R&D disclosures and the informativeness of future earnings

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# R&D disclosures and the informativeness of future earnings


## Abstract

This study examines the effect of 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

**JEL classification**

O30, M41, M48

## 1. Introduction

In this research, we examine the association between research and development (R&D) disclosures and the informativeness of stock prices. We effectively test 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 (Curtis et al., 2020; Jaruzelski et al., 2005; Lev, 1999). This is recognised 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 (Curtis et al., 2020; Hou et al., 2022; Mazzi et al., 2019a), market values (Hall, 1993; Sougiannis, 1994) and subsequent stock returns (Chan et al., 2001; Duqi et al., 2015; Hou et al., 2022; Lev, 1999; Lev & Sougiannis, 1996).

However, despite the importance of R&D, the related future payoffs are well recognised as being inherently uncertain (Hussinger & Pacher, 2019). Consistently, prior literature shows that R&D expenditure is positively associated with greater volatility in future earnings (Amir et al., 2005; Dargenidou et al., 2021; Kothari et al., 2002; Johnston, 2012) or volatility of market returns (Amir et al., 2005; Chambers et al., 2002; Chan et al., 2001). Additionally, outsiders cannot infer relevant information only by observing the productivity of R&D projects in other firms or by referring to an organised R&D market (Aboody & 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 hypothesise that greater levels of disclosures 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.

To measure R&D disclosure, as in Merkley (2014) and Oh et al. (2024), we develop a dictionary of 119 R&D related keywords. Using a computerised content analysis approach, we identify the number of times each firm makes reference to each of the keywords in our list in the annual report. Our sample comprises of 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 (c.f., 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 & 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 & 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 keywords 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 the *Research Phase* and *Intellectual Property* topics communicate information that assists investors to better anticipate future earnings and incorporate this information into current market prices across the full sample.

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

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 and not-surprisingly is 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, this 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 the primary objective of disclosures to "help investors to predict the future" (Gelb & Zarowin, 2002, p. 34). Prior literature has thus far examined whether R&D related disclosures are associated with market values (Cao et al., 2018; Chen et al., 2017; Dinh et al., 2020; Xu et al., 2007; 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 & 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 Cao et al. (2018), Guo et al. (2004), Jones (2007), Merkley (2014), and Xu et al. (2007) 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 & Zarowin, 2002; Lundholm & 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 enhances investors' ability to anticipate future earnings (e.g., Athanasakou & Hussainey, 2014; Schleicher et al., 2007; Wang & Hussainey, 2013). 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 (*Research Phase*, *Development Phase*, and *Intellectual Property*) are indeed informative to investors. In contrast, IAS 38 currently lacks mandatory disclosures despite the 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]

The remainder of this study is structured as follows. Section 2 discusses the current requirements around R&D disclosures, the relevant literature and then develops our hypothesis. Section 3 discusses the research design. Section 4 presents the findings from the main and additional analysis, while Section 5 discusses the sensitivity tests we have performed. Section 6 concludes the study.

## 2. Background and literature review

### 2.1 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 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: i) whether the useful life of the asset is indefinite or finite and, if finite, the useful life or the amortisation rate; ii) the amortisation method for assets with finite life; iii) the gross carrying amount and any accumulated amortisation; iv) the line item(s) of the statement of comprehensive income in which any amortisation of intangible assets is included; and v) reconciliation of the carrying amount at

[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.

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,b). 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). Similarly to the Italian 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

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

"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 (Dinh et al., 2020; ASCG 2004).

A notable example outside of the EU is China. From 2012, China Securities Regulatory Commission (CSRC) also requires more detailed R&D disclosures in narratives section of the 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 & Zou, 2024). in Appendix A, we summarise 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.

## 2.2 Literature review and hypothesis development

### 2.2.1 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 a US context, Dargenidou et al. (2011) use the transparency and disclosure (T&D) index prepared by Standard and Poor (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.

[5] Similar to AIMR disclosure ratings, Standard and Poor's T&D index includes both financial and non-financial as well as voluntary and mandatory disclosures.

Prior literature has also examined the impact of more specific disclosures on the market's ability to anticipate future earnings. In a 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 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".

### 2.2.2 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. Focusing on R&D disclosures in 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., Chan et al., 2001; Duqi et al., 2015; Hall, 1993; Hou et al., 2022; Lev, 1999; Lev & Sougiannis, 1996; Sougiannis, 1994) 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.*

## 3. Methods and data

### 3.1 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 keywords and terms (hereafter keywords) 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 keywords in our list. The sum of these frequencies for each keyword 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 computerised approach to content analysis ensures that the results are reliable in terms of reproducibility, stability and accuracy (Jones & Shoemaker, 1994; Sekaran, 1992; Weber, 1990). 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 keywords list is the one used in Mazzi et al. (2019b),[6] augmented by three additional keywords. The key advantages of using this list are the following. First, the list includes the keywords 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 supplemented Merkley's (2014) list and included keywords 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) relied on prior related studies (Chen et al., 2017; Dinh et al., 2020; Guo et al., 2004; Jones, 2007; La Rosa & Liberatore, 2014; Nekhili et al., 2016) 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 (c.f., Jones & Shoemaker, 1994; Weber, 1990) of the keywords list. Further, the results related to the determinants of the disclosure levels reported in Mazzi et al. (2019b) confirm the construct and hypothesis validity (c.f., Jones & Shoemaker, 1994; Weber, 1990) of the keywords 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 keywords across four broad topics: *Research Phase*; *Development Phase*; *Conditions for Capitalization*; and

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

[7] Specifically, Financial Accounting Standard Board (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.

[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.

*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. The *Research Phase* topic includes words associated with the early stage of R&D and contains 40 keywords such as "research program" or "research finding". The *Development Phase* topic includes 55 keywords relating to development of a product or service and includes keywords 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, the *Conditions for Capitalization* topic includes 15 keywords such as "ability to sell" or "existence of a market". The remaining nine keywords, 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 topic named *Intellectual Property*. Effectively these keywords 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 keywords 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 manually each report in two parts: 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 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.

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3.2 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 (Dargenidou et al., 2021; Oswald & Zarowin, 2007), risk disclosures (Moumen et al., 2016), forward looking disclosures (Athanasakou & Hussainey, 2014) or more broadly other voluntary disclosures (Dargenidou et al., 2011; Gelb & Zarowin, 2002; Hussainey & Walker, 2009). 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, $E_{i,t+1}$ represents firm's *i* earnings in year *t+1*, $E_{i,t}$ represents firm's *i* earnings in year *t*, $E_{i,t-1}$ represents firm's *i* earnings in year *t-1*, and$R_{i,t+1}$ represents the annual stock return of firm *i* in year *t+1*, . 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 Dargenidou et al. (2021), Dargenidou et al. (2011) and Ettredge et al. (2005), we use one year ahead earnings.[11] This is motivated by the investment practices of investors who rely on one-

[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 Section 5).

year forecasts (Demirakos et al., 2010; Imam et al., 2008). Further, if realised 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 & 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 & 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 Eq. (1) by introducing $LN\_DISC_{i,t}$, which is the natural logarithm of the frequency of R&D related terms (see Section 4.2 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:

$$R_{i,t}= a_0 + b_1 E_{i,t+1} + b_2E_{i,t} + b_3E_{i,t-1} + b_4R_{i,t+1}+ b_5E_{i,t+1}*LN\_DISC_{i,t} + b_6E_{i,t}* LN\_DISC_{i,t} + b_7E_{i,t-1}* LN\_DISC_{i,t} + b_8R_{i,t+1}* LN\_DISC_{i,t} + LN\_DISC_{i,t} + CONTROLS + \varepsilon_{i,t} \quad (2)$$

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 H1, 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 Eq. (2) separately for the keywords referred to in the narratives section of the annual report and those referred to in the financial 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 & Zarowin, 2007; Shah et al., 2013). Thus, we include an indicator variable, *CAP*, that equals to one for firms that capitalize development costs and zero otherwise. Additionally, we apply the estimation technique of Heckman (1989) and Lee (1979) to control for the endogenous decision to capitalize development costs (Dargenidou et al., 2021; Dinh et al., 2020; Oswald & Zarowin, 2007). 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 of 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 of one for civil law countries and zero if the country is common law (La Porta et al., 1998), and *CORRUPTION*, calculated as the inverse of 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 summarise in Appendix A, we include a time-varying country control variable (*RD_LAW*). This is an indicator variable that equals 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.[12]

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 winsorised at the 1% level of their distribution. Appendix E presents the definitions of all variables used in the analysis.

[12] It is noted that, although *RD_LAW* may be equal to 0 for some countries, if R&D activities form part of material information about the entity's business model and value creation, local regulations indirectly imply that firms provide some disclosures around R&D activities. Australia and Canada are countries that fall in this category.

### 3.2 Sample selection

Given the significant effort required to identify and download annual reports in English across several countries and then splitting them manually in two parts, we choose 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 permit firms to report under IFRS in 2005 up to and including 2013. To identify these countries, we rely on the IFRS Foundation guide on the use of IFRS by jurisdiction.[13] Then, we collect firm level data using the Worldscope lists containing the population of active and "dead" corporations for all countries that meet the above criteria. From these lists, we only consider equity (stock) listings (Datastream item TYPE to be EQ), with a primary listing being the country of investigation and retain firms that report 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 identify 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 period allows 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 apply several necessary selection criteria that are commonly applied in the relevant literature. We start by eliminating firm-year observations that either do not report under IFRS or the data item indicating the accounting standards is missing, to ensure that the accounting information is comparable and also R&D disclosures are better aligned with IAS 38 *recognition* requirements.[14]. Subsequently, to ensure that the earnings in Eq.1 are reported for periods of similar length, we eliminate firm-year observations with accounting periods of>380 or<350 days (Dargenidou et al., 2018; Tsalavoutas & Tsoligkas, 2021). We also eliminate firms that either have missing industry classification or belong in the Energy

[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 based on the ICB classification.[15] Subsequently, we eliminate firm-year observations with missing firm data in Datastream/Worldscope. From this pool of firm-year observations, we collect the corresponding annual reports. We specifically require 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 yields 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., Chen et al., 2017; Dinh et al., 2020; Guo et al., 2004; Jones, 2007; La Rosa & Liberatore, 2014; Nekhili et al., 2016).[16]

TABLE 1 HERE

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), 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 (Anagnostopoulou et al., 2023; Hou et al., 2022; Mazzi et al., 2019a). We also observe a variation of firm-year observations across industries. Consistent with prior literature (e.g., Dargenidou et al., 2021; Mazzi et al., 2019a), our sample is highly represented by firms from Industrials (1,600), Technology (1,488) and Health Care (1,130).

TABLE 2 HERE

[15] Informed by Dargenidou et al. (2021) and Mazzi et al. (2019a), we remove 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 (see Section 5), 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.

## 4 Findings

### 4.1 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 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 keywords 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 Section 2). 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 keywords featuring in firms' annual reports relate to the *Development Phase* and *Research Phase* topics (means (medians) of 36 (23) and 12 (5), respectively). Further, consistent with Panel A, the frequency of R&D keywords is significantly higher in the narratives part of the annual report, with the means 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 keywords related to the *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 a first glance may appear counter intuitive given that 45% of our sample capitalizes development costs (2,950 firm-year observations). However, as discussed in Section 2.1, IAS 38 lacks mandated disclosures for companies recognising such assets.

Panel C of Table 3 presents the frequencies of the 10 most frequently discussed R&D keywords in the annual report, along with the topic that each keyword belongs to. We also present the frequency with which each keyword 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 keywords are related to the *Development Phase* one to the *Research Phase* and one to the *Intellectual Property* topics, respectively. The most frequently used keywords include "research and development", "innovation", "patent" "development cost" and "product development". As indicated from the statistics in Panels A and B of Table 3, the frequency of these keywords 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 keywords for each of the four topics. Like the previous Panels, we present the frequency that each keyword is used in the annual report as a whole as well as the financial statements and narratives sections. We note that keywords relating to the *Development Phase* and *Research Phase* topics are the most frequently used. This is followed by keywords in the *Intellectual Property*. Lastly, keywords relating to *Conditions for Capitalization* topic is the least frequently used as discussed earlier.[18]

TABLE 3 HERE

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 (Dargenidou et al., 2021; Haw et al., 2012; 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 that the corresponding median values (medians: 0.043 and 0.056, respectively). Thus, returns are right-skewed consistent with prior literature (Dargenidou et al., 2021; Haw et al., 2012; Tsalavoutas & Tsoligkas, 2021).

TABLE 4 HERE

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,

[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.

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 degree of accounting enforcement, and *CIVCOM*, the indicator variable that equals to one for civil law and zero if 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*, the indicator variable that equals to 1 for civil law and zero if common law, is -0.942. In light of this, in sensitivity analysis, we remove all country level variables and instead use country fixed effects (see Section 5).[19]

TABLE 5 HERE

4.2 Multivariate analysis

Table 6 presents the results of the empirical implementation of Eq. 1 and Eq. 2. Column (1) presents the results of Eq. 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., Dargenidou et al., 2021; Ettredge et al., 2005; Haw et al., 2012; Lundholm & Myers, 2002; Tsalavoutas & 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 by 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.

The results presented in Column (2) present the results of Eq. 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 H1, 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 the 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-values<0.01) and narratives alone (coefficient: 0.068; partial F-test; 5.02, p-values<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 & Zarowin, 2002, p. 34). The lack of mandatory disclosure requirements for the financial statements section of the annual report (c.f., Dionysiou et al., 2023; Mazzi et al., 2022) 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.

TABLE 6 HERE

## 4.3 Additional analysis[20]

### 4.3.1 R&D related disclosure topics

As we discuss in Section 4.1, beyond computing an overall score of R&D disclosure, we also classify these keywords in 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 keyword 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 & Zarowin, 2002, p. 34), disclosures which 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 the *Development Phase*, *Conditions for Capitalization* and *Intellectual Property* topics could arguably be more likely to communicate R&D information of greater certainty/confidence that the R&D projects will deliver the future

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

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 & 0.039; p-values: <0.01 and <0.10, respectively) and the narratives section (coefficients: 0.077 & 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 interaction between earnings and R&D related disclosures with respect to *Conditions for Capitalization* topic 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* topics, communicate information that assists investors to better anticipate future earnings and incorporate this information into current market prices.

### 4.3.2 Expensers vs Capitalizers

Prior literature shows that capitalized development costs are indeed value relevant, both for equity and debt holders (e.g., Dinh et al., 2016; Kreß et al., 2019; Shah et al., 2013; Tsoligkas & Tsalavoutas, 2011). 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" (ibid, 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 assists 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 & 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. More 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 the three topics of *Research Phase*, *Development Phase*, and *Intellectual Property* in relation to the annual report as a 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 the *Research Phase* topic 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.

TABLE 7 HERE

[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 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.

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

4.3.3 R&D related disclosures, anticipation of future earnings and the role of country level regulation on R&D related disclosures

As discussed in Section 2.1, 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 of the EU countries, because of 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 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 around R&D activities.

On reflection of this, 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 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 in to 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 capitalize smaller amounts of development costs, scaled by market values (mean: 0.009 vs 0.015; difference significant at the 1% level) and 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 7-12 in Table 8 and show that R&D related disclosures assist investors to better anticipate 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).

TABLE 8 HERE

4.3.4 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 prior literature (see Leventis et al., 2023; Mazzi et al., 2019a for a review).[23] With regards to disclosures in particular, prior literature shows that firms headquartered in countries with higher levels of corruption provide more opaque information (Mazzi et al., 2018; Elamer et al., 2019; Baldini et al., 2018; Ioannou & Serafeim, 2012). 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 & 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. 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 Eq. 2 separately for firms headquartered in countries with lower and

[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).

higher levels of corruption, defined based on the yearly median value of Corruption Perception Index (CPI) of all the countries in the sample.

TABLE 9 HERE

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.

Taken together, these findings suggest that R&D related disclosures 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]

### 4.3.5 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 (Burgstahler et al., 2006; Lang et al., 2006; Leuz et al., 2003; Windisch, 2020) 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 less 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 recognise 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

[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 the 1%).

mandatory goodwill related information. Windisch (2021) shows that managerial discretion in accruals declines after the introduction of stricter enforcement. Tsalavoutas 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. (2011) 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 Eq. 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).

TABLE 10 HERE

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 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

[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 & Humphrey, 2021).

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 (4.3.4), these results indicate that R&D related disclosures 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 assist investors to anticipate future earnings.[26]

## 5 Sensitivity tests

To ensure that 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 recognise that R&D is a continuum from the research phase through to the development phase, leading to potential capitalization of relevant costs. Further, some keywords/terms may be difficult to categorise in a single category. They may span several categories depending on the context in which they appear in the annual report. Moreover, some keywords may be identified in both the topics of *Research Phase* and *Development Phase*, depending on the stage of advancement of the relevant processes. Finally, the *Conditions for Capitalization* can be considered as part of the wider *Development Phase* topic, 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 improves the market ability to anticipate future earnings and this result is driven by capitalizers.

TABLE 11 HERE

Second, as discussed in Section 4.2, 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-

[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.

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

level variables other than those of interest to the topic being examined (e.g., Ettredge et al., 2005; Dargenidou et al., 2021; Lundholm & Myers, 2002; Schleicher et al., 2007). 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 employ as additional analysis frequently (Dargenidou et al., 2021; Ettredge et al., 2005; Lundhold & Myers, 2002). 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: i) 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; ii) earnings persistence by including *Losses*, a dummy variable taking the value one if a company reports profit in the following year, and zero otherwise; iii) 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 iv) 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 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 which 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 which either cut R&D relative to the previous year's R&D expenditure or capitalize

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 & 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 keywords 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 relation 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 (Almaghrabi et al., 2024; Boutchkova et al., 2021), and following Lara et al. (2017), a dummy variable indicating whether the firm has a usual board size (i.e., between 5 and 12 members) or otherwise *(BSIZED,* a dummy variable taking the value of 1 if board size is between 5 and 12 directors, 0 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.

Tenth, 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

[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.

corporate governance mechanisms. For example, Lara et al. (2017) note that in firms with unusually small or large boards monitoring may suffer and consequently lead to greater earnings management.

TABLE 12 HERE

## 6 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 keywords 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 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 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 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 generalisable 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).

## 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 requires 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 27I | From 2001, companies to discuss or report financial information R&D activities, albeit at a very generic level. From 2012, national regulation provides more detailed requirements for quantitative and/or qualitative disclosures around R&D activities. | 1 up to 2012 2 from 2012 |
| Denmark | Prior to sample selection | LBK no. 196 of 23/03/2004 | National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level. | 1 |
| 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 | National regulation provides more detailed requirements for quantitative and/or qualitative disclosures around R&D activities. | 2 |
| Israel[++] | NA | NA | NA | 0 |
| Japan | 2018 | Corporate governance code | National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level. | 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 Article 19 nr. 2 letter b | 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 | Årsredovisningslagen (Annual Accounts Act), chapter 6, 1§, second part, point 4 | National regulation requires companies to discuss or report financial information R&D activities, albeit at a very generic level. | 1 |
| Switzerland | 2015 | Art. 961c | 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 1 from 2015 |
| 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. | 0 up to 2006 1 from 2007 |

*Notes: *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 (Sweeden), Philip Joos (Netherlands & 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

| Research Phase (n=40) | Annual Report (AR) | Financial Statements (FS) | Narratives (NR) |
|---|---|---|---|
| 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 |
| **Development Phase (n=55)** | **Annual Report (AR)** | **Financial Statements (FS)** | **Narratives (NR)** |
| 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 |
| 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 |
| **Conditions for Capitalization (n=15)** | **Annual Report (AR)** | **Financial Statements (FS)** | **Narratives (NR)** |
| ability to sell | 269 | 149 | 120 |
| ability to use | 1,416 | 1,288 | 128 |
| availability of financial resource | 6 | 3 | 3 |
| 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 |
| **Intellectual Property (n=9)** | **Annual Report (AR)** | **Financial Statements (FS)** | **Narratives (NR)** |
| 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 |

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

## Appendix C. Validation of the R&D disclosure index

"Validity relates to how well the results of a study mirror reality" (Jones & 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) i.e., 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 is 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.

Starting from the last, semantic validity, we note that Mazzi et al. (2019b) discussed the content of the research instrument and received feedback from two experts who are professional accountants with significant experience. Additionally, we received and considered detailed feedback from six experienced professionals (see discussion in Section 3.1).

Then, to assess construct and hypothesis validity, we first test 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., Chen et al., 2017; Dinh et al., 2020; La Rosa & Liberatore, 2014; Merkley, 2014; Nekhili et al., 2016). 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 & 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 consider prior R&D literature indicating that R&D exhibits high levels of persistence and it is stable over the years (Childs & Triantis, 1999; Mañez & 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 replace the dependent variable in the model presented in Panel A with one year's ahead R&D intensity instead, and repeat our analysis. We present these results in Panel B of Table C1. Consistent with prior literature, we find that the coefficients of 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 predictive ability of the instrument, we consider prior literature showing that R&D expenditure can predict future earnings as indicated by its positive association with future

earnings (Curtis et al., 2020; Mazzi et al., 2019a; Sougiannis, 1994). To this end, and considering the positive association between R&D intensity and R&D disclosure (see above), we examine 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).

**Table C1. Validity tests**
**Panel A. R&D disclosure score determinants**

| | (1) *AR* | (2) *FS* | (3) *NR* |
|---|---|---|---|
| Constant | -6.510*** | -5.170*** | -5.612*** |
| | (-11.62) | (-10.04) | (-10.66) |
| *CAP* | 0.081** | 0.184*** | -0.011 |
| | (2.42) | (5.48) | (-0.29) |
| *BM* [w] | -0.205*** | -0.179*** | -0.193*** |
| | (-8.02) | (-6.86) | (-6.93) |
| *RD_VALUE* [w] | -0.000*** | -0.000*** | -0.001*** |
| | (-6.06) | (-4.53) | (-6.82) |
| *RD_INT* [w] | 0.031*** | 0.023*** | 0.036*** |
| | (4.42) | (3.88) | (4.75) |
| *SIZE* | -0.060*** | -0.074*** | -0.043*** |
| | (-5.56) | (-7.21) | (-3.75) |
| *BETA* [w] | 0.023 | 0.002 | 0.034 |
| | (0.90) | (0.10) | (1.28) |
| *LEV* [w] | -0.586*** | -0.598*** | -0.424*** |
| | (-5.41) | (-5.68) | (-3.74) |
| *FOR_SALES* [w] | 0.002*** | 0.001** | 0.004*** |
| | (4.64) | (2.49) | (6.37) |
| *BENCHBEAT* | 0.255*** | 0.225*** | 0.270*** |
| | (10.91) | (9.82) | (10.58) |
| *AUDIT* | 0.023 | 0.042 | 0.020 |
| | (0.71) | (1.37) | (0.55) |
| *LENGTH* | 0.982*** | 0.781*** | 0.893*** |
| | (21.07) | (19.63) | (24.15) |
| *CORRUPTION* | 0.002 | -0.001 | 0.008** |
| | (0.89) | (-0.36) | (2.51) |
| *AUDENF* | 0.002 | 0.011** | -0.005 |
| | (0.30) | (2.00) | (-0.78) |
| *RD_LAW* | -0.042 | -0.200*** | 0.077 |
| | (-0.82) | (-4.39) | (1.06) |
| *RD_DIVERGENCE* | 0.086 | -0.070 | 0.254** |
| | (1.08) | (-0.96) | (2.33) |
| *ANTISELF_DEAL* | -0.152 | 0.354* | -0.275 |
| | (-0.71) | (1.79) | (-1.05) |
| *CIVCOM* | 0.422*** | 0.752*** | 0.374* |
| | (2.71) | (5.19) | (1.91) |
| Year/Industry FE | Yes | Yes | Yes |
| Observations | 6,490 | 6,490 | 6,490 |
| Adjusted $R^2$ | 0.498 | 0.394 | 0.568 |
| F | 97.05 | 53.82 | 138.1 |

*Notes:* 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.

**Panel B. Testing construct and hypothesis validity**

| | (1) *AR* | (2) *FS* | (3) *NR* |
|---|---|---|---|
| Constant | 1.614*** | 1.716*** | 1.126*** |
| | (2.97) | (3.61) | (2.72) |
| *LN_DISC* | 0.136*** | 0.118*** | 0.121*** |
| | (3.23) | (3.16) | (3.29) |
| *CAP* | -0.204*** | -0.215*** | -0.190*** |
| | (-4.96) | (-5.09) | (-4.77) |
| *BM* [w] | -0.094*** | -0.096*** | -0.101*** |
| | (-3.22) | (-3.22) | (-3.52) |
| *RD_VALUE* [w] | -0.000 | -0.000 | -0.000 |
| | (-0.52) | (-1.26) | (-0.55) |
| *RD_INT* [w] | 0.489*** | 0.490*** | 0.488*** |
| | (14.20) | (14.33) | (14.20) |
| *SIZE* | -0.021* | -0.015 | -0.031*** |
| | (-1.80) | (-1.40) | (-2.98) |
| *BETA* [w] | 0.103** | 0.108** | 0.098** |
| | (2.34) | (2.44) | (2.23) |
| *LEV* [w] | -0.330** | -0.317** | -0.374*** |
| | (-2.44) | (-2.36) | (-2.76) |
| *FOR_SALES* [w] | -0.002** | -0.002** | -0.002** |
| | (-2.18) | (-2.01) | (-2.29) |
| *BENCHBEAT* | 0.072 | 0.080* | 0.073 |
| | (1.56) | (1.70) | (1.60) |
| *AUDIT* | -0.030 | -0.028 | -0.038 |
| | (-0.62) | (-0.57) | (-0.78) |
| *LENGTH* | -0.128** | -0.132*** | -0.063 |
| | (-2.08) | (-2.70) | (-1.53) |
| *CORRUPTION* | -0.004* | -0.003 | -0.005** |
| | (-1.84) | (-1.31) | (-2.24) |
| *AUDENF* | 0.000 | -0.000 | 0.001 |
| | (0.10) | (-0.08) | (0.24) |
| *RD_LAW* | 0.037 | 0.051 | 0.013 |
| | (0.70) | (0.98) | (0.23) |
| *RD_DIVERGENCE* | 0.010 | 0.031 | -0.009 |
| | (0.17) | (0.49) | (-0.15) |
| *ANTISELF_DEAL* | -0.026 | -0.116 | 0.033 |
| | (-0.12) | (-0.53) | (0.16) |
| *CIVCOM* | -0.138 | -0.173 | -0.103 |
| | (-0.99) | (-1.22) | (-0.75) |
| Year/Industry FE | 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 |

*Notes:* 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 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.

**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* |
| Constant | -0.159** | -0.075 | -0.068 | -0.074 | -0.383* | -0.100 | -0.079 | -0.078 |
| | (-2.23) | (-1.06) | (-0.96) | (-1.04) | (-1.69) | (-0.44) | (-0.34) | (-0.34) |
| *RDE* [w] | 0.422*** | | | | 1.477*** | | | |
| | (6.65) | | | | (7.06) | | | |
| *LN_DISC* | | 0.005 | 0.003 | 0.008** | | 0.024* | 0.021 | 0.024** |
| | | (1.27) | (0.59) | (2.20) | | (1.81) | (1.40) | (2.15) |
| *CAP* | 0.011 | 0.013* | 0.013* | 0.014* | 0.054** | 0.058** | 0.056** | 0.061** |
| | (1.57) | (1.76) | (1.74) | (1.84) | (2.40) | (2.48) | (2.39) | (2.57) |
| *CAPEX* [w] | 0.436*** | 0.523*** | 0.521*** | 0.523*** | 2.016*** | 2.325*** | 2.326*** | 2.323*** |
| | (5.55) | (6.54) | (6.48) | (6.59) | (8.98) | (9.95) | (9.87) | (9.98) |
| *SIZE* | 0.011*** | 0.004* | 0.004** | 0.003* | 0.023*** | -0.002 | -0.001 | -0.003 |
| | (5.56) | (1.88) | (2.12) | (1.65) | (3.76) | (-0.38) | (-0.13) | (-0.51) |
| *LEV* [w] | 0.059** | 0.076*** | 0.076*** | 0.076*** | 0.232*** | 0.293*** | 0.293*** | 0.291*** |
| | (2.22) | (2.62) | (2.60) | (2.62) | (2.84) | (3.18) | (3.17) | (3.17) |
| *FOR_SALES* [w] | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| | (0.32) | (0.73) | (0.84) | (0.58) | (0.81) | (1.13) | (1.23) | (1.04) |
| *BENCHBEAT* | 0.019*** | 0.042*** | 0.043*** | 0.041*** | 0.044** | 0.117*** | 0.119*** | 0.116*** |
| | (3.10) | (6.84) | (6.93) | (6.74) | (2.54) | (6.85) | (6.89) | (6.85) |
| *AUDIT* | 0.021*** | 0.020** | 0.021*** | 0.020** | 0.079*** | 0.077*** | 0.079*** | 0.076*** |
| | (2.73) | (2.53) | (2.61) | (2.43) | (3.31) | (3.05) | (3.14) | (3.00) |
| *CORRUPTION* | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 |
| | (0.59) | (0.66) | (0.81) | (0.52) | (0.36) | (0.40) | (0.56) | (0.37) |
| *AUDENF* | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | -0.000 | -0.001 | -0.000 |
| | (0.11) | (0.03) | (0.03) | (0.07) | (0.04) | (-0.11) | (-0.14) | (-0.06) |
| *RD_LAW* | 0.020** | 0.023** | 0.024** | 0.021** | 0.060* | 0.072** | 0.077** | 0.066** |
| | (2.15) | (2.39) | (2.45) | (2.16) | (1.91) | (2.21) | (2.38) | (2.00) |
| *RD_DIVERGENCE* | -0.007 | -0.001 | -0.000 | -0.003 | -0.033 | -0.011 | -0.006 | -0.014 |
| | (-0.55) | (-0.08) | (-0.02) | (-0.19) | (-0.75) | (-0.23) | (-0.14) | (-0.31) |
| *ANTISELF_DEAL* | 0.025 | 0.018 | 0.012 | 0.023 | 0.124 | 0.103 | 0.078 | 0.110 |
| | (0.60) | (0.42) | (0.29) | (0.54) | (0.96) | (0.77) | (0.59) | (0.83) |
| *CIVCOM* | 0.018 | 0.019 | 0.018 | 0.021 | 0.062 | 0.065 | 0.053 | 0.072 |
| | (0.59) | (0.65) | (0.61) | (0.72) | (0.65) | (0.69) | (0.56) | (0.76) |
| Year/Industry FE | 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 |
| 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 |

*Notes:* 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.

## Appendix D. Determinants of the decision to capitalize R&D

| | *CAP* | |
|---|---|---|
| | *Coeff.* | *t-stat* |
| 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 | |

*Notes:* 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.

## Appendix E. Definition of variables

| Name | Description |
|---|---|
| *DISC* | 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). |
| *LN_DISC* | Logarithmic transformation of 1 plus *DISC* |
| *LENGTH* | Total number of words in each firm's annual report calculated as the sum of total number of words in the narratives section of the annual report and financial statements section of the annual report. In the multivariate analysis, we use the corresponding total number of words. |
| *CURR_R* | 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). |
| *FUT_E* | Net income (WC01551) scaled by firm market value (WC08001) measured at time *t+1*. |
| *CURR_E* | Net income (WC01551) scaled by firm market value (WC08001) measured at time *t.* |
| *LAG_E* | Net income (WC01551) scaled by firm market value (WC08001) measured at time *t-1*. |
| *FUT_R* | One-year compounded firm stock returns, measured from three months after the end of each firm's financial year end onwards (Return Index: RI). |
| *CAP* | Indicator variable that equals to 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 amortisation of R&D (WC01153). |
| *IMR* | Inverse Mills Ratio calculated from the probit model examining the determinants of capitalizing R&D with *CAP* is the dependent variable (see Appendix D). |
| *BM* | Book to market ratio calculated as common equity (WC03501) scaled by market capitalization (WC08001). |
| *RD_VALUE* | R&D value measured as the difference between the market value of equity (WC08001) and book value of equity (WC03501) less 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 research and development 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 amortisation of R&D (WC01153). |
| *RD_INT* | R&D expenditure scaled by sales (WC01001). R&D expenditure is defined as the sum of research and development 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 amortisation of R&D (WC01153). |
| *SIZE* | Natural logarithm of market capitalization (WC08001). |
| *BETA* | A firm's beta estimated using 12 months returns over each firm local index (Datastream). |
| *LEV* | Total debt (WC03255) divided by total assets (WC02999). |
| *FOR_SALES* | The percentage of international sales to total sales (WC07101). |
| *BENCHBEAT* | Indicator variable that equals to 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. |
| *AUDIT* | Indicator variable that equals to one if the annual report is audited by a Big4 firm, and 0 otherwise (BSAuditorCode). |
| $FutInc_{t+1}$ | 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 amortisation (WC01151). |
| $FutInc_{\sum t+1,t+3}$ | 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 amortisation (WC01151). |
| *CORRUPTION* | The reverse of Corruption Perceptions Index (CPI) and the higher the Corruption the more corrupt a country is perceived (Transparency International). |
| *CAPEX* | is the capital expenditure (WC04601) for year *t* scaled by the market value of equity (WC08001) |
| *RDE* | The R&D expenditure for the year scaled by the market value of equity. R&D expenditure is defined as the sum of research and development 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 amortisation of R&D (WC01153). |
| *AUDENF* | An index capturing the quality of audit function and degree of accounting enforcement in each country measured in 2008 (Brown et al., 2014). |

**Appendix E** *(Continued)*

| | |
|---|---|
| *RD_LAW* | Indicator variable that equals 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). |
| *RD_DIVERGENCE* | Indicator variable that equals to 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. |
| *ANTISELF_DEAL* | Anti self-dealing index measuring legal protection of minority shareholders against expropriation by corporate insiders (La Porta et al., 2008). |
| *CIVCOM* | Indicator variable that equals to one for civil law and zero if common law (La Porta et al., 1998). |

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**Table 1. Sample selection**

| | |
|---|---|
| Firms in top 15 countries by R&D intensity. The sample period is 2006 to 2015. 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 | 23,936 |
| 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 |

**Table 2. Sample distribution**

***Panel A. Distribution of observations by County 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 Discretionary | 56 | 64 | 69 | 66 | 81 | 88 | 71 | 69 | 70 | 65 | *699* |
| 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* |

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

**Table 3. R&D disclosure**

***Panel A. Descriptive statistics of R&D related disclosures***

| Variable | Mean | SD | 25th perc | Median | 75th perc |
|---|---|---|---|---|---|
| *Annual Report (AR)* | | | | | |
| *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 (FS)* | | | | | |
| *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 (NR)* | | | | | |
| *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 | | -3875*** | -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 | | | NR | | | Comparison | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean | SD | Median | Mean | SD | Median | Mean | SD | Median | t-test | Mann-Whitney test |
| *Research phase* | | | | | | | | | | | |
| *DISC* | 12 | 23 | 5 | 1.5 | 5 | 0.000 | 10 | 20 | 4 | 8.759*** | 4.000*** |
| *LN_DISC* | 1.778 | 1.226 | 1.792 | 0.497 | 0.734 | 0.000 | 1.640 | 1.226 | 1.609 | 1.143*** | 1.609*** |
| *Development phase* | | | | | | | | | | | |
| *DISC* | 36 | 191 | 23 | 14 | 19 | 10 | 22 | 176 | 11 | 8.474*** | 1.000*** |
| *LN_DISC* | 3.120 | 0.989 | 3.178 | 2.364 | 0.853 | 2.398 | 2.428 | 1.166 | 2.485 | 0.064*** | 0.087*** |
| *Conditions for capitalization* | | | | | | | | | | | |
| *DISC* | 1 | 3 | 1 | 1 | 3 | 0 | 0 | 1 | 0 | -0.615*** | 0.000*** |
| *LN_DISC* | 0.529 | 0.605 | 0.693 | 0.431 | 0.558 | 0.000 | 0.136 | 0.346 | 0.000 | -0.295*** | 0.000*** |
| *Intellectual property* | | | | | | | | | | | |
| *DISC* | 9 | 61.5 | 2 | 3 | 11 | 1 | 6 | 57 | 1 | 2.500*** | 0.000*** |
| *LN_DISC* | 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 |
|---|---|---|---|---|
| research and development* | *Development Phase* | 67,161 | 31,507 | 35,654 |
| innovation | *Research Phase* | 60,031 | 6,384 | 53,647 |
| patent* | *Intellectual Property* | 59,024 | 21,555 | 37,469 |
| R&D* | *Development Phase* | 41,630 | 9,186 | 32,444 |
| development cost | *Development Phase* | 36,709 | 29,728 | 6,981 |
| product development* | *Development Phase* | 19,227 | 4,165 | 15,062 |
| clinical trial | *Development Phase* | 16,212 | 2,339 | 13,873 |
| new technology* | *Development Phase* | 7,102 | 694 | 6,408 |
| product candidate* | *Development Phase* | 5,357 | 319 | 5,038 |
| internally generated | *Development Phase* | 5,000 | 4,697 | 303 |

***Panel D. Top 5 keywords based on frequency in the annual report, by R&D topic***

| Topic | Keyword | AR | FS | NR |
|---|---|---|---|---|
| *Research Phase* | innovation | 60,031 | 6,384 | 53,647 |
| | research center* | 2,369 | 333 | 2,036 |
| | invention | 2,335 | 268 | 2,067 |
| | new project | 2,315 | 256 | 2,059 |
| | research project* | 2,041 | 459 | 1,582 |
| *Development Phase* | research and development* | 67,161 | 31,507 | 35,654 |
| | R&D* | 41,630 | 9,186 | 32,444 |
| | development cost | 36,709 | 29,728 | 6,981 |
| | product development* | 19,227 | 4,165 | 15,062 |
| | clinical trial | 16,212 | 2,339 | 13,873 |
| *Conditions for Capitalization* | technical feasibility | 2,151 | 2,025 | 126 |
| | ability to use | 1,416 | 1,288 | 128 |
| | commercial success | 1,313 | 150 | 1,163 |
| | generate future economic benefit | 947 | 941 | 6 |
| | intention to complete | 936 | 930 | 6 |
| *Intellectual Property* | 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 |

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

*** indicate statistical significance at the 0.01 level.

**Table 4. Descriptive statistics of the remaining variables**

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

Variable definitions are reported in Appendix E. $^{w}$ Variables winsorised at 1% and 99%.

**Table 5. Correlation Matrix**

| Variable | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *CURR_R*$^{w}$ (1) | 1 | | | | | | | | | | | | | | | |
| *LN_DISC_AR* (2) | 0.001 | 1 | | | | | | | | | | | | | | |
| *LN_DISC_FS* (3) | -0.011 | 0.822*** | 1 | | | | | | | | | | | | | |
| *LN_DISC_NR* (4) | 0.009 | 0.924*** | 0.598*** | 1 | | | | | | | | | | | | |
| *FUT_E*$^{w}$ (5) | 0.219*** | 0.019 | -0.034*** | 0.052*** | 1 | | | | | | | | | | | |
| *CURR_E*$^{w}$ (5) | 0.225*** | -0.002 | -0.062*** | 0.032*** | 0.413*** | 1 | | | | | | | | | | |
| *LAG_E*$^{w}$ (7) | -0.001 | 0.011 | -0.048*** | 0.042*** | 0.289*** | 0.442*** | 1 | | | | | | | | | |
| *FUT_R*$^{w}$ (8) | -0.011 | 0.004 | 0.007 | 0.002 | 0.257*** | 0.005 | 0.038*** | 1 | | | | | | | | |
| *CAP* (9) | 0.016 | 0.005 | 0.100*** | -0.048*** | -0.003 | 0.057*** | 0.052*** | 0.008 | 1 | | | | | | | |
| *IMR* (10) | 0.051*** | 0.064*** | -0.035*** | 0.098*** | 0.032** | 0.006 | 0.005 | -0.074*** | -0.313*** | 1 | | | | | | |
| *CORRUPTION* (11) | 0.005 | 0.079*** | 0.041*** | 0.093*** | 0.044*** | 0.036*** | 0.041*** | 0.048*** | -0.012 | 0.058*** | 1 | | | | | |
| *AUDENF* (12) | -0.024* | -0.253*** | -0.179*** | -0.261*** | -0.077*** | -0.082*** | -0.095*** | -0.014 | 0.042*** | -0.122*** | 0.217*** | 1 | | | | |
| *RD_LAW* (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 | | | |
| *RD_DIVERGENCE* (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 | | |
| *ANTISELF_DEAL* (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 | |
| *CIVCOM* (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 |

*Notes:* 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.

**Table 6. The effect of R&D related disclosures on the informativeness of future earnings**

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

*Notes:* 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.

**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 |
|---|---|---|---|---|
| Research phase | $\beta_1$ *FUT_E*$^w$ | 0.155*** | 0.234*** | 0.150*** |
| | | (3.00) | (5.64) | (3.06) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.066*** | 0.017 | 0.077*** |
| | | (2.63) | (0.31) | (3.07) |
| Development phase | $\beta_1$ *FUT_E*$^w$ | 0.099 | 0.136 | 0.154** |
| | | (1.13) | (1.64) | (2.27) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.048* | 0.045 | 0.040 |
| | | (1.78) | (1.50) | (1.46) |
| Conditions for capitalization | $\beta_1$ *FUT_E*$^w$ | 0.241*** | 0.243*** | 0.231*** |
| | | (5.52) | (5.64) | (6.59) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | -0.000 | -0.003 | 0.066 |
| | | (-0.01) | (-0.05) | (0.99) |
| Intellectual property | $\beta_1$ *FUT_E*$^w$ | 0.191*** | 0.232*** | 0.188*** |
| | | (4.15) | (5.38) | (4.50) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.039* | 0.007 | 0.069*** |
| | | (1.77) | (0.22) | (2.97) |

**Panel B. Expensers and capitalizers**

| | | Expensers | | | Capitalizers | | |
|---|---|---|---|---|---|---|---|
| **Topic of R&D disclosure** | **Coefficient** | **AR** | **FS** | **NR** | **AR** | **FS** | **NR** |
| Total R&D disclosure (*DISC*) | $\beta_1$ *FUT_E*$^w$ | 0.158 | 0.270* | 0.190* | -0.010 | 0.106 | 0.018 |
| | | (1.16) | (1.95) | (1.80) | (-0.09) | (1.09) | (0.20) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.031 | -0.001 | 0.027 | 0.067** | 0.039 | 0.079*** |
| | | (0.87) | (-0.03) | (0.82) | (2.28) | (1.16) | (2.62) |
| Research phase | $\beta_1$ *FUT_E*$^w$ | 0.140* | 0.258*** | 0.127 | 0.143** | 0.204*** | 0.142** |
| | | (1.65) | (3.72) | (1.64) | (2.23) | (4.24) | (2.26) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.092** | 0.038 | 0.111*** | 0.052* | 0.004 | 0.059* |
| | | (2.24) | (0.40) | (2.94) | (1.66) | (0.07) | (1.75) |
| Development phase | $\beta_1$ *FUT_E*$^w$ | 0.211 | 0.221 | 0.245** | -0.016 | 0.043 | 0.068 |
| | | (1.53) | (1.63) | (2.47) | (-0.14) | (0.42) | (0.76) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.020 | 0.022 | 0.010 | 0.077** | 0.069* | 0.068** |
| | | (0.43) | (0.44) | (0.23) | (2.36) | (1.90) | (2.04) |
| Conditions for capitalization | $\beta_1$ *FUT_E*$^w$ | 0.217*** | 0.219*** | 0.253*** | 0.262*** | 0.267*** | 0.203*** |
| | | (3.23) | (3.37) | (4.49) | (5.02) | (5.18) | (4.59) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.105 | 0.127 | 0.102 | -0.086 | -0.107 | 0.019 |
| | | (1.46) | (1.50) | (1.01) | (-1.30) | (-1.43) | (0.22) |
| Intellectual property | $\beta_1$ *FUT_E*$^w$ | 0.248*** | 0.276*** | 0.244*** | 0.129*** | 0.183*** | 0.126*** |
| | | (2.91) | (3.51) | (3.28) | (2.64) | (3.90) | (2.69) |
| | $\beta_5$ *FUT_E*$^w$**LN_DISC* | 0.013 | -0.011 | 0.026 | 0.072** | 0.027 | 0.138*** |
| | | (0.38) | (-0.22) | (0.77) | (2.38) | (0.64) | (4.02) |

*Notes:* 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.

**Table 8. The 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** | |
| *FUT_E* $^{w}$ | 0.068 | 0.204* | 0.210** | 0.174* | 0.091 | 0.238** | -0.013 | 0.101 | 0.131 | 0.131 | 0.013 | 0.119 |
| | (0.71) | (1.93) | (2.19) | (1.71) | (1.20) | (2.14) | (-0.10) | (1.00) | (1.14) | (1.21) | (0.13) | (1.10) |
| *FUT_E* $^{w}$**LN_DISC* | 0.048* | 0.031 | 0.006 | 0.055 | 0.055** | 0.024 | 0.061* | 0.091** | 0.020 | 0.113** | 0.073** | 0.096** |
| | (1.86) | (1.01) | (0.20) | (1.29) | (2.13) | (0.70) | (1.83) | (2.31) | (0.51) | (2.08) | (2.22) | (2.41) |
| *LN_DISC* | -0.000 | 0.011 | -0.006 | 0.016 | 0.001 | 0.012 | 0.007 | 0.035 | -0.001 | 0.009 | 0.010 | 0.043 |
| | (-0.02) | (0.78) | (-0.66) | (1.19) | (0.10) | (0.91) | (0.47) | (1.02) | (-0.07) | (0.28) | (0.74) | (1.18) |
| Firm/Country Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year/Industry FE | 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 $R^2$ | 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 |

*Notes:* 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.

**Table 9. The 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) |
|---|---|---|---|---|---|---|---|---|
| | *Base line* | | *AR* | | *FS* | | *NR* | |
| | *Low* | *High* | *Low* | *High* | *Low* | *High* | *Low* | *High* |
| *FUT_E* $^{w}$ | 0.083 | 0.350*** | -0.150 | 0.295*** | 0.064 | 0.303*** | -0.150 | 0.344*** |
| | (1.63) | (10.56) | (-1.08) | (3.35) | (0.45) | (3.58) | (-1.52) | (5.15) |
| *FUT_E* $^{w}$**LN_DISC* | | | 0.073* | 0.016 | 0.008 | 0.018 | 0.100** | 0.003 |
| | | | (1.80) | (0.69) | (0.18) | (0.59) | (2.54) | (0.14) |
| *LN_DISC* | | | 0.001 | 0.004 | -0.012 | 0.005 | 0.006 | 0.002 |
| | | | (0.07) | (0.46) | (-0.88) | (0.57) | (0.49) | (0.22) |
| Firm/Country Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2068 | 4422 | 2068 | 4422 | 2068 | 4422 | 2068 | 4422 |
| 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 |

*Notes:* 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.

**Table 10. The 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) |
|---|---|---|---|---|---|---|---|---|
| | *Base line* | | *AR* | | *FS* | | *NR* | |
| | *Low* | *High* | *Low* | *High* | *Low* | *High* | *Low* | *High* |
| *FUT_E* $^{w}$ | 0.287*** | 0.228*** | 0.216* | 0.042 | 0.104 | 0.223** | 0.285*** | 0.075 |
| | (3.70) | (6.66) | (1.86) | (0.42) | (0.60) | (2.49) | (2.69) | (0.97) |
| *FUT_E* $^{w}$**LN_DISC* | | | 0.021 | 0.057** | 0.072 | 0.002 | 0.001 | 0.064*** |
| | | | (0.70) | (2.21) | (1.44) | (0.06) | (0.03) | (2.62) |
| *LN_DISC* | | | 0.010 | 0.001 | 0.014 | -0.005 | 0.008 | 0.003 |
| | | | (0.83) | (0.13) | (1.27) | (-0.52) | (0.66) | (0.28) |
| Firm/Country Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 2191 | 4299 | 2191 | 4299 | 2191 | 4299 | 2191 | 4299 |
| Adjusted $R^2$ | 0.397 | 0.221 | 0.398 | 0.222 | 0.400 | 0.221 | 0.396 | 0.223 |
| F | 16.912 | 33.339 | 12.841 | 25.717 | 13.584 | 23.338 | 12.798 | 25.530 |

*Notes:* 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.

**Table 11. Aggregation of R&D related disclosure topics**

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

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

*Notes:* 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.

**Table 12. Summary results of sensitivity tests**

| Panel A. No firm controls and country fixed effects | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.256*** | 0.117 | 0.224*** | 0.128* |
| | (8.12) | (1.37) | (2.75) | (1.82) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.042* | 0.012 | 0.050** |
| | | (1.86) | (0.46) | (2.18) |
| *LN_DISC* | | -0.003 | -0.006 | -0.000 |
| | | (-0.48) | (-0.88) | (-0.04) |
| Firm/Country Controls | No | No | No | No |
| Year/Industry/Country FE | Yes | Yes | Yes | Yes |
| Observations | 6490 | 6490 | 6490 | 6490 |
| Adjusted $R^2$ | 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) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.242*** | 0.085 | 0.197** | 0.105 |
| | (7.56) | (1.00) | (2.43) | (1.50) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.047** | 0.017 | 0.054** |
| | | (2.13) | (0.66) | (2.35) |
| *LN_DISC* | | 0.003 | -0.001 | 0.004 |
| | | (0.41) | (-0.09) | (0.57) |
| Firm Controls | Yes | Yes | Yes | Yes |
| Country Controls | No | No | No | No |
| Year/Industry/Country FE | Yes | Yes | Yes | Yes |
| Observations | 6490 | 6490 | 6490 | 6490 |
| Adjusted $R^2$ | 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) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.3915*** | 0.2697*** | 0.3612*** | 0.2835*** |
| | (4.97) | (2.63) | (3.47) | (3.01) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.0406* | 0.0133 | 0.0473** |
| | | (1.88) | (0.53) | (2.32) |
| *LN_DISC* | | -0.0013 | -0.0054 | 0.0007 |
| | | (-0.17) | (-0.70) | (0.10) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry/ FE | Yes | Yes | Yes | Yes |
| Observations | 6490 | 6490 | 6490 | 6490 |
| 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) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.240*** | 0.082 | 0.195** | 0.102 |
| | (7.38) | (0.95) | (2.38) | (1.44) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.048** | 0.017 | 0.054** |
| | | (2.11) | (0.65) | (2.34) |
| *LN_DISC* | | -0.000 | -0.003 | 0.000 |
| | | (-0.06) | (-0.34) | (0.02) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes |
| Observations | 6373 | 6373 | 6373 | 6373 |
| Adjusted $R^2$ | 0.258 | 0.259 | 0.259 | 0.259 |
| F | 43.107 | 32.801 | 30.876 | 32.235 |

**Table 12** *(continued)*

| Panel E. Exclude UK firms | | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.198*** | -0.061 | 0.045 | 0.001 |
| | (4.21) | (-0.52) | (0.39) | (0.01) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.076*** | 0.057 | 0.074** |
| | | (2.65) | (1.64) | (2.56) |
| *LN_DISC* | | 0.018** | 0.015* | 0.018** |
| | | (1.98) | (1.72) | (2.04) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes |
| Observations | 3843 | 3843 | 3843 | 3843 |
| 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) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.310*** | 0.138 | 0.378*** | 0.116 |
| | (6.62) | (0.90) | (2.70) | (1.05) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.055 | -0.027 | 0.084** |
| | | (1.26) | (-0.50) | (2.21) |
| *LN_DISC* | | 0.012 | 0.009 | 0.012 |
| | | (0.93) | (0.73) | (1.03) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes |
| Observations | 2603 | 2603 | 2603 | 2603 |
| Adjusted $R^2$ | 0.257 | 0.262 | 0.259 | 0.263 |
| F | 28.535 | 20.369 | 20.270 | 20.835 |
| Panel G. Substitute 1-year ahead earnings and returns with 3-years ahead earnings and returns | | | | |
| | (1) | (2) | (3) | (4) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.097*** | -0.036 | -0.032 | 0.046 |
| | (6.52) | (-0.63) | (-0.57) | (1.32) |
| *FUT_E*$^{w}$ x *LN_DISC* | | 0.040*** | 0.049** | 0.020* |
| | | (2.61) | (2.58) | (1.82) |
| *LN_DISC* | | 0.006 | 0.004 | 0.003 |
| | | (0.68) | (0.46) | (0.41) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes |
| Observations | 5987 | 5987 | 5987 | 5987 |
| 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) |
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E*$^{w}$ | 0.239*** | 0.233*** | 0.262*** | 0.238*** |
| | (7.40) | (4.00) | (4.35) | (4.29) |
| *FUT_E*$^{w}$ x *DISC_PROP* | | 0.005* | 0.002 | 0.003* |
| | | (1.72) | (0.66) | (1.80) |
| *DISC_PROP* | | 0.000 | 0.001 | 0.000 |
| | | (0.00) | (0.86) | (0.50) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes |
| Observations | 6490 | 6490 | 6490 | 6490 |
| Adjusted $R^2$ | 0.257 | 0.278 | 0.278 | 0.278 |
| F | 43.661 | 37.260 | 37.394 | 35.205 |

**Table 10** *(continued)*

Panel I. Inclusion of corporate governance controls.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | *Base line* | *AR* | *FS* | *NR* |
| *FUT_E* $^{w}$ | 0.273*** | 0.089 | 0.169 | 0.147* |
| | (5.95) | (0.79) | (1.40) | (1.79) |
| *FUT_E* $^{w}$ x *LN_DISC* | | 0.055* | 0.040 | 0.047* |
| | | (1.85) | (1.05) | (1.71) |
| *LN_DISC* | | -0.003 | -0.005 | -0.006 |
| | | (-0.37) | (-0.54) | (-0.64) |
| *DIVERSITY* | -0.003 | 0.027 | 0.018 | 0.013 |
| | (-0.06) | (0.54) | (0.38) | (0.26) |
| *BSIZED* | 0.028* | 0.027 | 0.027 | 0.029* |
| | (1.66) | (1.57) | (1.57) | (1.71) |
| Firm/Country Controls | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes |
| Observations | 4,658 | 4,658 | 4,658 | 4,658 |
| Adjusted $R^2$ | 0.260 | 0.262 | 0.262 | 0.262 |
| F | 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) |
|---|---|---|---|---|---|---|
| | *Usual* | *Unusual* | *Usual* | *Unusual* | *Usual* | *Unusual* |
| | *AR* | | *FS* | | *NR* | |
| *FUT_E* $^{w}$ | 0.021 | 0.416** | 0.118 | 0.471** | 0.075 | 0.408*** |
| | (0.16) | (2.33) | (0.83) | (2.38) | (0.76) | (3.34) |
| *FUT_E* $^{w}$*LN_DISC | 0.064* | -0.002 | 0.046 | -0.023 | 0.060* | -0.000 |
| | (1.67) | (-0.04) | (0.99) | (-0.34) | (1.70) | (-0.01) |
| *LN_DISC* | -0.013 | 0.029* | -0.013 | 0.016 | -0.016 | 0.036** |
| | (-1.21) | (1.70) | (-1.15) | (0.92) | (-1.61) | (2.23) |
| *DIVERSITY* | 0.026 | 0.029 | 0.018 | 0.033 | 0.002 | 0.042 |
| | (0.43) | (0.24) | (0.30) | (0.28) | (0.04) | (0.36) |
| Firm/Country Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Year/Industry FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 3,553 | 1,105 | 3,553 | 1,105 | 3,553 | 1,105 |
| Adjusted $R^2$ | 0.254 | 0.328 | 0.253 | 0.326 | 0.253 | 0.329 |
| F | 15.03 | 7.993 | 13.59 | 7.995 | 14.98 | 9.044 |

*Notes: Diversity* is the percentage of non-executive directors. *BSIZED* a is dummy variable taking the value of 1 if the board size is between 5 and 12 directors, 0 otherwise (cf. Lara et al., 2017). All other 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.