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REPORTING OF R&D:
DISCLOSURE WITHOUT RECOGNITION?

ACCA AND ADAM SMITH BUSINESS SCHOOL RESEARCH REPORT

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1. Introduction

1.1 Background and objectives

Intangibles, such as goodwill and research and development (R&D) compared with tangible physical assets, are increasingly important to company value as significant drivers of future earnings. Indeed, within the academic literature, R&D is recognised as facilitating future value, having a significant impact on future cash earnings through driving, inter alia, new products and brands as well as intellectual property (such as patents, trademarks and copyright) (Chen et al. 2014; Curtis et al. 2020; Kreß et al. 2019; Mazzi et al. 2019a) and of importance to investors (as primary users of reporting information) (Mazzi et al. 2022).

In an International Financial Reporting Standards (IFRS) reporting regime, IAS 38 Intangible Assets governs the accounting treatment and reporting of R&D. This mandates that firms are required to expense research costs (R&D expense in the income statement) and are required to capitalise development costs (R&D asset on the balance sheet). The latter treatment is mandated if the related six conditions specified in the standard are met.[1] For disclosures about R&D, the standard requires that firms disclose the aggregate amount of R&D expenditure recognised as an expense during the period (IAS 38, paragraph 126). Further, if the company has capitalised development costs as an asset, it needs to disclose whether the useful life is indefinite or finite. If finite, the useful life or the amortisation rate used, the amortisation method used, the gross carrying amount and any accumulated amortisation (aggregated with accumulated impairment losses) at the beginning and end of the period, the line item(s) of the statement of comprehensive income in which any amortisation is included and a reconciliation of the carrying amount at the beginning and end of the period (paragraph 118) are to be disclosed. There are no other disclosure requirements in relation to R&D in IAS 38.[2] Importantly, the requirements in IAS 1 Presentation of Financial Statements stipulate that information in the financial statements is to be reported separately, providing that it is material.[3] Hence, if the company deems the values involved to be immaterial, the information required in paragraphs 118 and 126 will not be reported separately but may be amalgamated with that for other intangible assets with finite lives or other line items in the financial statements.

Despite the importance of R&D activities to firms (and to users of financial statements), recent R&D-related empirical literature under IFRS (Mazzi et al. 2019b; Dionysiou et al. 2021) indicates that a significantly large number of firm-year observations are for firms classified as R&D-inactive. This is where firms have not reported an R&D expense and/or asset separately; therefore it is potentially not recognised.[4] Further, in a US study (where all R&D costs are expensed) Koh and Reeb (2015: 73) report: 'a perusal of a subsample of the 3000+ NYSE listed firms in our sample shows that a substantial number fail to provide any information regarding their corporate R&D efforts. Specifically, 1,737 NYSE-listed firms do not report any information on R&D, while 373 of them report zero R&D'. Nonetheless, they 'find that 10.5% of non-reporting R&D firms receive patents, with several of these firms receiving dozens of patents each year' (Koh and Reeb 2015: 73).

This background reveals a picture consistent with concerns that financial statements may not necessarily reflect accurately the level of investment in intangible assets as underpinning drivers of value, leading to a potential consequential loss of their value-relevance (Bernanke 2011; Haskel and Westlake 2017; Lev and Gu 2016; Lev 2018; Zambon et al. 2020) to users. Specifically, the non-separate reporting of amounts involved in R&D activities renders uncertain the level of R&D activity being undertaken by firms, and thus users must rely on voluntary disclosure to fill the resultant information gap (Stark 2008; Wyatt 2008; Lev 2018). With regard to the latter, however, Mazzi et al. (2022) report the views of investors, highlighting their concerns about the general information environment for R&D and the need for greater R&D-related disclosure. These concerns also echo the findings of Mazzi et al. (2019b), who use a large sample of R&D-active firms (ie firms having reported separately an R&D expense and/or asset) and report that firms do not provide a high volume of R&D-related disclosure. Specifically, they report, inter alia, that the median count of R&D-related terms in annual reports is only 17. Overall, this evidence suggests an information gap for R&D, either through non-separate disclosure of relevant amounts (ie neither an R&D expense nor an asset is present) or where there are amounts reported separately but there is a relative lack of R&D-related disclosures.

1 To capitalise development costs, a company should assess the technical feasibility of completing the intangible asset so that it will be available for use or sale; its intention to complete the intangible asset and use or sell it; its ability to use or sell the intangible asset; how the intangible asset will generate probable future economic benefits; the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset; and its ability to measure reliably the expenditure attributable to the intangible asset during its development (IAS 38, paragraph 57).

2 Evidence from across the world has consistently shown (eg Tsalavoutas et al. 2014) that firms do not use the revaluation model for intangible assets with finite useful lives. Hence, it is highly unlikely that the related disclosures are relevant in the R&D context.

3 Under the amendment to IAS 1 and IAS 8 Accounting Policies, Changes in Accounting Estimates and Errors. (Definition of Material (Amendments to IAS 1 and IAS 8, effective 1 January 2020)), 'information is material if omitting, misstating or obscuring it could reasonably be expected to influence the decisions that the primary users of general-purpose financial statements make on the basis of those financial statements, which provide financial information about a specific reporting entity'.

4 See the sample selection process in section 2.1 below.

Given the large numbers of firms designated as R&D-inactive in previous studies (Mazzi et al. 2019b; Dionysiou et al. 2021), the objective of the present research is to gain a better understanding of whether there is indeed such a large population of R&D-inactive IFRS-reporting firms across the world. Such firms either do not invest in R&D, or alternatively one could infer from the references/discussion made in their annual reports that these firms do invest in R&D activities but do not report any amounts separately in their financial statements. Evidence consistent with the latter would suggest that there is an information gap in financial reporting regarding the actual level of investment in R&D, although dependent on materiality. To this end, the ultimate objective of the research is to investigate a reporting conundrum about a potential lack of R&D recognition in the financial statements that leads users, regulators, standard setters, academics and other stakeholders to hold a mistaken perception of firms' engagement in R&D related activities, and hence their perception of future growth prospects, which may have a detrimental effect on the allocation of capital more broadly.

To meet this objective, the evidence from the present study, based on IFRS reporting firms globally, provides insights into the following questions. For clarity, we denote firms that do not report any R&D amount separately in the financial statements as R&D-inactive.

1. What proportion of firms are R&D-inactive across countries?
2. What are the key characteristics (country, industry and firm level) of R&D-inactive firms?
3. Do R&D-inactive firms provide information about their R&D investments via narratives in the annual report (and hence are seemingly active rather than inactive)?
4. What are the key characteristics (country, industry and firm level) of the seemingly R&D-active firms (ie R&D-inactive firms with nonetheless high levels of R&D-related disclosures)?
5. How do such seemingly R&D-active firms refer to R&D in their annual reports?

1.2 Method

The project involves two stages of analysis.

In Phase 1, we apply desk-based analysis, through the use of appropriate databases, to all listed firms from 40 countries that have adopted IFRS (or converged national standards to IFRS), for the financial periods 2017 to 2021. For this sample, we identify how many firms are R&D active (ie have a non-zero R&D expenditure for the year by expensing amounts in the income statement and/or capitalising development costs on their balance sheet during the year) or are R&D inactive (ie no relevant amount is reported separately in a given year in the financial statements). All the related evidence is provided in aggregate and on a country and industry level. We then provide analyses that indicate the country- and firm-level determinants that relate to being an R&D-inactive firm. Additionally, we identify the number of firms that 'switched' from one category to the other or never changed their category during the sample period.

Phase 2 is based on company annual reports. In this Phase, we rank all R&D-inactive firms from Phase 1 in country-year-industry clusters by market capitalisation. Subsequently, for each such cluster we retain the first firm as a starting point, then the third, the fifth, and so on, to determine the availability of their annual report in English. This resulted in a representative sample across countries with an over 70% annual report availability. We then split the annual reports into narratives ('front-end') and financial statements ('back-end') parts.[5] Following this, we revisit the list of R&D-related terms in Mazzi et al. (2019b) and augment it by adding 33 further terms, resulting in a list of 149 R&D-related terms. By applying automated content analysis, we capture the number of times these R&D terms feature in either of the two parts of the annual report. Further analyses draw on the industry- and country-level determinants of 'higher' versus 'lower' disclosers of R&D-inactive firms. Finally, for a relatively small number of firms, we manually extract examples of R&D-related disclosure from these R&D-inactive firms. First, for those firms with a high volume of disclosure, these examples illustrate the level of detail of R&D-related reporting, despite the absence of an R&D expense and/or asset that would normally indicate an R&D-active firm. Secondly, the examples include instances of 'boilerplate' R&D disclosure, especially in accounting policy notes. Thirdly, the examples include discussions in the annual report containing terms from our list of R&D-related terms but where these terms do not relate to R&D or signify R&D activity and investment.

1.3 Findings

The key findings from Phase 1 and Phase 2 are highlighted below. Additionally, the findings are supplemented with quotes from two roundtable discussions (November 2022), during which the findings were presented. Roundtables were held with business groups (comprising preparers and auditors) and with standard setters/policymakers.[6] All quotes are anonymised by person/organisation but identified by contributor type.

5 For some firms, we are able to find only the back-end in English and so only this document is included in the corresponding analysis.

6 The roundtables were held with the business group on 16 November 2022 (10 external participants) and with standard setters/policymakers on 24 November 2022 (11 external participants). Additionally, the findings were presented at the ACCA Global Forum meeting (23 November), and the 2023 FARSIG Symposium (13 January 2023).

PHASE 1:
R&D accounting treatment and reporting

- 53% of our sample firms do not separately report R&D amounts.
- In most countries, these R&D-inactive firms represent about 60% of the population of listed firms. Significant exceptions are the Republic of Korea and China, in which the majority of the firms (over 85% of the population of firm-year observations) report separately the R&D-related amounts in the financial statements.
- R&D-inactive firms tend to be located in countries with lower country-level R&D expenditure to GDP ratio, indicating a less conducive country-level environment for R&D investment.
- R&D-inactive firms tend to be located in industries characterised with low R&D intensity (ie Real Estate and Financials).
- R&D-inactive firms are characterised by smaller size, lower growth opportunities, lower levels of other intangibles and higher levels of tangible assets than R&D-active firms. Additionally, R&D-inactive firms exhibit higher levels of closely held ownership than R&D active firms.

PHASE 2:
R&D-related disclosures by R&D-inactive firms

There are a large number of firm-year observations of R&D-inactive firms that use R&D-related terms as frequently as by R&D-active firms. In fact, for some R&D-inactive firms the count of R&D-related terms is voluminous.

The mean (median) number of R&D-related terms for (i) financial statements (back-end) is 6 (3), with a maximum of 143, (ii) narratives (front-end) is 12 (5), with a maximum of 598, and (iii) annual reports as a whole (ie front-end and back-end) is 15 (8), with a maximum of 606. This contrasts to the findings of Mazzi et al. (2019b) who report that the mean (median) count of R&D-related terms of R&D-active firms in the financial statements is 9 (15), while that for narratives is 15 (9) and that for the annual report as a whole is 25 (17). This indicates that for some R&D-inactive firms, disclosure would suggest they are R&D active.

Firms without software development (SD) cost capitalised during the year do use terms related to R&D. For this sub-sample, the mean (median) count of R&D-related terms in financial statements is 5 (3) and the mean (median) for the narratives is 10 (5). These values are close to the mean and median values presented for the full sample.

Firms without other intangible assets engage with R&D-related disclosures. The mean (median) word count is 4 (2) in the financial statements and the mean (median) word count in the narratives is 6 (3). Although this level of disclosure may not appear high at first glance, it is comparable to the results reported in Mazzi et al. (2019b) with respect to R&D-related disclosures by R&D-active firms with the lowest levels of R&D intensity.

Firms from Finland, France, Italy, Netherlands, Norway, Spain, Sweden and Turkey tend to have the highest use of R&D related terms whereas firms from Australia, Brazil, Canada, Denmark, Greece, Hong Kong, India, Indonesia, and Singapore tend to have the lowest levels of such use.

Firms in the Healthcare, Utilities, Telecommunications and Technology industries exhibit the highest levels of use of R&D-related terms whereas firms in Basic Materials, Financials and Consumer Discretionary industries tend to use such terms much less frequently.

For the terms most frequently mentioned in our sample of firm-year observations, we note a considerable overlap between our findings and those for R&D-active firms in Mazzi et al. (2019b). In particular, 12 out of the 30 most frequently used terms we identify are also included in the 15 terms most frequently identified in Mazzi et al. (2019b).

170 firm-year observations use terms that are included in our list more than 100 times, while 496 firm-year observations use terms that are included in our word list between 50 and 100 times, seemingly indicating an active engagement with R&D.

These findings on relatively high levels of disclosure but with no separately reported expense/asset on the financial statements drew observations and discussions during the roundtables about the implications for the reporting of R&D and how materiality perceptions are perhaps reflected in the financial statements.

> *'There were two things that struck me: one is materiality, where you have got firms that are saying a lot – outside the financial statements– about things that indicate that they are doing R&D and then in the financial statements it seems likely that they are not applying materiality properly or they are not complying with the disclosure requirements in the IFRS. Particularly, they might be thinking of materiality only in a quantitative threshold, if the number was relatively low, but not thinking about the qualitative aspects of materiality. And that's something our regulators are trying to encourage preparers to think more carefully about. And secondly, the overarching disclosures: if this stuff [disclosures in the narratives] is so important to understand [for understanding] the financial statements, then there should be disclosures about it in the financial statements'.*
>
> **Roundtable participant – standard setter/policymaker**

And, similarly on the disconnection between the levels of narrative disclosure and separate reporting in the financial statements, another roundtable participant commented,

> *'These disclosures should not stand alone. They should be related. You should make a link to financial performance'.*
>
> **Roundtable participant – standard setter/policymaker**

When the sample is split into three disclosure groups (referred to as High, Low and Minimal disclosers), we document a large concentration of firms in the High and Minimal disclosure groups for both narratives and financial statements.

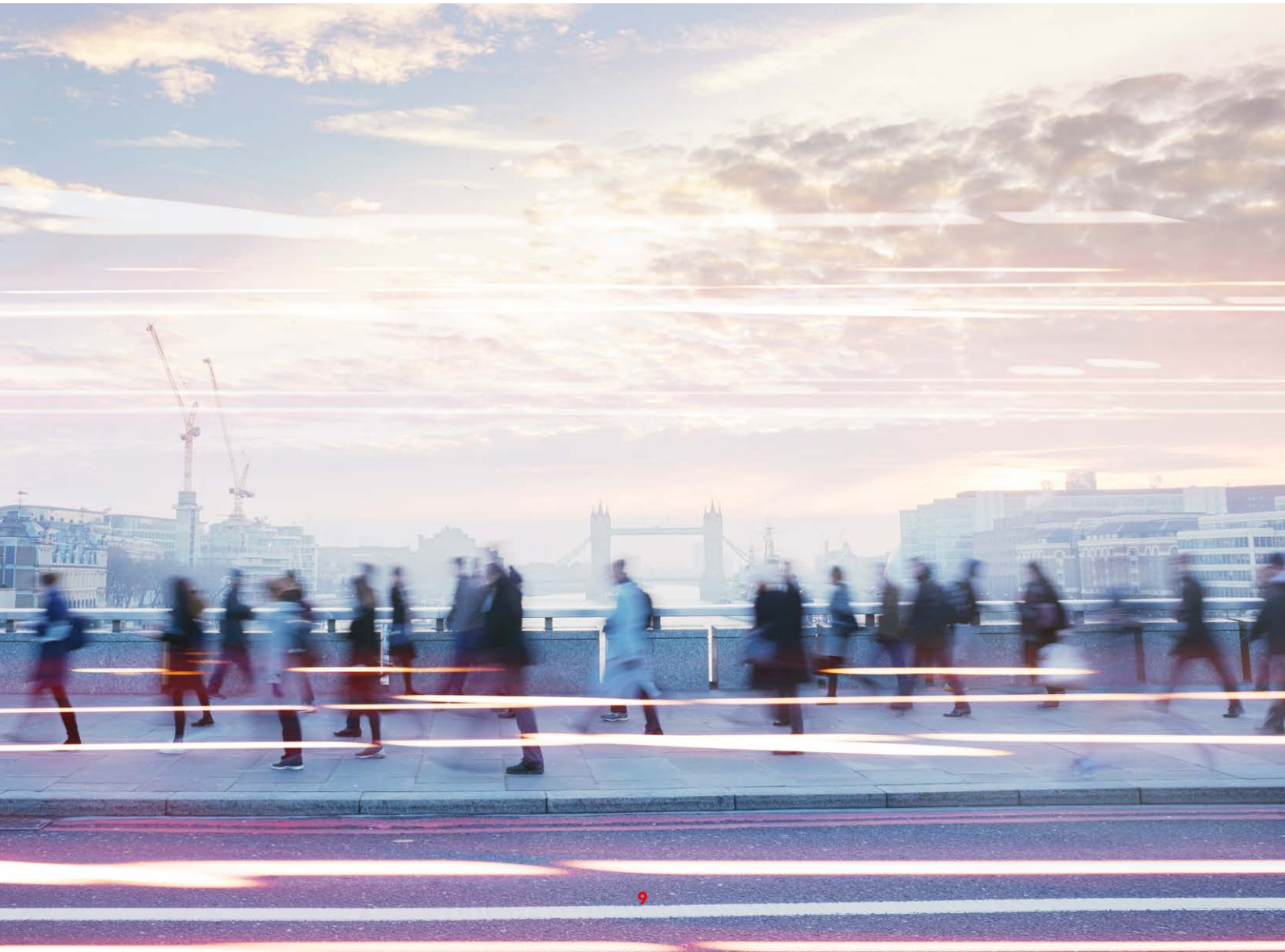
For those firm-year observations in the 'High disclosure' group, the most frequent term identified is 'development cost' and other frequently used terms include: 'regulatory approval'; 'generate future economic benefit'; 'intention to complete'; and 'research activity'. In fact, we note that eight terms (ie, 'research and development'; 'ability to use'; 'internally generated'; 'technical feasibility'; 'development phase'; 'prototype'; 'research phase'; 'ability to sell') are those mentioned frequently in IAS 38, mostly in relation to the criteria to be considered for the capitalisation of development costs.

Firms with above-average levels of R&D-related disclosures have higher growth opportunities, are perceived as riskier by investors, have fewer tangible assets, are more likely to report more other intangible assets and capitalise greater amounts of SD assets than firms with below-average levels of R&D-related disclosures. Further, firms with above-average levels of R&D-related disclosures exhibit lower levels of closely held ownership where shareholders are more likely to rely on financial reporting for information, given the need for communicating information to many shareholders. These findings corroborate the findings in Phase 1 that firms with higher closely held ownership are most likely not to report separately an R&D amount in a given year given the private levels of communication.

Firms with above-average levels of R&D-related disclosures are generally domiciled in countries with higher ratios of country-level R&D expenditure to gross domestic product (GDP).

1.4 Report outline

Chapter 2 describes the research design and method of analysis and the findings of Phase 1 of the research. Chapter 3 describes the research design and method of analysis and the findings of Phase 2 of the research. Chapter 4 concludes the report by outlining the practical implications and recommendations.



Spotlight: Key findings

Category of reporters:

Proportion of firm-year observations that are R&D-inactive **53%**

Proportion of firm-year observations that are R&D-active **47%**

Proportion of firm-year observations that have never been R&D-active **49%**

Proportion of firm-year observations that have always been R&D-active **42%**

Proportion of firm-year observations that switched from being R&D-inactive to R&D-active **2%**

Proportion of firm-year observations that switched from being R&D-active to R&D-inactive **1%**

Frequency of R&D-related terms identified:

15 Mean frequency in the annual reports

12 Mean frequency in the narratives

6 Mean frequency in the financial statements

2 Mean frequency in the annual reports of minimal disclosers

1 Mean frequency in the narratives of minimal disclosers

1 Mean frequency in the financial statements of minimal disclosers

8 Mean frequency in the annual reports of low disclosers

5 Mean frequency in the narratives of low disclosers

2 Mean frequency in the financial statements of low disclosers

34 Mean frequency in the annual reports of high disclosers

27 Mean frequency in the narratives of high disclosers

11 Mean frequency in the financial statements of high disclosers

Firm-year observations categorised as Minimal and High disclosers across narratives and financial statements:

32% Percentage of firm-year observations of minimal disclosers – based on narratives

18% Percentage of firm-year observations of minimal disclosers – based on narratives and financial statements

33% Percentage of firm-year observations of high disclosers – based on narratives

17% Percentage of firm-year observations of high disclosers – based on narratives and financial statements

2. Phase 1 – Identification of R&D-inactive firms and their characteristics

In this first phase of the project, we use listed firms from 40 countries that adopted IFRS or had their national accounting standards converged with the IFRS, and identify firms that are R&D active and inactive for each of the financial periods between 2017 and 2021. We also identify firms that 'switch' from being R&D active to inactive at least once in the period tested and vice versa. We report the percentage of R&D-inactive firms by country and industry and also examine country- and firm-level factors that determine the likelihood that a firm will be R&D inactive in a given year.

2.1 Sample selection

We rely on the IFRS Foundation guide on the use of IFRS by jurisdiction (IFRS 2022) and identify the 40 countries that either had adopted IFRS or had their national accounting standards converged with the IFRS by 2015. All firms in the countries meeting these criteria are included in our sample for analysis during the financial years 2017 to 2021. For each of these countries, we then take the Worldscope population of active and dead corporations for each year investigated, considering only the equity (stock) listings per company (Datastream item TYPE to be EQ), with primary listing being the country of investigation. This leads to an initial sample consisting of 140,794 firm-year observations from all countries for the financial periods 2017 to 2021.

In sequence, we exclude 14,335 firm-year observations related to firms not reporting under IFRS or not reporting under the converged national accounting standards.[7] Owing to the possibility that our analysis might be biased by any transition effects of first-time adopters (Mazzi et al. 2019b), we further exclude 3,948 firm-year observations for firms adopting IFRS for the first time in the sample period. In line with García Lara et al. (2005) and Dargenidou et al. (2021), we additionally exclude 946 firm-year observations relating to firms that changed their financial year period during the years investigated, and 5,857 firm-year observations that belong in the energy sector or where the firm's industry classification is missing.[8] Finally, we eliminate 37,034 firm-year observations that lack some firm-specific data necessary for the analysis. These steps result in a final sample consisting of 71,787 firm-year observations from 18,580 firms across 40 countries. The sample selection process is summarised in Table 2.1.

TABLE 2.1: Sample selection process

SAMPLE SELECTION PROCESS	FIRM-YEAR OBSERVATIONS
We focus on the countries that, as of 2015, had adopted IFRS or had converged their accounting standards with the IFRS, or permitted listed firms to report under IFRS. Our sample begins in 2017 and ends in 2021.	140,794
Excluding firms that do not report under IFRS	(14,335)
Excluding observations of firms that adopted IFRS for the first time in a year over the sample period	(3,948)
Excluding firm-year observations from firms that changed their reporting period	(946)
Excluding firms in the energy sector with missing industry classification information	(5,857)
Excluding firm-year observations of firms with negative book value of equity	(6,887)
Excluding firm-year observations of firms with missing firm-specific data	(37,034)
Final sample [t=2017, 2021] [18,580 firms]	**71,787**

7 Following Schleicher et al. (2010), Daske et al. (2013) and Mazzi et al. (2019a), we use the Worldscope item WC07536 'accounting standards followed' to identify the reporting accounting standards of a company in a given year.

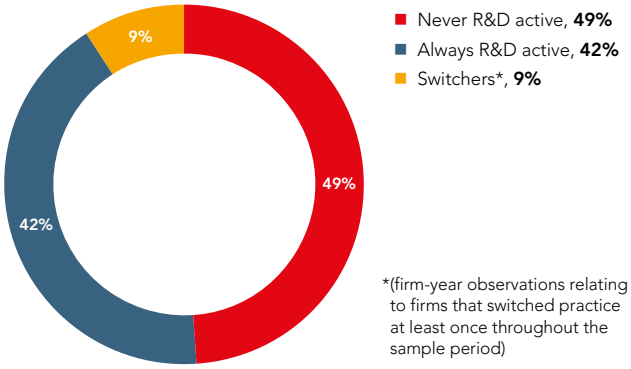
8 Worldscope may record exploration and evaluation expenses (assets) as R&D expenses (development asset) for firms in this industry (Dargenidou et al., 2021; Mazzi et al. 2019a).

2.1.1 Sample composition

As shown in Appendix 1,[9] the sample is heavily dominated by four Asian locations: China (mainland), Republic of Korea, India and Hong Kong SAR (18.6%, 12.9%, 11.8% and 8.1% of the overall firm-year observations, respectively). Australia (8.1%), Canada (6.6%), UK (5.2%) and Malaysia (4.4%) follow, with each of the remaining countries constituting less than 2.5% of the sample.

Using the presence of an amount in relation to R&D expenses or amortisation of development costs or capitalisation of development assets in a given year, we identify and classify 33,502 firm-year observations (47% of the full sample) as indicating that the firms concerned are R&D active. When all such figures are absent (ie no amounts are shown in the financial statements), we identify and classify 38,285 firm-year observations (53% of the full sample) as indicating that the firms concerned are R&D inactive. Among the firm-year observations classified as R&D inactive, 35,265 (49% of the full sample) are from firms that have never been R&D active. From the firm-year observations from firms classified as R&D active, 30,249 (42% of the full sample) indicate that the firms concerned have been active across all the years examined. The remaining 6,273 firm-year observations are from firms classified as 'switchers', meaning that the firms concerned changed from R&D inactive to R&D active and vice versa at least once during the sample period. Figure 2.1 depicts this information visually.

FIGURE 2.1: Percentage of observations across categories that indicate R&D activity



In fact, we identify 1,271 instances of switches from active to inactive (2% of the full sample) and 712 instances of switches from inactive to active (1% of the full sample), across the years examined. Therefore, we can infer that only a very small proportion of IFRS-reporting firms change their R&D reporting practice.[10] Table 2.2 illustrates this sample composition.

In summary, the data suggests that the majority of the firm-year observations examined are from firms that do not seem to be R&D active and do not seem to change this policy over the sample period.

TABLE 2.2: Sample composition

R&D REPORTING PRACTICE	SAMPLE
Inactive	38,285
Active	33,502
Total sample	71,787
of which:	
Never R&D active	35,265
Always R&D active	30,249
Switchers (firm-year observations relating to firms that switched practice at least once throughout the sample period)*	6,273
Unique instances of switches:*	
From inactive to active	1,271
From active to inactive	712

* For instance, company X did not report an R&D related amount for 2017 and 2018, it then reported an amount in 2019 and reported no amount in 2020 and 2021. This represents two *unique instances of switches* over the sample period of five years. However, the five firm-year observations are classified as *switchers* throughout the sample period.

9 Appendix 1 reports the number of firm-year observations of R&D active and inactive firms (see discussion below) across countries and industries for each year in the sample period. It also reports the country mean R&D expenditure in the economy as a whole as a percentage of the country's GDP, for the sample period.

10 When delving further in the data, we observe that 65% of the firm-year observations from firms changing their R&D policy at least once (ie switchers) are based in Latvia, Luxembourg, Poland and Portugal. Moreover, 45% of the switchers operate in Utilities, Real Estate, Financials and Consumer staples (so in industries with traditionally low R&D activity; and see Figure 2.3).

Figure 2.2 shows the percentage of R&D-inactive firms by country. We refer to this as 'exclusion rate' (as shown in Appendix 1), given that such firm-year observations are excluded in R&D-related academic studies or from national statistics relating to innovation. In most countries, these inactive firms represent about 60% of the population of listed firms. In fact, 13 countries that provide 12% of the overall firm-year observations have an exclusion rate of over 80% (ie Chile, Croatia, Hungary, Indonesia, Luxembourg, Malaysia, Mexico, Peru, Philippines, Romania, Russia, Singapore and South Africa), while seven of those indicate an exclusion rate of over 90% and represent 10% of our firm-year observations (ie Chile, Croatia, Indonesia, Malaysia, Philippines, Romania, and Singapore).

Significant exceptions (or outliers of this rate) are the Republic of Korea and China, in which the majority of the firms (over 85% of the population of firm-year observations) report separately the R&D-related amounts in the financial statements and consequently have an exclusion rate of 14.1% and 11.5% respectively.

The finding relating to China can be explained by the following, non-IFRS-related regulation: the China Securities Regulatory Commission (CSRC) mandated R&D disclosures in annual reports issued after 2012.[11] More specifically, Article 27(c) in the 'Standards Concerning the Content and Formats of Information Disclosure by Companies Offering Securities to Public No. 2 – Contents' requires detailed and explicit financial and non-financial information to be disclosed in the discussion and analysis of the firm's business operation. This includes: *'the amount, proportion, and change of research and development personnel; indicate the total amount of research and development investment and proportion to the operating revenue in the current year, and explain the reasons for such changes, in the case of any significant changes in the data from the previous year; and disclose the proportion and change of capitalization of research and development investment, and analyze its rationality'* (China Securities Regulation Commission 2017). It appears that given that firms are required to provide such granular information in the front-end of the annual report, this information is fed into the financial statements as well, whereas no such disclosure is mandated by the corresponding IAS 38 standard.

According to the data we present in Appendix 1, Austria, Belgium, Denmark, Germany, Israel, and Sweden are countries with very high country-level R&D expenditure relative to GDP (>=3%). This would imply a country environment where R&D activities are an important function of the economy and this could be reflected in a larger proportion of R&D-active firms. Counter to this expectation, however, we observe that a relatively large proportion of firms appear as R&D inactive in these countries (ie exclusion rates of 37.91%, 43.75%, 57.68%, 40.75%, 67.06% and 47.19%, respectively).[12] Similarly, the results also show that a large proportion of firms appear as R&D inactive in other developed and large capital markets, such as Australia, Canada and the UK. These exhibit large exclusion rates of 78.12%, 77.40% and 61.20%, respectively.

The case of the UK is arguably an interesting example of a country to be compared with China. Disclosure and Transparency Rules (DTR), and in particular DTR 4.1.11R, in the UK require listed firms to give an indication of 'activities in the field of research and development" in the management report (FCA 2023a: 54).[13] While this requirement is in the same direction as those required in China, it is far less prescriptive and makes no explicit reference to 'financial'-related disclosures. Hence, it is not surprising that this does not result in a spill-over effect where there is separate disclosure of related amounts that have been recognised in the financial statements, and this can provide an insight to the significantly higher exclusion rate in the UK.[14]

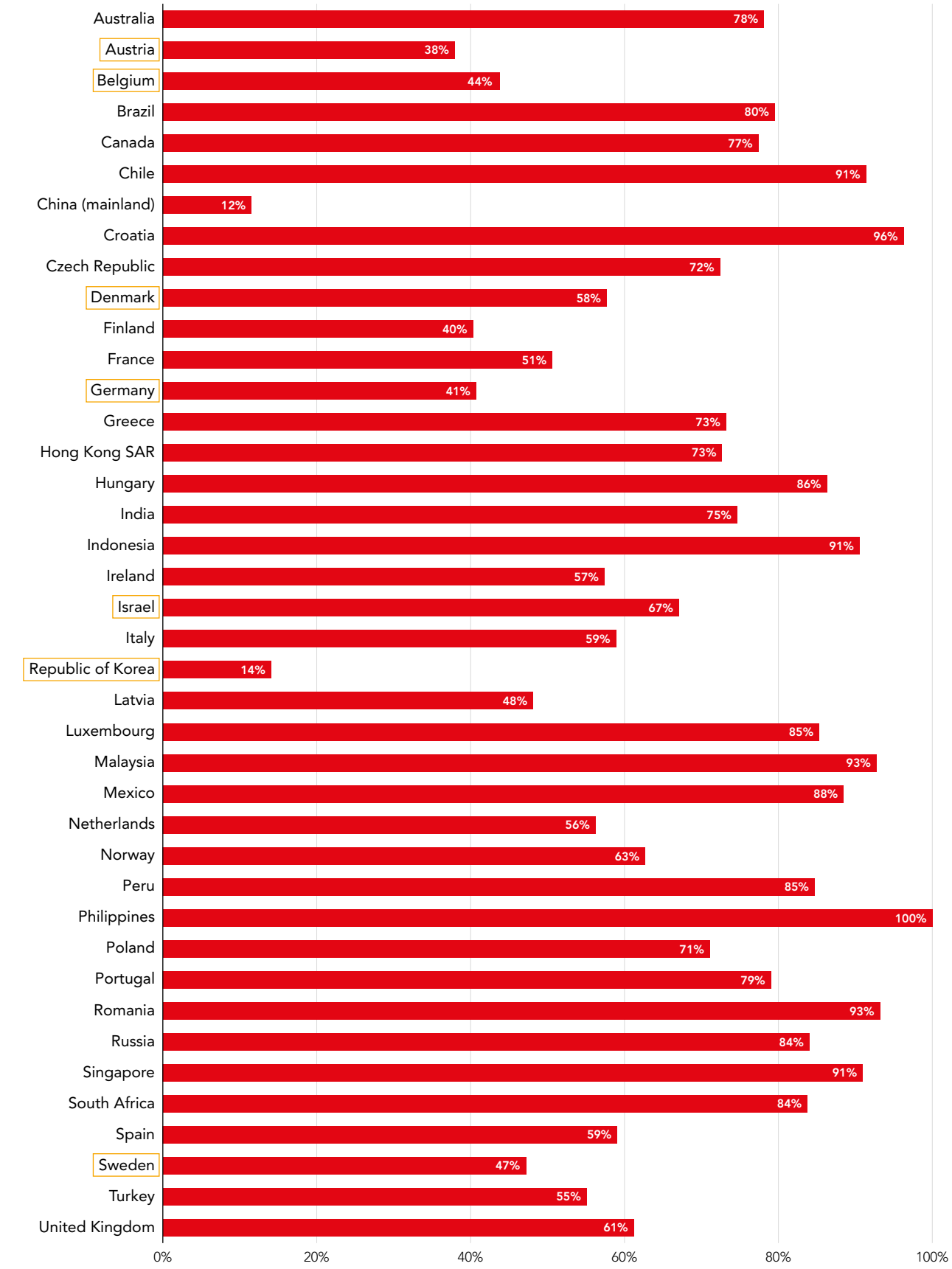
11 <http://www.csrc.gov.cn/pub/csrc_en/laws/overRule/Announcement/201210/t20121025_216124.html>

12 The exception is the Republic of Korea which exhibits a very high country-level R&D expenditure relative to GDP but we identify a very low exclusion rate.

13 This requirement came into effect on 2007 (see note 1 in FCA 2023b) and similar regulations exist in other European countries (Mazzi et al. 2019b).

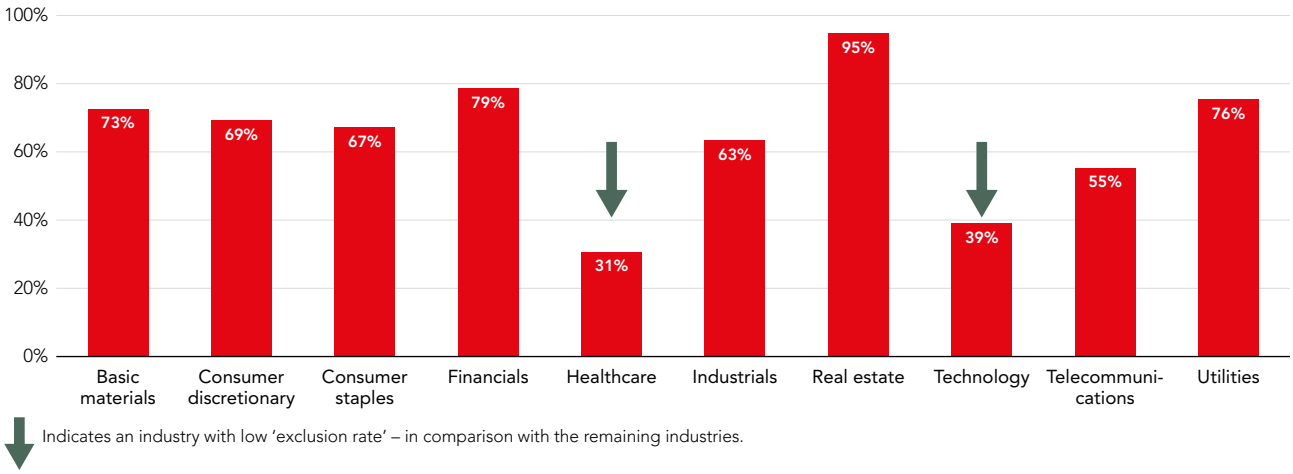
14 Indeed, the analysis in the next phase of this study indicates that a large proportion of UK firms that are classified as R&D inactive provide a significantly high volume of R&D-related disclosure in the annual report, and particularly in the narratives section. Also, the results in Mazzi et al. (2019b) indicate that these regulations may indeed contribute higher R&D-related disclosure levels, albeit for firms that are considered R&D active.

FIGURE 2.2: Percentage of R&D-inactive firms – 'exclusion rate' – by country/location



Indicates a country with very large country-level investments in R&D as a proportion to GDP (>=3%).

FIGURE 2.3: Percentage of R&D-inactive firms – 'exclusion rate' – by industry (excluding China)



As China has by far the largest number of firm-year observations in the sample (18.6%) and it is also the country with the lowest exclusion rate (11.5%), we exclude the firm-year observations from China when we explore the distribution of R&D-inactive firms across industries. For completeness, in Appendix 1, Table A1.2 shows by industry including China (Panel A) and for China only (Panel B).

Figure 2.3 shows the proportion of R&D-inactive firms per industry (using the 10 industries as defined by the Industry Classification Benchmark (ICB) taxonomy issued by FTSE Russell (see Vass 2019). Most industries have an exclusion rate that ranges between 50% and 70%. Real Estate and Financials exhibit the highest exclusion rates of c.95% and c.79%, respectively. Industries such as Healthcare and Technology, which have traditionally consisted of R&D-active firms, are, as expected, the industries with the highest R&D activity. Yet, somewhat surprisingly, they still have high exclusion rates of 31% and 39%, respectively, suggesting that a relatively large proportion of firm-year observations are from firms that do not report R&D amounts separately. Further, we observe that about 55% of the firm-year observations in Telecommunications do not report amounts for R&D separately.

These statistics are in line with previous R&D-related studies (Dionysiou et al. 2021; Mazzi et al. 2019b) that indicate a large exclusion rate, raising the question of whether such a large proportion of firms really do not engage in R&D activities.

2.2 Characteristics of R&D-active and inactive firms

To get a better understanding of the characteristics of R&D-inactive firms, we consider firm-level and country-level characteristics. In identifying these characteristics, we rely on prior literature investigating the determinants of the decision to capitalise development costs and the magnitude of development costs capitalised (see Dionysiou et al. 2021; Dargenidou et al. 2021; Mazzi et al. 2019b). A combined representation of the models we apply is expressed in Equation 2.1.

EQUATION 2.1:

$$NonR\&Dactive = f\{ROA, BM, Size, BETA, LEV, BIG4AR, CAPEX, TANGIBILITY, AGE, CLOSELYHELD\%, STRAOWN\%, LIQUIDITY, GOODWILL, MATBC, SDASSET, SDCAPD, INTSALES\%, SWITCH, OTHERINT, RDGDP, RevisedAntidirectorIndex, CPI, Secrecy, AudEnf2008\}$$

where *NonR&Dactive* is a binary variable that takes one (1) when a firm is characterised as non-R&D active in a particular year, and zero (0) otherwise. To begin with the firm-specific variables capturing a firm's life cycle and risk, *ROA* is the return-on-assets; *BM* is the book to market ratio, *Size* is firm size represented by the market value of the company, *BETA* is the market beta, *LEV* stands for leverage, *AGE* is the firm age, *LIQUIDITY* captures a firm's ability to meet its short-term needs and *INTSALES%* is the percentage of international sales and controls for a firm's international exposure. *BIG4AR* is an indicator variable that equals one (1) if the financial statements are audited by a Big Four firm and zero (0) otherwise, because the academic literature suggests that a Big Four auditor is more likely to ensure higher quality of the presented information in the annual report. Further, we include a number of variables which control for a firm's level of investment in tangible assets, as these firms are less likely to invest in intangible assets and R&D more generally. These are: *CAPEX*, which captures capital expenditure and *TANGIBILITY*, which captures the level of tangible fixed assets. We also include ownership structure variables, namely, *CLOSELYHELD%* and *STRAOWN%*, which are ownership concentration variables, measuring the percentage of closely held shares and the percentage owned by pension funds and institutional investors, respectively. We include these because key shareholders in firms with higher closely held ownership are less likely rely on financial reporting for information, given these firms' private channels for

communicating information to shareholders, while pension funds and institutional investors could act as monitoring devices influencing financial reporting. Considering that IFRS 3, effective for financial periods starting on or after 1 July 2009, permits the recognition of intangible assets that are acquired as a result of business combinations, we also include *GOODWILL*, which is the amount of net goodwill scaled by total assets and *MATBC*, which is a binary variable that equals one (1) if firms have engaged in a material business combination during the year and zero (0) otherwise. Further, given that companies that are not necessarily heavily involved in R&D activities invest in software to develop websites as well as other software for use as part of their operations, we include *SDASSET*, which reflects the amount of software development costs capitalised in year as a percentage of the firm market value; *SDCAPD* is an indicator variable that takes the value of one (1) if a firm capitalises software development costs during the year and zero (0) otherwise;. Additionally, we include a binary variable *SWITCH* to control for the fact that some firm-year observations relate to firms that appear to have switched their R&D reporting policy at least once during the years examined and hence differ from the rest. *OTHERINT* controls for the separate reporting of intangible assets by taking the value of one (1) if a firm has other intangible assets on the balance sheet in a given year, and zero (0) otherwise.

We also augment the model with the inclusion of country-level factors such as the *RDGDP*, which measures the country-level ratio of expenditure on R&D to GDP over the years tested. *AntidirectorIndex* serves as a measure of investor protection in a country; *CPI* is the Corruption Perceptions Index rank, controlling for corruption levels within a country. The higher the CPI rank the less corrupt a country is perceived to be. We also include a measure of enforcement (*AudEnf*), defined as the sum of the audit quality and accounting enforcement (Brown et al. 2014). Finally, we consider *Secrecy*, which is a measure of national culture, constructed from Hofstede's cultural dimensions (Hofstede 1980; Gray 1988). *Secrecy* controls for the potential impact culture may have on disclosures (Gray 1988; Jaggi and Low 2000; Hope 2003; Orij 2010). Detailed variable definitions are provided in Appendix 2.

To avoid extreme values, all continuous variables are winzorised at the ±1 percentiles. To control for the panel structure of the dataset, all our models include year and industry fixed-effects and we cluster the standard errors at the firm level.

2.2.1 Findings from univariate and multivariate analysis

Table 2.3 provides descriptive statistics for the variables included in the analysis, while Table 2.4 presents the results of the multivariate probit regression, in line with Equation 2.1. Models 1–3 in Table 2.4 use the full sample but vary in the inclusion of the country-level variables (and that is why the number of observations differs among them). Model 4 repeats the analysis, but it excludes all firm-year observations classified as 'switchers', in case their presence in the sample affects our inferences. Additionally, the tables exclude firm-year observations from China, as discussed earlier. Appendix 3 shows the results when we consider only firm-year observations from China.[15]

Recall that the aim of Phase 1 is to identify the characteristics of firms that affect the likelihood of their not reporting R&D amounts separately in a given year. As the results from bivariate analysis/descriptive statistics, shown in Table 2.3, do not control for potential concurrent influences of the relationships among all variables of interest, we rely on the characteristics that are statistically significant and consistent in their sign in both the univariate and multivariate analysis.

Overall, compared with R&D-active firms, inactive firms have smaller market value (*Size*) and exhibit higher leverage in their capital structure (*LEV*). Further, as one would expect, R&D-inactive firms tend to have lower growth opportunities, as indicated by higher book-to-market ratio (*BM*) and lower market risk (*BETA*) relative to R&D-active firms. At the same time, the likelihood that a firm will be R&D inactive is higher for those firms with higher values of tangible assets as a proportion of their total assets (*TANGIBILITY*) and are less likely to capitalise software development costs during the year (*SDCAPD*) or report other intangibles in their balance sheet (*OTHERINTA*) than R&D-active firms. Finally, R&D-inactive firms are those with more closely held ownership (*CLOSELYHELD%*), where shareholders are less likely to rely on financial reporting for information, and more likely to rely on private channels for communication.

As regards country-level characteristics, R&D-inactive firms, compared to R&D active firms, are more likely to be located in countries with a lower country-level R&D to GDP ratio (*RDGDP*). Perhaps this is not surprising as R&D-active firms operate in countries where R&D investment at the country level represents a significant proportion of GDP, motivating the investment in and separate reporting of R&D by individual firms.[16]

15 As shown in Appendix 3, the descriptive statistics and multivariate analysis for the firm-year observations from China give a similar picture, with a few exceptions. Specifically, BETA is no longer a significant determinant factor. Although a small proportion of firms from China employ Big Four auditor (Big4AR), R&D-inactive firms are more likely to employ a Big Four auditor (Big4AR).

16 We have repeated all tests by excluding firm-year observations from Republic of Korea, which has very high country-level R&D to GDP ratio and a very high proportion of R&D-active firms. Our findings do not change.

TABLE 2.3: Characteristics of R&D-inactive vs active firms (excluding China)

	R&D-INACTIVE (36,745)				R&D-ACTIVE (21,664)				TEST OF DIFFERENCES			
	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean diff	t-stat	Median diff	z-stat
ROA	–0.017	0.042	–2.187	0.578	–0.010	0.049	–2.187	0.578	–0.007	2.761	-0.008	9.399
BM	1.166	0.760	0.029	8.653	0.814	0.552	0.029	8.653	0.352	37.170	0.208	36.192
Size	15.703	14.768	3.336	36.508	19.381	18.868	5.445	36.732	–3.678	76.327	-4.100	66.446
BETA	0.860	0.800	–1.430	3.642	0.935	0.910	–1.430	3.642	–0.075	12.007	-0.110	17.329
LEV	0.852	0.353	0.000	11.242	0.685	0.351	0.000	11.242	0.167	13.558	0.002	0.514
Big4AR	0.393	0.000	0.000	1.000	0.472	0.000	0.000	1.000	–0.079	18.729	0.000	18.673
CAPEX	0.056	0.022	0.000	0.711	0.050	0.028	0.000	0.711	0.006	7.607	-0.006	18.687
TANGIBILITY	0.434	0.444	0.001	0.950	0.378	0.379	0.001	0.950	0.056	24.885	0.065	23.022
AGE	18.628	17.000	1.000	70.000	18.671	17.000	1.000	70.000	–0.043	0.408	0.000	2.167
CLOSELYHELD%	53.803	59.230	0.000	95.980	44.514	45.855	0.000	95.980	9.289	42.967	13.375	46.439
STRAOWN%	2.903	0.000	0.000	36.000	3.918	0.000	0.000	36.000	–1.014	16.666	0.000	21.915
LIQUIDITY	2.996	1.594	0.198	32.779	2.717	1.673	0.198	32.779	0.279	8.066	–0.079	7.962
GOODWILL	0.048	0.000	0.000	0.534	0.058	0.000	0.000	0.534	–0.011	11.570	0.000	27.162
MATBC	0.066	0.000	0.000	1.000	0.083	0.000	0.000	1.000	–0.017	7.658	0.000	7.655
SDASSET	0.001	0.000	0.000	0.044	0.002	0.000	0.000	0.044	0.000	5.229	0.000	44.033
SDCAPD	0.212	0.000	0.000	1.000	0.398	0.000	0.000	1.000	–0.186	49.341	0.000	48.345
INTSALES%	16.740	0.000	0.000	100.000	34.406	19.895	0.000	100.000	–17.666	61.991	–19.895	74.218
OTHERINTA	0.685	1.000	0.000	1.000	0.929	1.000	0.000	1.000	–0.244	71.261	0.000	68.352
RDGDP	1.474	1.164	0.144	5.007	2.760	2.236	0.144	5.007	–1.286	120.000	–1.071	89.972
AntidirectorIndex	4.338	5.000	2.000	5.000	4.266	4.500	2.000	5.000	0.072	10.576	0.500	22.444
CPI	61.824	67.000	28.000	88.000	63.655	61.000	28.000	88.000	–1.831	13.071	6.000	11.087
AudEnf2008	37.965	40.000	9.000	54.000	35.817	28.000	9.000	54.000	2.148	18.570	12.000	15.036
Secrecy	57.195	69.000	33.000	140.000	74.638	72.000	–33.000	140.000	–17.443	41.038	–3.000	48.269

TABLE 2.4: Multivariate analysis examining the likelihood of being classified as an R&D-inactive firm (excluding China)

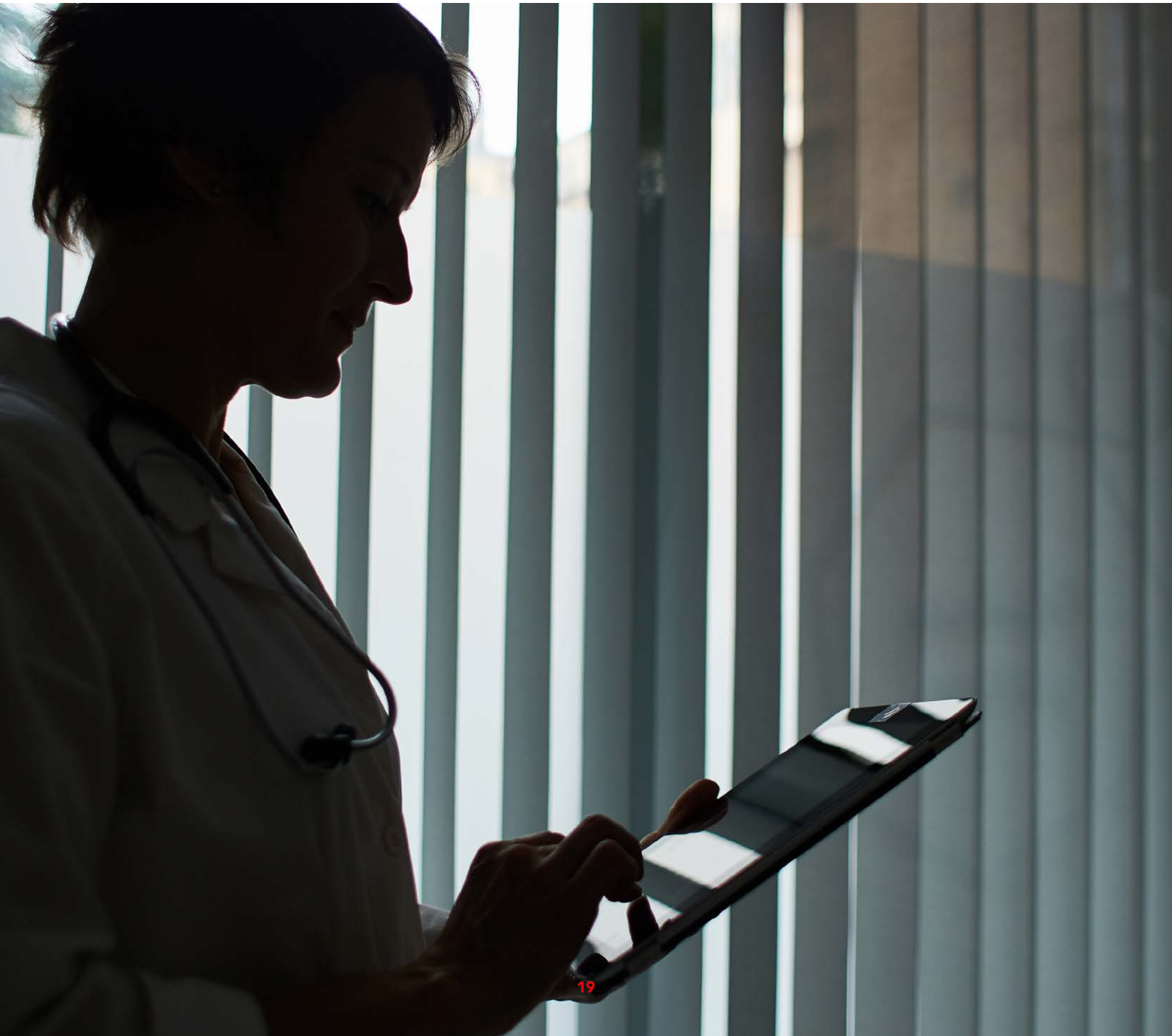
VARIABLES	(1)	(2)	(3)	(4)
ROA	0.306***	0.303***	0.311***	0.314***
	(8.98)	(8.88)	(9.11)	(8.06)
BM	0.094***	0.092***	0.104***	0.112***
	(7.69)	(7.44)	(8.19)	(7.53)
Size	–0.041***	–0.045***	–0.040***	–0.046***
	(–14.58)	(–13.63)	(–11.63)	(–14.40)
BETA	–0.064***	–0.065***	–0.068***	–0.067***
	(–4.90)	(–4.96)	(–5.17)	(–4.53)
LEV	0.055***	0.055***	0.058***	0.062***
	(7.02)	(7.04)	(7.23)	(6.88)
Big4AR	–0.032	–0.025	–0.028	–0.055*
	(–1.28)	(–1.00)	(–1.09)	(–1.93)
CAPEX	0.200*	0.217**	0.203**	0.243**
	(1.94)	(2.10)	(1.96)	(2.04)
TANGIBILITY	0.151***	0.149***	0.118**	0.239***
	(2.83)	(2.79)	(2.19)	(3.89)
AGE	–0.012	–0.014	–0.016	–0.008
	(–0.92)	(–1.12)	(–1.23)	(–0.52)
CLOSELYHELD%	0.004***	0.003***	0.004***	0.004***
	(7.09)	(6.79)	(7.36)	(7.38)
STRAOWN%	–0.001	–0.001	–0.003	–0.001
	(–0.70)	(–0.77)	(–1.58)	(–0.78)
LIQUIDITY	0.002	0.002	0.002	0.001
	(0.68)	(0.82)	(0.61)	(0.19)
GOODWILL	0.722***	0.718***	0.625***	0.921***
	(5.83)	(5.80)	(4.99)	(6.55)
MATBC	0.074**	0.075***	0.074**	0.075**
	(2.53)	(2.58)	(2.55)	(2.32)
SDASSET	11.667***	11.914***	11.609***	12.349***
	(5.70)	(5.81)	(5.62)	(5.33)
SDCAPD	–0.320***	–0.324***	–0.329***	–0.313***
	(–11.70)	(–11.81)	(–11.91)	(–10.15)
INTSALES%	–0.009***	–0.009***	–0.009***	–0.009***
	(–24.49)	(–24.03)	(–23.74)	(–22.70)
SWITCH	–0.474***	–0.471***	–0.464***	
	(–15.44)	(–15.34)	(–15.00)	
OTHERINT	–0.572***	–0.575***	–0.573***	–0.634***
	(–16.35)	(–16.35)	(–16.26)	(–15.50)
RDGDP	–0.309***	–0.307***	–0.296***	–0.350***
	(–27.94)	(–27.68)	(–25.82)	(–28.02)
AntidirectorIndex	0.057***	0.069***	0.064***	0.063***
	(3.58)	(4.18)	(3.83)	(3.45)
CPI	0.002**	0.004***	0.002	0.003***
	(2.25)	(2.86)	(1.45)	(2.62)
AudEnf2008		–0.003*	–0.004**	
		(–1.90)	(–2.10)	
Secrecy			–0.002***	
			(–4.52)	
Constant	1.815***	1.884***	2.005***	1.818***
	(14.13)	(14.04)	(14.27)	(12.43)
Observations	58,409	58,323	57,642	53,257
chi2	4932	4943	4899	4317

Note: The table presents the results of a Probit regression examining the likelihood of firms' being R&D inactive. All variables are defined in Appendix 2. Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

2.3 Summary of findings in Phase 1

To summarise, using a large sample of firm-year observations from 2017 to 2021 from 40 countries that had adopted, or converged their national standards to, IFRS by 2015, we find that 53% of our sample do not separately report R&D amounts. Thirteen countries that represent 12% of the overall firm-year observations have a rate of inactive R&D firm-year observations of over 80%, while seven of those countries indicate an exclusion rate that is over 90% and represent 10% of our firm-year observations. Firms in Healthcare and Technology industries, which are traditionally R&D-active sectors, exhibit the lowest exclusion rates, as expected (31% and 39% respectively). Firms in Real Estate and Financial industries exhibit the highest exclusion rates (95% and 79% respectively).

Finally, this chapter highlights the characteristics and/or the environment in which firms are most likely not to report separately an R&D amount in a given year. Our models indicate that, in comparison with R&D-active firms, R&D-inactive ones tend to be smaller firms and with higher leverage, while they report lower growth opportunities and risk. At the same time, they have higher tangible assets and seem not only R&D inactive, but also less active in reporting other intangibles and software development costs. In addition, they are firms with higher closely held ownership. Regarding country-level characteristics, R&D-inactive firms tend to be located in countries with lower country-level R&D to GDP ratio, indicating a less conducive country-level environment for R&D investment.



3. Phase 2 – R&D-related disclosures by R&D-inactive firms

The aim of this Phase is to investigate the quantity of R&D-related disclosures in annual reports of R&D-inactive firms by examining the separate sections of the annual reports in which R&D-related terms may be mentioned. Hence, this phase aims to infer firms' investment in R&D activities from the extent of the references/discussion made in their annual reports even when they do not report any related amounts separately in the financial statements. Providing evidence that this indeed occurs would suggest an information gap regarding the actual level of investment in R&D.

3.1 Sample selection

Given the time required for identifying and downloading firms' annual reports, the analysis in this Phase of the project is necessarily based on a sub-sample of the observations identified in Phase 1 as being R&D-inactive firms. Similarly to Mazzi et al. (2019b), we apply a strategic sampling approach. Specifically, we rank all the 38,285 observations of R&D-inactive firms identified in Phase 1 in country-year-industry clusters by market capitalisation and in a descending order. Subsequently, for each cluster, we retain the first firm as a starting point, then the third, the fifth, and so on. Ranking firms according to this approach ensures that the sample considered at this stage is represented by firms of all sizes, across all countries and all industries. This procedure yields a sub-sample of 19,598 firm-year observations (51.19%) for which we searched for the annual report.[17]

For this sub-sample, we required the 'financial statements' and/or 'narratives' in the annual report to be available in the English language and be editable (ie not in picture format). Editable text allows character recognition. These requirements led to a final sample of 12,992 narratives (ie the front-end of an annual report up to and excluding the financial statements), 14,193 financial statements (consisting of the auditors' report, the financial statements and the notes to the financial statements). Among these, there are 12,890 firm-year observations for which we have both the financial statements and narratives (ie a full annual report).[18]

3.2 Methods applied

3.2.1 Identifying R&D-related disclosures

To measure the quantity of R&D-related disclosures in firms' annual reports (in full or in part, depending on availability), we use a list of R&D-related terms. The starting point of this list was the list used by Mazzi et al. (2019b). We augment it by adding 30 further terms, resulting in a final list of 149 R&D-related terms. Appendix 4 presents all 149 terms we used.

Using this, we then apply a computerised content analysis. Specifically, as in Mazzi et al., (2019b), we use the MaxDictio application of MaxQDA software to search the number of times each firm refers to the R&D-related terms in our list. Subsequently, we measure the quantity of R&D-related disclosures as the sum of the number of times each firm refers to each term in our list in either part of the annual report and/or the annual report as a whole.

3.2.2 Descriptive analysis

First, we report aggregate counts of R&D-related terms for the full sample of firm-year observations used in the analysis. Further, we report these across firm-year observations for those that capitalised SD assets during the year and those that did not. This is particularly relevant given that some of the terms included in our list of R&D-related terms could arguably reflect development of SD assets instead of R&D activities. Additionally, we report these counts across firm-year observations that report other intangibles on the balance sheets and those that do not report other intangibles. This is important since a company could have aggregated development costs with other intangible assets without reporting them separately.

17 To find the annual reports, we started by searching on Perfect Information database, which provides comprehensive annual reporting coverage at an international level. If the annual report was not provided there, we used the database Refinitiv (Thomson Eikon) or searched on the firms' websites.

18 The latter suggests that for only 102 firm-year observations we were unable to source the financial statements in English and/or in editable format. This would not be a problem for data vendors who use the financial statements as provided by the firms in the local language, which may also not be editable.

Subsequently, to provide further granularity to our analysis, using the distribution of the count of R&D-related terms, we allocate firm-year observations into three disclosure groups, namely: Minimal, Low and High disclosers. We follow this process separately across the three groups of documents (narratives, financial statements and the annual report as a whole) and present this analysis, for the full sample, across countries and across industries.

3.2.3 Characteristics of 'above- and below-average disclosers'

We supplement the analysis by examining the country, industry and firm-level determinant factors of the quantity of R&D-related disclosures using multivariate regression analysis. This analysis is performed across the three groups of documents (narratives, financial statements and the annual report as a whole). The dependent variable is a dummy variable separating the observations across 'above average disclosers' versus 'below average disclosers' of R&D-inactive firms. We classify firm-year observations as 'above-average disclosers' if the count of R&D-related terms is above the mean count across our full sample in each of the three documents, respectively. We select the mean because this is similar to the corresponding mean reported by Mazzi et al. (2019b), who analyse the frequency of R&D-related terms in the annual reports of R&D-active firms. This categorisation effectively positions firms that are R&D inactive (given that they do not report separately an amount in relation to R&D expenses or amortisation of development costs or capitalisation of development assets in a given year) as seemingly R&D active (given that they provide similar levels of R&D-related disclosures in their annual reports to those provided by R&D-active firms). The independent variables are the same as those used in the multivariate analysis performed for Phase 1. Thus, the model we employ is expressed as in Equation 3.1.

EQUATION 3.1:

RDDISCLOSURE = f(ROA, BM, Size, BETA, LEV, Big4AR, CAPEX, TANGIBILITY, AGE, CLOSELYHELD%, STAOWN, LIQUIDITY, GOODWILL, MATBC, SDASSET, SDCAPD, INTSALES%, SWITCH, OTHERINT, RDGDP, AntidirectorIndex, CPI)

where RDDISCLOSURE is a binary variable that takes a value of one (1) when a firm's count of R&D-related terms is above the mean count across our full sample in each of the three documents, respectively, and zero (0) otherwise. All other variables are defined in Appendix 2. As in Phase 1, to control for the panel structure of the dataset, all our models include year and industry fixed-effects and we cluster the standard errors at the firm level.

3.2.4 Examples of R&D-related disclosures from R&D-inactive firms

Finally, for a relatively small number of firms, we manually extract three types of examples of R&D-related disclosures provided by R&D-inactive firms. These are shown in Section 3.5.

3.3 Findings and discussion

3.3.1 Counts of disclosures of R&D-related terms

Table 3.1 presents the descriptive statistics of the R&D-related disclosures we identified in the financial statements, the narratives and in the annual report as a whole. Specifically, Panel A of Table 3.1 shows that of the 14,193 financial statements, 10,054 (71%) refer at least once to a term included in our list of R&D-related terms. The mean (median) number of R&D-related disclosures in these documents is 6 (3), while the maximum number of times a firm refers to terms in our word list is 143. Further, of the 12,992 narratives, 11,113 (86%) refer at least once to a term on our list. The mean (median) count of R&D-related terms in the narratives is 12 (5), while the maximum number of times a firm refers to terms in our word list is 598. Finally, 12,029 (93%) of the 12,890 annual reports use at least once a term considered in our list of R&D-related terms. The mean (median) count of R&D-related terms in the annual report is 15 (8), while the maximum number of times a firm uses the terms included in our list is 606.

Following on from this and delving further into the underlying data, we observe that a sizable proportion of the R&D-inactive firms in our sample use R&D related terms quite extensively. Specifically, we find that of the 11,113 narratives that use a term from our word list at least once, 110 use terms in our list more than 100 times, while 320 use terms in our word list between 50 and 100 times. Further, we find that of the 12,029 annual reports that use a term in our word list at least once, 170 use words in our list more than 100 times, while 496 use terms in our word list between 50 and 100 times.

To put things in perspective, Mazzi et al. (2019b) report that the mean (median) count of R&D-related terms of R&D-active firms in the financial statement is 9 (15), while that for narratives is 15 (9) and that for the whole annual report is 25 (17). The overall mean and median in our sample indicate that the frequency of R&D-related terms is highly skewed on the left. Thus, when comparing these findings for R&D-inactive firms to the frequency of R&D-related disclosures by R&D-active firms, the mean and median are, perhaps as expected, lower. Nonetheless, the distribution of the frequencies of R&D-related terms indicates that there are a large number of firm-year observations that use R&D-related terms as frequently as R&D-active firms. In fact, for some R&D-inactive firms the count of disclosures is very high.

Panel B of Table 3.1 shows the mean and median frequency of R&D disclosure levels across firms with and without capitalised SD costs during the year. We observe that, as arguably expected, firms recognising SD costs during the year and report them separately exhibit disclosure levels that are higher than those of firms that do not capitalise SD costs during the year. This holds for both narratives and financial statements, and the whole annual report.[19] Nevertheless, we note that firms without SD costs capitalised during the year do use terms related to R&D. For this sub-sample, the mean (median) frequency of R&D-related disclosures in financial statements is 5 (3) and the mean (median) for the narratives is 10 (5). These values are close to the mean and median values presented for the full sample (Panel A). Further, these results are also comparable to the results presented in Mazzi et al. (2019b) for R&D-active firms, but with lower R&D intensity.[20]

Panel C of Table 3.1 shows the mean and median frequency of R&D terms across firms with and without other intangible assets.[21] As perhaps expected, firms with other intangible assets exhibit R&D disclosure levels that are higher than those of firms without other intangible assets. Specifically, for firms with other intangible assets, the mean (median) frequency is 7 (3) in the financial statements and 14 (7) in the narratives. Focusing on firms without other intangible assets, the mean (median) frequency is 4 (2) in the financial statements and the mean (median) disclosure in the narratives is 6 (3). Although this level of disclosure for firms without other intangible assets may not appear high at first glance, it is similar to the results reported in Mazzi et al. (2019b) for R&D disclosures by R&D-active firms with the lowest levels of R&D intensity.[22]

In Appendix 5, we present the R&D disclosure frequencies across countries/locations (Table A5.1) and industries (Table A5.2). Table A5.1 shows that firms from Finland, France, Italy, Netherlands, Norway, Spain, Sweden and Turkey tend to have the highest R&D disclosure levels and the mean count in the annual reports in these countries/locations is above 25.[23] At the other extreme, firms from Australia, Brazil, Canada, Denmark, Greece, Hong Kong, India, Indonesia and Singapore tend to disclose the least.[24] The mean count of R&D-related terms for firms in these countries/locations is below 15.

TABLE 3.1: Mean and median R&D disclosure levels

PANEL A: Full Sample

	N	Mean	Median	Min	Max
FS	10,054	6	3	1	143
Narratives	11,113	12	5	1	598
Annual report	12,029	15	8	1	606

PANEL B: Firm-year observations without vs firm-year observations with SD capitalised in the year

	Without SD			With SD		
	N	Mean	Median	N	Mean	Median
FS	7,878	5	3	2,176	7	4
Narratives	8,533	10	5	2,580	17	10
Annual report	9,387	14	7	2,642	22	13

PANEL C: Firm-year observations without, vs firm-year observations with, Other Intangibles on the balance sheet

	Without Other Intangibles			With Other Intangibles		
	N	Mean	Median	N	Mean	Median
FS	3,280	4	2	6,774	7	3
Narratives	3,233	6	3	7,880	14	7
Annual report	3,727	8	5	8,302	19	10

Note: The table reports the descriptive statistics of the frequency of R&D terms shown across the documents we selected for the full sample (Panel A), across firm-year observations with and without SD costs capitalised during the year (Panel B) and across firm-year observations with and without other intangibles (Panel C).

19 In unreported tests, we find that the differences in the means and medians are statistically significant.

20 This is with reference to the results presented in Table 4.8 in Mazzi et al. (2019b) where the mean and median of R&D disclosure levels are presented for different levels of R&D intensity and, specifically, the results presented in Panels C and D (ie the third and fourth quartile of R&D intensity).

21 In additional tests, we find that the differences in the means and median are statistically significant.

22 This is with reference to the results presented in Table 4.8 (Panel D) in Mazzi et al. (2019b) and in particular the bottom quartile of R&D intensity (ie 4th quartile of R&D intensity).

23 The mean count of R&D-related terms in the annual report is also above 25 for firms from Austria, Belgium, Chile, Peru, Portugal, Israel, and Russia, but the number of firm-year observations is below 50 (and for some instances, well below 50) to allow for trustworthy conclusions.

24 Firms from Latvia, Luxembourg and the Philippines also exhibit low disclosure levels but the number of firm-year observations from these countries is small to allow for trustworthy conclusions.

Table A5.2 shows that firms in the Healthcare, Utilities, Telecommunications and Technology industries exhibit the highest count of R&D-related terms and the mean (median) count in the annual reports is above 24 (13). Given that these industries are more R&D intensive, this finding is not very surprising. On the other end of the spectrum, firms in Basic Materials, Financials and Consumer Discretionary industries tend to provide the fewest disclosures, with the mean (median) frequency in the annual reports being below 12 (7).

To summarise, we observe relatively high R&D-disclosure levels in our sample for firm-year observations that report other intangibles or capitalising SD assets during the year (see Table 3.1). Nevertheless, firm-year observations that do not report other intangibles or capitalise SD assets during the year exhibit R&D disclosure levels that are comparable to those reported in Mazzi et al. (2019b) for R&D-active firms with lower levels of R&D intensity. Additionally, the R&D-disclosure levels vary across countries and industries and the relatively high R&D-disclosure levels appear to be driven by a relatively large number of firms, across a number of countries and industries. Nevertheless, it is somewhat surprising that despite the high frequency of R&D disclosure, these firms do not report separately an R&D expense and/or asset.

3.3.2 Most and least popular terms in R&D-inactive firms' annual reports

Appendix 6 presents the most and least frequently mentioned R&D terms in the annual reports analysed. Among the most frequently used (ie popular) terms is 'development cost' and six terms (ie 'research and development'; 'ability to use'; 'internally generated'; 'technical feasibility'; 'development phase'; and 'prototype') that are mentioned in IAS 38 appear frequently, and most of them in relation to the criteria to be considered for the capitalisation of development costs. Further, we note a considerable overlap between our findings and those for R&D-active firms in Mazzi et al. (2019b). In particular, 12 terms (ie 'research and development'; 'r&d'; 'product development'; 'new technolog*'; 'ability to use'; 'internally generated'; 'software development'; 'technical feasibility'; 'clinical trial'; 'technology development'; 'development phase'; 'research development') out of the 30 most frequently used terms we identify are also among the 15 terms most frequently identified by Mazzi et al. (2019b). Beyond these, other terms that R&D-inactive firms refer to frequently relate to innovation, patents and new technology/projects, indicating that at least a sizeable proportion of the firms in our sample indeed engage in R&D activities even though the related amounts are not reported separately as an R&D expense and/or asset in their financial statements.

3.3.3 Minimal, Low and High disclosers

The findings so far indicate that a significant proportion of the R&D-inactive firms in our sample provide similar levels of R&D-related disclosures to those of explicitly R&D-active firms and hence signal that they engage in R&D activities to a similar extent. Given this, arguably, one would expect them to have reported separately an amount for R&D expenses or amortisation of development costs or capitalisation of development assets in a given year.

To identify more accurately those R&D-inactive firms that behave similarly to R&D-active firms for R&D disclosures, we allocate the firm-year observations into three disclosure groups based on the distribution of the frequency of R&D disclosures, namely: Minimal, Low and High disclosers.[25] We do this separately across the three groups of documents (narratives, financial statements and the annual reports).

Table 3.2 presents the mean and median R&D disclosure frequencies for each disclosure group (ie Minimal, Low and High), across the types of documents we collected. Firm-year observations in the High disclosure group exhibit a mean (median) frequency of 34 (24) in the annual report as a whole. Firms in the Low and Minimal disclosure groups exhibit significantly lower levels of R&D-related disclosures. Specifically, the mean (median) frequency of R&D disclosure terms for the Low category is 8 (8) while that for Minimal category is 2 (2). We observe similar significant differences for R&D disclosure levels in the narratives and financial statements sections of the annual reports across the three disclosure groups.

TABLE 3.2: Mean and median R&D disclosure levels across Minimal, Low and High disclosure groups

	FINANCIAL STATEMENTS			NARRATIVES			ANNUAL REPORT		
Disclosure group	N	Mean	Median	N	Mean	Median	N	Mean	Median
Minimal	2,894	1	1	2,883	1	1	3,894	2	2
Low	2,770	2	2	4,241	5	5	3,931	8	8
High	4,390	11	8	3,989	27	17	4,204	34	24
Total	**10,054**	**6**	**3**	**11,113**	**12**	**5**	**12,029**	**15**	**8**

25 Reflecting the skewed distribution noted in Table 3.1, these groups are of unequal size, with groups Minimal and Low consisting of firm-year observations with overall low R&D disclosure levels.

Table 3.3 cross-tabulates the number of firm-year observations in each disclosure group (ie Minimal, Low and High), across narratives and financial statements. We find that a large proportion of firm-year observations (17%; 2,013) in the High disclosure group in the narratives are also present in the High disclosure group in the financial statements. Consistent with this, we also find a large proportion of firm-year observations (18%; 2,193) in the Minimal group in narratives being also present in the Minimal group in financial statements. Taken together, these findings suggest that there is a strong correlation between R&D-related disclosures in the two sections of the annual report with a large concentration of firms in the High and Minimal groups in both narratives and financial statements.

Table 3.4 presents a breakdown of the firm-year observations in each disclosure group (Minimal, Low and High) by country/location. This shows that more than 50% of firm-year observations from Finland, France, Germany, Italy, Netherlands, Norway, Spain, South Africa and Sweden, are from firms in the High disclosure group for R&D-related disclosures in the annual report.[26] With the exception of firms in Spain and the Netherlands, a small proportion of firm-year observations are for firms that capitalise SD assets during the year and thus it is unlikely that these disclosures relate to SD assets. Nevertheless, above 95% of firm-year observations from all these countries relate to firms that do report other intangible assets. When observing the findings reported in Mazzi et al. (2019b), it is noted that these countries are among those with high levels of R&D-related disclosures in annual reports for R&D-active firms. Further, from the information presented in Appendix 1, for most of these countries, the country-level R&D expenditure as a proportion of GDP is higher than the sample mean (2.00%). For instance, for Germany and Sweden, country-level R&D expenditure as a proportion of GDP is in excess of 3%, while that for Finland, France and Netherlands is between 2% and 3%.

In addition, compared to the above countries, a smaller percentage of firms from Australia, Brazil, Canada, Hong Kong, India, and Singapore are in the High disclosure group; this ranges between 20% and 30%.[27] When observing the findings reported in Mazzi et al. (2019b), these countries are among those with low levels of R&D-related disclosures for R&D-active firms. Again, from the information presented in Appendix 1 we see that the proportion of country-level R&D expenditure to GDP is much lower for these countries (it ranges between 0.9% and 1%). These findings are what would be expected intuitively, in that one would expect a more favourable economic environment for R&D activities to be reflected on the operations of the firms in it.

Figure 3.1 shows the mean count of R&D-related terms by country/location, for the firms in the High disclosure group. The mean count in the annual reports of firm-year observations in Finland, France, Italy, Netherland, Norway, Spain and Sweden is above 35 (ie 36, 69, 39, 67, 50, 67 and 44, respectively),[28] while that reported in Mazzi et al. (2019b) for R&D-active firms in these countries is 70, 100, 51, 45, 35, 85 and 52, respectively. Although for some of these countries the mean count of R&D-related terms for R&D-inactive firms is smaller than those for R&D-active firms, the trends of the magnitudes are comparable.[29]

TABLE 3.3: Number of firm-year observations in each disclosure group (ie Minimal, Low and High), across narratives and financial statements.

	FINANCIAL STATEMENTS			
Narratives	Minimal	Low	High	Total
Minimal	2,193	831	844	**3,868**
Low	2,123	850	1,250	**4,223**
High	1,165	760	2,013	**3,938**
Total	**5,481**	**2,441**	**4,107**	**12,029**

26 We also observe a similar pattern for firm-year observations from Austria, Belgium, China, Chile, Czech Republic, Israel, Mexico, Peru, Portugal, Romania, and Russia, although we note that the number of observations is much smaller for these countries to allow conclusive evidence.

27 We also observe a similar pattern for Latvia. However, only one of the 14 firm-year observations is in the High disclosers group.

28 We also observe a similar pattern for firm-year observations from Austria, Belgium Chile, Croatia, Ireland, Israel, Peru, Portugal, Russia and Turkey, although the number of observations in these countries is too small to allow conclusive evidence.

29 The lack of data for Hungary, Latvia and Republic of Korea exists because there is no firm-year observation in the High disclosure group for that type of report.

TABLE 3.4: Number of firm-year observations in each country/location

	ANNUAL REPORT				FINANCIAL STATEMENTS				NARRATIVES			
COUNTRY/ LOCATION	Minimal	Low	High	Total	Minimal	Low	High	Total	Minimal	Low	High	Total
Australia	640	548	469	1,657	337	366	739	1,442	506	477	319	1,302
Austria	0	4	22	26	8	3	14	25	0	9	17	26
Belgium	1	4	43	48	1	2	44	47	1	6	43	50
Brazil	18	19	15	52	14	29	44	87	12	19	18	49
Canada	248	352	263	863	427	439	480	1,346	207	388	227	822
Chile	0	2	12	14	1	3	9	13	0	2	14	16
China (mainland)	9	6	31	46	12	11	18	41	5	2	35	42
Croatia	0	3	2	5	3	0	1	4	0	2	3	5
Czech Republic	0	0	4	4	0	0	4	4	0	0	4	4
Denmark	11	24	29	64	6	13	31	50	11	22	29	62
Finland	9	17	58	84	6	16	60	82	9	34	40	83
France	2	15	158	175	9	24	146	179	4	17	157	178
Germany	16	48	107	171	25	32	99	156	16	49	105	170
Greece	20	16	22	58	22	7	12	41	16	22	21	59
Hong Kong SAR	855	686	410	1,951	663	395	407	1,465	607	729	433	1,769
Hungary	1	4	3	8	0	5	18	23	6	1	0	7
India	901	949	592	2,442	342	418	514	1,274	593	1,076	703	2,372
Indonesia	58	87	91	236	168	84	57	309	38	78	118	234
Ireland	12	13	13	38	11	8	15	34	6	18	9	33
Israel	2	0	9	11	3	0	9	12	0	0	9	9
Italy	10	26	97	133	7	29	97	133	14	30	86	130
Republic of Korea					0	0	1	1				
Latvia	13	0	1	14	4	5	1	10	8	1	0	9
Luxembourg	6	4	7	17	0	5	11	16	2	5	6	13
Malaysia	389	398	547	1,334	304	261	544	1,109	335	501	391	1,227
Mexico	12	7	24	43	8	10	15	33	4	11	26	41
Netherlands	1	10	55	66	5	11	45	61	1	7	55	63
Norway	21	33	53	107	20	12	57	89	16	41	48	105
Peru	0	0	1	1	0	1	1	2	0	0	1	1
Philippines	2	6	5	13	1	2	13	16	2	6	2	10
Poland	22	15	26	63	16	12	26	54	11	25	24	60
Portugal	5	5	39	49	3	14	31	48	7	7	34	48
Romania	7	2	12	21	3	4	14	21	4	6	10	20
Russia	2	4	31	37	9	13	20	42	7	6	36	49
Singapore	213	182	99	494	139	145	127	411	153	174	89	416
South Africa	51	74	169	294	48	79	96	223	38	81	188	307
Spain	6	10	52	68	5	7	49	61	7	9	51	67
Sweden	22	52	140	214	27	38	116	181	16	53	143	212
Turkey	2	8	41	51	15	25	20	60	2	8	47	57
United Kingdom	307	298	452	1,057	222	242	385	849	219	319	448	986

FIGURE 3.1: Graphical representation of the mean count of R&D-related terms by country/location (High disclosure group)

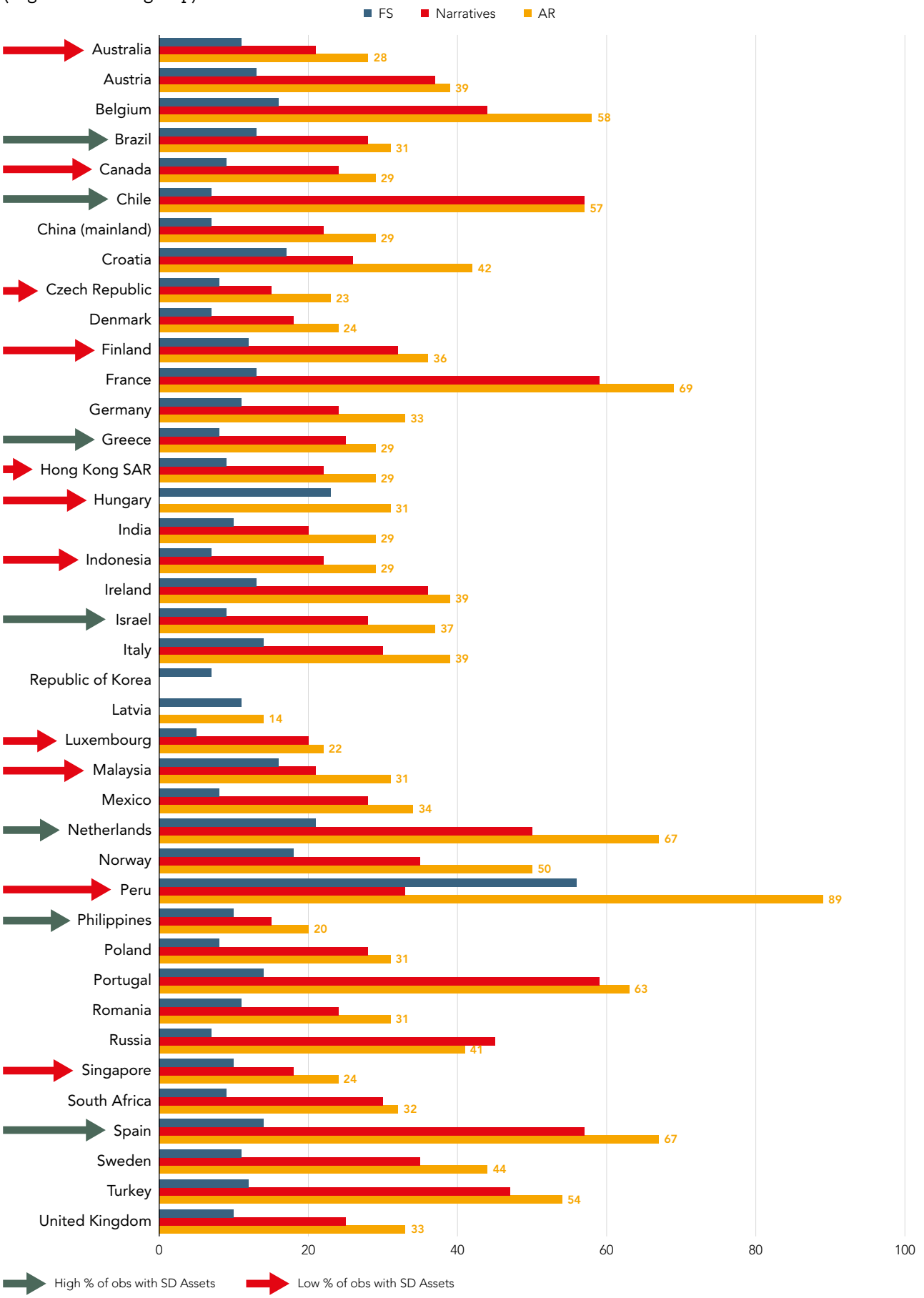


Table 3.5 presents a breakdown of the firm-year observations in each disclosure group (Minimal, Low and High) by industry. Perhaps unsurprisingly, more than 50% of the observations in the Technology, Utilities, Healthcare and Telecommunications industries are in the High disclosure group for R&D-related disclosures in the annual report. This is consistent with the findings reported in Mazzi et al. (2019b): that these industries are among those with the highest levels of R&D-related disclosures for R&D-active firms.[30] More specifically, Mazzi et al. (2019b) report that the mean count of R&D-related disclosures in Healthcare was more than 90 while that for Technology, Utilities, and Telecommunications was approximately 50. We note, however, that a large proportion of firms in Telecommunications have a high percentage of SD assets capitalised during the year and therefore the frequency we capture may reflect these assets.

At the other end of the spectrum, fewer than 30% of the firm-year observations in Basic Materials (22%), Consumer Discretionary (30%) and Financials (29%) industries are in the High disclosure category for R&D-related disclosures in the annual report. Despite the variation across industries, a significant proportion of firms refer to R&D with high frequency although they do not report any amounts separately in the financial statements. Figure 3.2 informs this discussion by presenting the mean count of R&D-related terms by industry for the High disclosers group.

When observing the findings reported in Mazzi et al. (2019b), these industries are among those with low levels of R&D-related disclosures for R&D-active firms. Specifically, the mean count of R&D-related disclosures for R&D-active firms in Basic Materials is approximately 40 words while that for Financials is fewer than 30 words.[31] Nevertheless, we observe that a large proportion of R&D-inactive firms in Financials report other intangibles and capitalise SD assets during the year while this is not the case for firms in Basic Materials. Thus, the frequency of R&D disclosures we observe in Basic Materials is unlikely to capture references to SD assets or other intangible assets.

TABLE 3.5: Number of firm-year observations in each industry by disclosure group

	ANNUAL REPORT				FINANCIAL STATEMENTS				NARRATIVES			
INDUSTRY*	Minimal	Low	High	Total	Minimal	Low	High	Total	Minimal	Low	High	Total
Basic Materials	1,001	909	543	2,453	721	794	955	2,470	747	873	472	2,092
Consumer Discretionary	936	928	814	2,678	684	553	745	1,982	632	1,029	835	2,496
Consumer Staples	340	284	339	963	211	207	284	702	221	306	359	886
Financials	126	91	87	304	92	76	116	284	95	90	83	268
Healthcare	114	144	282	540	110	102	250	462	80	169	276	525
Industrials	929	923	1,013	2,865	686	579	902	2,167	689	1,076	970	2,735
Real Estate	162	247	229	638	134	138	286	558	157	242	192	591
Technology	132	202	474	808	111	143	483	737	125	242	400	767
Telecomms.	88	103	203	394	68	74	198	340	78	107	189	374
Utilities	66	100	220	386	77	104	171	352	59	107	213	379
Total	**3,894**	**3,931**	**4,204**	**12,029**	**2,894**	**2,770**	**4,390**	**10,054**	**2,883**	**4,241**	**3,989**	**11,113**

The classification is based on the Industry Classification Benchmark taxonomy issued by FTSE Russell (Vass 2019).

30 This is with reference to Figure 4.6 in Mazzi et al. (2019b).

31 We abstain from a direct comparison with respect to Consumer Discretionary since the Industry Classification Benchmark issued by FTSE Russell has changed since the publication of Mazzi et al. (2019b).

FIGURE 3.2: Graphical representation of the mean count of R&D-related terms by industry (High disclosure group)

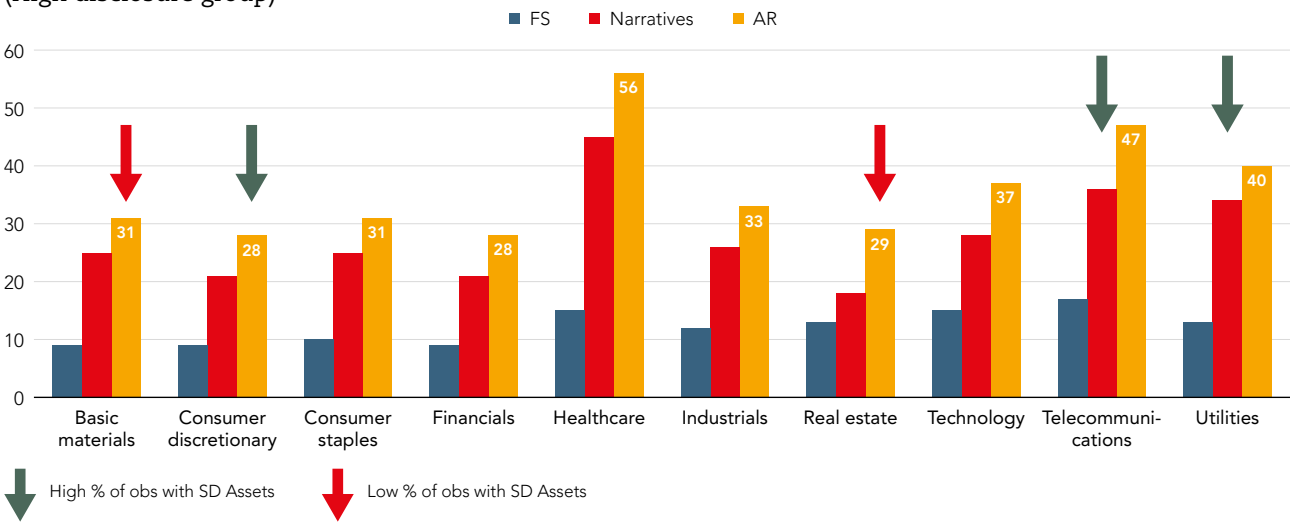


Table 3.6 lists the 30 most (least) frequently used R&D-related terms in the annual reports of those firm-year observations in the High disclosure group. The most frequent term identified is 'development cost' and other frequently mentioned terms include: 'regulatory approval'; 'generate future economic benefit'; 'intention to complete'; and 'research activity'. In fact, eight terms (ie 'research and development'; 'ability to use'; 'internally generated'; 'technical feasibility'; 'development phase'; 'prototype'; 'research phase'; 'ability to sell') are those mentioned frequently in IAS 38 and most of them in relation to the criteria to be considered for the capitalisation of development costs. Further, 12 terms (ie 'research and development'; 'internally generated'; 'r&d'; 'software development"; ability to use'; 'technical feasibility'; 'product development'; 'development phase'; 'new technology'; 'technology development'; 'clinical trial'; and 'research development') are also included by Mazzi et al. (2019b) in their 15 most frequently identified terms in the annual reports of R&D-active firms. High frequencies of these 30 R&D-related terms would indicate strongly that this sizeable proportion of the firms in our sample engage in R&D activities even though the related amounts are not reported separately as an R&D expense and/or asset in their financial statements.

Taken together, these findings provide a clearer picture and indicate that for R&D-related disclosures, despite the variations across countries and industries, approximately the top one-third of the firm-year observations for R&D-inactive firms for which we found the annual report are very similar to those for R&D-active firms . In fact, the terms they use in their annual reports are those mentioned in IAS 38 and in particular those for the criteria for capitalising development costs. Although the remaining firms use the R&D-related terms in our list, they are often describing a different context that is unrelated to R&D.

TABLE 3.6: Most and least popular R&D terms identified in R&D-inactive firms' annual reports (High disclosure group)

MOST COMMON R&D-RELATED TERMS	TOTAL COUNT	LEAST COMMON R&D-RELATED TERMS	TOTAL COUNT
development_cost	12,338	announced_a_collaboration	0
*research_and_development***	4,629	applications_pending	0
innovation	4,311	generate_future_cashflow	0
patent	3,852	applied_for_patent	0
*internally_generated***	2,467	awarded_patent	0
*r_d***	2,466	basic_research	0
*software_development***	2,165	claims_in_these_patents	0
innovative	1,916	claims_in_this_patent	0
*ability_to_use***	1,878	clinical_candidate	0
*technical_feasibility***	1,142	commercial_resource	0
*product_development***	1,059	completion_of_key_milestone	0
*development_phase***	615	design_of_jig	0
*new_technolog***	528	design_of_mould	0
regulatory_approval	508	design_of_tool	0
generate_future_economic_benefit	466	development_of_new_process	0
intention_to_complete	453	development_of_proprietary_techn	0
*technology_development***	423	entering_development	0
new_project	410	established_a_collaboration	0
*clinical_trial***	388	established_collaborations	0
research_activity	388	existence_of_markets	0
prototype	177	experimental_phase	0
research_phase	161	experimental_stud	0
pilot_plant	153	generate_future_value	0
research_project	129	important_patent	0
*research_development***	126	in_process_development	0
invention	113	issued_a_patent	0
intellectual_capital	110	joint_venture_to_develop	0
patent_right	96	key_patent	0
ability_to_sell	85	patent_was_awarded	0
clinical_research	77	patents_awarded	0

Terms in red are those mentioned frequently in IAS 38, most of them in relation to the criteria to be considered for the capitalisation of development costs.
Terms in *italics*** are also included in the top 15 most frequently identified terms in the annual reports of R&D-active firms in Mazzi et al. (2019b).

3.4 Characteristics of below- and above-average disclosers

Table 3.7 provides descriptive statistics for the variables included in the multivariate analyses of this Phase of the project. These are shown separately for the firm-year observations including R&D-related terms in narratives with frequency above the mean count across our full sample and those with counts of R&D-related terms below the mean.[32] Table 3.8 presents the results of the multivariate probit analysis following the model in Equation 3.1. The three models employed for each type of report (narratives, financial statements and the annual report as a whole) vary in the use of the country-level variables separately. As the results on bivariate analysis and descriptive statistics do not control for other potential concurrent influences of the relationships between the variables of interest, we discuss the characteristics that are statistically significant and consistent in their sign in both the univariate and multivariate analysis.

The results show that above-average-disclosure firms are larger in market capitalisation (*Size*) and have lower book to market ratios (*BM*), than below-average-disclosure firms, suggesting that they have more growth opportunities. However, this result is primarily driven by disclosures in the narratives. Additionally, above-average-disclosure firms are perceived as risker by investors (ie have higher *BETA*), have lower tangible assets (*TANGIBILITY*), are more likely to report other intangible assets separately on their balance sheet (*OTHERINTA*) and capitalise greater amounts of SD assets (*SDASSET*). Hence, above-average-disclosure firms are more intangible-intensive firms. Less-liquid firms (*LIQUIDITY*) are more likely to disclose more on R&D and more likely to employ a Big Four auditor (*Big4AR*). Further, above-average-disclosure firms are those that are less closely held (*CLOSELYHELD%*) where more shareholders are more likely to rely on financial reporting for information.

For country-level variables, we find that firms from countries with higher country-level R&D expenditure relative to GDP (RDGDP) are more likely to disclose more about R&D. Perhaps this is not surprising, as these firms operate in countries where R&D expenditure is a significant proportion of GDP. Such an environment is conducive to engagement with and discussion about R&D activities.

TABLE 3.7: Characteristics of firms classified as above and below average disclosers (based on the frequencies in narratives)

	BELOW AVERAGE DISCLOSERS 9,672				ABOVE AVERAGE DISCLOSERS 3,320				TEST OF DIFFERENCES			
VARIABLES	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean diff	t-stat	Median diff	z-stat
ROA	–0.021	0.034	–2.187	0.578	0.039	0.061	–2.187	0.578	–0.060	10.964	–0.027	16.758
BM	1.278	0.833	0.029	8.653	0.905	0.592	0.029	8.653	0.374	14.883	0.241	16.508
Size	14.716	14.394	6.238	36.348	16.529	15.814	6.588	36.278	–1.813	22.168	–1.420	21.482
BETA	0.878	0.820	–1.430	3.642	0.972	0.905	–1.430	3.642	–0.095	6.086	–0.085	6.933
LEV	0.793	0.307	0.000	11.242	1.028	0.517	0.000	11.242	–0.234	7.490	–0.210	15.431
Big4AR	0.373	0.000	0.000	1.000	0.589	1.000	0.000	1.000	–0.216	22.120	–1.000	21.716
CAPEX	0.055	0.019	0.000	0.711	0.048	0.027	0.000	0.711	0.007	3.750	–0.008	8.858
TANGIBILITY	0.441	0.454	0.001	0.950	0.381	0.377	0.001	0.950	0.061	11.011	0.077	10.538
AGE	18.528	16.000	1.000	70.000	19.750	18.000	1.000	70.000	–1.222	4.980	–2.000	3.827
CLOSELYHELD%	55.325	60.740	0.000	95.980	47.591	53.115	0.000	95.980	7.734	15.149	7.625	14.355
STRAOWN%	2.583	0.000	0.000	36.000	4.188	0.000	0.000	36.000	–1.605	11.551	0.000	14.470
LIQUIDITY	3.264	1.693	0.198	32.779	2.132	1.440	0.198	32.779	1.131	13.265	0.253	11.680
GOODWILL	0.038	0.000	0.000	0.534	0.094	0.017	0.000	0.534	–0.056	25.162	–0.017	34.207
MATBC	0.054	0.000	0.000	1.000	0.116	0.000	0.000	1.000	–0.061	11.975	0.000	11.910
SDASSET	0.001	0.000	0.000	0.044	0.003	0.000	0.000	0.044	–0.002	20.156	0.000	26.132
SDCAPD	0.158	0.000	0.000	1.000	0.365	0.000	0.000	1.000	–0.207	25.843	0.000	25.205
INTSALES%	16.862	0.000	0.000	100.000	28.573	3.820	0.000	100.000	–11.711	17.484	–3.820	23.334
OTHERINT	0.603	1.000	0.000	1.000	0.883	1.000	0.000	1.000	–0.279	30.712	0.000	29.655
RDGDP	1.264	1.040	0.254	5.007	1.443	1.277	0.144	5.007	–0.179	13.424	–0.237	8.845
AntidirectorIndex	4.598	5.000	1.000	5.000	4.329	5.000	1.000	5.000	0.269	18.480	0.000	15.056
CPI	63.827	76.000	28.000	88.000	62.951	73.000	28.000	88.000	0.877	2.478	3.000	1.223
AudEnf2008	40.570	47.000	9.000	54.000	39.168	42.000	9.000	54.000	1.402	5.143	5.000	4.957
Secrecy	49.542	69.000	–33.000	140.000	49.507	69.000	–33.000	140.000	0.035	0.039	0.000	0.396

32 Our inferences remain unchanged when we look at the financial statements alone or the annual report as a whole instead of the narratives alone.

TABLE 3.8: Determinants of the likelihood of firms to be above average disclosers

	FINANCIAL STATEMENTS			NARRATIVES			ANNUAL REPORT		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ROA	0.019	0.022	0.011	0.036	0.043	0.028	–0.094	–0.091	–0.119*
	(0.39)	(0.43)	(0.21)	(0.49)	(0.58)	(0.38)	(–1.48)	(–1.41)	(–1.84)
BM	–0.021	–0.004	–0.008	–0.054***	–0.041**	–0.043***	–0.055***	–0.033**	–0.038**
	(–1.49)	(–0.31)	(–0.52)	(–3.31)	(–2.53)	(–2.60)	(–3.63)	(–2.17)	(–2.45)
Size	–0.022***	–0.003	0.000	0.074***	0.088***	0.091***	0.038***	0.064***	0.067***
	(–3.82)	(–0.44)	(0.05)	(13.42)	(13.31)	(13.33)	(6.74)	(9.33)	(9.60)
BETA	0.064***	0.056***	0.050**	0.077***	0.069***	0.063***	0.085***	0.071***	0.064***
	(3.30)	(2.87)	(2.53)	(3.64)	(3.26)	(2.98)	(4.10)	(3.44)	(3.09)
LEV	0.012	0.016	0.020**	0.015	0.017	0.017	–0.002	0.003	0.003
	(1.20)	(1.57)	(1.97)	(1.37)	(1.61)	(1.56)	(–0.17)	(0.33)	(0.27)
Big4AR	0.180***	0.144***	0.120***	0.359***	0.329***	0.311***	0.342***	0.294***	0.261***
	(4.66)	(3.66)	(3.00)	(8.94)	(8.07)	(7.55)	(8.66)	(7.30)	(6.40)
CAPEX	–0.057	–0.100	–0.056	0.213	0.160	0.203	0.069	–0.009	0.062
	(–0.39)	(–0.67)	(–0.37)	(1.12)	(0.83)	(1.06)	(0.39)	(–0.05)	(0.34)
TANGIBILITY	–0.268***	–0.265***	–0.255***	–0.434***	–0.423***	–0.418***	–0.422***	–0.412***	–0.397***
	(–3.85)	(–3.80)	(–3.62)	(–5.54)	(–5.39)	(–5.29)	(–5.53)	(–5.38)	(–5.14)
AGE	0.063***	0.065***	0.069***	0.017	0.018	0.020	0.032	0.031	0.036*
	(3.24)	(3.35)	(3.52)	(0.83)	(0.84)	(0.96)	(1.55)	(1.53)	(1.73)
CLOSELYHELD%	–0.001	–0.000	–0.001	–0.005***	–0.004***	–0.005***	–0.003***	–0.002**	–0.003***
	(–1.31)	(–0.14)	(–0.88)	(–5.64)	(–4.89)	(–5.54)	(–3.65)	(–2.42)	(–3.61)
STRAOWN%	–0.001	–0.001	0.001	–0.003	–0.003	–0.002	–0.004	–0.003	–0.001
	(–0.35)	(–0.35)	(0.34)	(–1.23)	(–1.19)	(–0.77)	(–1.36)	(–1.29)	(–0.43)
LIQUIDITY	–0.015***	–0.017***	–0.016***	–0.016***	–0.017***	–0.017***	–0.017***	–0.019***	–0.020***
	(–4.03)	(–4.44)	(–4.39)	(–3.00)	(–3.15)	(–3.18)	(–3.52)	(–3.91)	(–3.94)
GOODWILL	0.026	–0.024	–0.015	0.490***	0.429**	0.454**	0.305*	0.209	0.254
	(0.14)	(–0.13)	(–0.08)	(2.75)	(2.40)	(2.52)	(1.74)	(1.17)	(1.41)
MATBC	0.002	–0.008	0.005	–0.097*	–0.098*	–0.091	–0.052	–0.058	–0.047
	(0.04)	(–0.15)	(0.10)	(–1.67)	(–1.69)	(–1.56)	(–0.93)	(–1.03)	(–0.83)
SDASSET	17.302***	16.326***	18.378***	17.304***	16.612***	16.427***	21.787***	20.674***	21.092***
	(5.34)	(4.96)	(5.69)	(5.50)	(5.29)	(5.17)	(6.77)	(6.43)	(6.48)
SDCAPD	0.034	0.037	0.052	0.074	0.078*	0.097**	0.025	0.030	0.056
	(0.72)	(0.77)	(1.08)	(1.59)	(1.67)	(2.05)	(0.53)	(0.63)	(1.16)
INTSALES%	0.002***	0.002***	0.001**	0.004***	0.004***	0.003***	0.004***	0.003***	0.003***
	(3.83)	(3.09)	(2.16)	(7.28)	(6.65)	(6.00)	(7.01)	(6.00)	(4.92)
SWITCH	0.776***	0.770***	0.777***	0.528***	0.530***	0.535***	0.672***	0.673***	0.680***
	(13.41)	(13.29)	(13.33)	(7.98)	(8.02)	(8.08)	(10.50)	(10.51)	(10.59)
OTHERINT	0.320***	0.333***	0.330***	0.449***	0.458***	0.458***	0.444***	0.461***	0.461***
	(7.55)	(7.86)	(7.76)	(9.93)	(10.16)	(10.11)	(10.05)	(10.48)	(10.45)
RDGDP	0.390***	0.503***	0.566***	0.375***	0.468***	0.516***	0.431***	0.593***	0.669***
	(8.17)	(8.61)	(8.78)	(7.68)	(8.14)	(8.47)	(8.67)	(9.77)	(10.25)
AntidirectorIndex	–0.066**	–0.056*	–0.042	–0.072**	–0.062*	–0.044	–0.104***	–0.085***	–0.061*
	(–2.32)	(–1.82)	(–1.32)	(–2.39)	(–1.90)	(–1.34)	(–3.51)	(–2.60)	(–1.84)
CPI	–0.011***	–0.021***	–0.020***	–0.012***	–0.020***	–0.019***	–0.015***	–0.029***	–0.026***
	(–6.25)	(–8.04)	(–7.25)	(–6.99)	(–7.83)	(–7.20)	(–8.66)	(–10.51)	(–9.46)
AudEnf2008		0.018***	0.020***		0.013***	0.015***		0.022***	0.024***
		(6.09)	(6.64)		(4.45)	(4.83)		(7.18)	(7.70)
Secrecy			0.002***			0.002***			0.003***
			(3.77)			(2.63)			(4.80)
Constant	–0.266	–0.888***	–1.323***	–1.819***	–2.262***	–2.585***	–0.946***	–1.730***	–2.271***
	(–1.17)	(–3.41)	(–4.58)	(–7.35)	(–8.00)	(–8.64)	(–3.88)	(–6.15)	(–7.61)
Observations	14,193	14,156	14,078	12,992	12,956	12,881	12,890	12,854	12,791
chi2	936.2	943.7	944.7	1398	1422	1389	1356	1383	1373

Note: The table presents the results of a Probit regression examining the likelihood of firm-year observations being from reports of 'above average disclosers' ie the frequency of disclosure is above the mean count of R&D-related terms across our full sample in each of the three types of documents and vice versa. All variables are defined in Appendix 2. Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

3.5. Extracts from firms' reports

To enable a better understanding of the complexity around firms' R&D-related disclosures and variation in reporting practices, in this section, we provide extracts of indicative examples from firm-year observations in our sample. The first type of example is from firms with numerous disclosures about R&D in their entire annual report and hence signal significant R&D activities to users of the report, although these disclosures are not matched by the separate reporting of an expense or asset in the financial statements. The second type of example relates to typical boilerplate disclosures that replicate the wording of the standard within the accounting policies note, although there is neither further discussion of R&D in the annual report nor a separately reported related amount in the financial statements. The third type of example involves discussions in the annual report containing terms from our list of R&D-related terms but where these terms do not relate to R&D or signify R&D activity and investment.

TYPE 1:

Examples from firms with numerous disclosures about R&D in their annual report and hence signal significant R&D activities to users of the report, although these are not matched by the separate reporting of an expense or asset in the financial statements.

Extract from MFE (2018), Italy

P2: In the light of the good results of the 2018 financial year, the AEFFE Group continues its commitment in terms of research, creativity and high quality manufacturing…

P60: As of 31 December 2018, the Group's tax receivables amount to EUR 7,760 thousand. The variation of EUR 2,349 thousand compared with the value at 31 December 2017 is mainly due to the increase of VAT receivable and to the recognition of the tax credit in the subsidiary Moschino Spa for incremental investments made in research and development activities.

P72: Labour costs. Labour costs increase by EUR 3,126 thousand from EUR 65,377 thousand in 2017 to EUR 68,503 thousand in 2018, recording an incidence on revenues which changes from 20.9% in 2017 to 19.8% in 2018. In 2018 the Group invested mainly in Research and Development, in commercial and communication/ marketing departments.

P93: Research and Development Group Chapter 6, Other Material Topics

P110: One of the Group's key strengths is the creative independence of each fashion house: research and experimenting are an essential feature of the each stylist's mindset. These activities take place on an ongoing basis in the Group, enabling a constant renewal that aims to capture and anticipate the markets latent desires and latest trends. The creative development of each product is carried out by the stylist and the styling office, which devise each collection based on their intuition and experience, supported by the information about market trends identified by internal functions within the Group. All products, whether garments or footwear, carry a label containing information about the composition of the fabrics used and the washing instructions to be followed by the end consumer in order to look after the product properly, as well as the 'Made in' information.

P126: 14. INFORMATION PURSUANT TO ART.1, PARAGRAPH 125, THIRD PERIOD, L.124/2017. With regard to the regulations on the transparency of public disbursements, the disclosure is provided regarding 'subsidies, contributions, paid offices and in any case economic benefits of any kind received'. Credit for R&D: 1,122,827.

P23: 4. RESEARCH & DEVELOPMENT ACTIVITIES. Considering the particular nature of the Group's products, research & development activities consist in the continual technical/stylistic renewal of models and the constant improvement of the materials employed in production. These costs were charged in full to the Income Statement.

Extract from Wilmar (2020), Singapore

P11: Led by more than 300 scientists and researchers in China, our research and development work focuses on creating high quality, nutritional and innovative food products. YKA will work on expanding its product portfolio with high-quality and functional food products, supported by extensive research and development (R&D) in creating innovative products to stay ahead of consumers' changing preferences and intense competition in the food industry. We are also focusing our R&D on developing functional foods that are health-enhancing. An example is designer cooking oils for elderly patients and those with metabolic diseases. We will also expand our R&D Center in Shanghai as we believe China will become not only the biggest but also the most sophisticated food market in the world due to its huge population and the diversity of Chinese cuisine.

P20: Outlook and Strategy. We will continue to leverage our existing distribution networks, brands and research and development capabilities to create new products to widen our range of food staples. We are also developing superior quality products with higher margin to improve our profitability.

P23: Wilmar's research and development (R&D) activities support our business operations by improving manufacturing processes, ensuring the consistency and enhancing the quality of existing products as well as developing new innovative products. Our R&D work is carried out by around 600 scientists and researchers in various locations worldwide, including Singapore, China, Indonesia, India, Malaysia, Russia, Australia

and New Zealand. In line with the Group's integrated approach, our R&D teams engage in cross-border collaborations as well as with external organisations to share knowledge and resources to enhance the collective R&D effort. In 2020, as consumers around the world turned to healthier and better quality food products, our R&D teams focused their efforts in the following are:

P37: Innovating for the Future The expansion of our R&D centres globally is a testament to our commitment to innovation. Our R&D work is carried out worldwide and focuses on developing new products, enhancing the quality of existing products and optimising operational processes.

P108: Internally generated intangible assets, excluding capitalised development assets, are not capitalised and expenditure is reflected in the income statement in the period in which the expenditure is incurred.

Extract from ABT Advanced Braking Technology (2017), Australia

P4: The Board remains of the view that ABT is primarily an application engineering company, which has benefited from substantial foundation research and development into sealed and wet brake technology.

P32: Research and development. Expenditure during the research phase of a project is recognised as an expense when incurred. Development costs are capitalised only when technical feasibility studies identify that the project is expected to deliver future economic benefits and these benefits can be measured reliably. Development costs have a finite life and are amortised on a systematic basis based on the future economic benefits over the useful life of the project. An intangible asset arising from development (or from the development phase of an internal project) is recognised if, and only if, all of the following are demonstrated: • the technical feasibility of completing the intangible asset so that it will be available for use or sale; • the intention to complete the intangible asset and use or sell it; • the ability to use or sell the intangible asset; • how the intangible asset will generate probable future economic benefits; • the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset; and • the ability to measure reliably the expenditure attributed to the intangible asset during its development. Capitalised development costs will be amortised over their expected useful lives once commercial sales commence.

P48: SEGMENT REPORTING. The Consolidated Group's principal activities are research and development, commercialisation and manufacture of SIBS® and the new Terra Dura® braking systems, predominantly in Australia and via distribution arrangements to other countries. For management purposes, the Group is organised into one main operating segment. All of the Group's activities are interrelated and discrete financial information is reported to the Board (Chief Operating Decision Maker) as a single segment. The financial results from this segment are equivalent to the financial statements of the group.

P38: REVENUES FROM OTHER ACTIVITIES – R&D Tax Incentive 796

Extract from ORPEA (2021), France:

P8: established partnerships in France and in European countries with research centres, laboratories and learned societies whose work focuses on…

P10: the quality of the public/private partnerships developed by our teams in the field and the links our medical and paramedical teams have with various academic and research environments make ORPEA a recognised player in the European healthcare landscape.

P11: Preventing falls has been the focus of research and experimentation programmes in many countries. In France, a predictive tool assessing the risk of falls among elderly patients in institutions was developed in 2020 and 2021. In Spain, two projects were carried out by teams on the ground and presented at the ORPEA Excellence Awards 2021. Similarly, a project to reduce the number of falls was organised in Italy through a different approach including educational workshops.

P13: Participation in scientific research: 15 scientific articles published in renowned journals.

P16: created the International Research department, which has shaped its roadmap around the following three focuses: – prevention, – caring for the people the Group supports, – caring for employees; • supported 29 research projects in its various subsidiaries and promoted 79 papers in national and international conferences.

Extract from EIFAGE (2017), France

P180: the company's R&D teams are now conducting development projects to further reduce the temperature, and intend to begin trials this year with the aim of reporting to the market by the end of 2018.

P80: The first of these funds, Seed'Innov, provides assistance from the earliest stages of R&D and proof-of-concept activities, continuing to support projects through to commercial launch.

P91: our R&D teams are looking closely at the potential for replacing bituminous materials with plant-based substitutes.

P103: the Infrastructures division is involved in cutting-edge R&D programmes.

P172: Teams are also developing and deploying R&D solutions for reusing and upcycling materials at work sites.

Extract from WINSOME BREWERIES (2019), India

P8: Research & Development. Specific Areas in which R&D Carried out by the Company a. Quality Up gradation. b. Productivity enhancement. c. Quality Control Management. ii. Benefits Derived as Result of the above R&D: Increase in production. iii. Future plan of action: Cost efficiency in manufacturing operations through better methods and techniques of production. iv. Expenditure in R & D: Specific expenditure of recurring or capital nature is not involved

Extract from LATVIJAS GAZE (2019), Latvia

P4: In 2021 Latvijas Gāze focused on biomethene production project research and development with the aim to commence the production in coming years.

TYPE 2:

Typical boilerplate disclosures that replicate the wording of the standard within the accounting policies note, although there is no further discussion of R&D in the annual report or a separately reported related amount in the financial statements.

Extract from GL EVENTS (2019), France

P40: SUSTAINABLE PRODUCTS AND SERVICES: ADAPTING OUR OFFERINGS – PROPOSING ALTERNATIVES. — Research and development for new service offerings in close collaboration with the marketing and purchasing teams.

P126: E. RESEARCH AND DEVELOPMENT Please refer to the Non-Financial Statement, page 40.

P146: 2.5.2 Other intangible assets. Research and development expenditures as well as pre-opening and start-up costs not meeting the criteria of intangible assets under IAS 38 and, as such qualifying for capitalisation, are expensed.

Extract from BERGS TIMBER (2020), Sweden

P11: Business concept. Bergs owns and develops companies that produce and sell processed timber products to discerning customers in selected markets. This means that: • We own and develop companies in the wood processing industry • Our subsidiaries develop and produce processed wood products, with the customer's needs in focus.

P63: Intangible assets. Expenses for research aimed at obtaining new scientific or technological knowledge are recognised as expenses when they arise. Expenses for development, when the results of research or other knowledge is applied to obtain new or improved products or processes, are recognised as assets in the balance sheet if the product or process is technologically or commercially usable and the company has sufficient resources to complete development and subsequently use or sell the intangible asset. Currently, the company has no own developed intangible assets that are recognised as assets. The carrying amount includes expenses for material, direct expenses for salaries and indirect expenses that can be reasonably and consistently attributed to the asset. Other expenses for development are recognised in profit or loss as costs when they arise. Intangible assets also include goodwill, patents, licenses and software.

Extract from PHOSAGRO (2017), Russia

P166: (i) Research and development. Expenditure on research activities, undertaken with the prospect of gaining new scientific or technical knowledge and understanding, is recognised in the profit or loss as an expense as incurred. Expenditure on development activities, whereby research findings are applied to a plan or design for the production of new or substantially improved products and processes, is capitalised if the product or process is technically and commercially feasible and the Group has sufficient resources to complete development. The expenditure capitalised includes the cost of materials, direct labour and an appropriate proportion of overheads. Other development expenditure is recognised in the profit or loss as an expense as incurred. Capitalised development expenditure is stated at cost less accumulated amortisation and impairment losses.

(ii) Other intangible assets. Other intangible assets acquired by the Group are represented by Oracle software, which has finite useful life and is stated at cost less accumulated amortisation and impairment losses.

Extract from Peppermint Innovation Limited (2021), Australia

P21: The principal activities of the Group (the Company and its controlled entities) were the development and commercialisation of its mobile banking, payment and remittance platform.

P23-24: Research and development costs. Research costs are expensed as incurred. An intangible asset arising from development expenditure on an internal project is recognised only when the Group can demonstrate the technical feasibility of completing the intangible asset so that it will be available for use or sale, its intention to complete and its ability to use or sell the asset, how the asset will generate future economic benefits, the availability of resources to complete the development and the ability to measure reliably the expenditure attributable to the intangible asset during its development. Following the initial recognition of the development expenditure, the cost model is applied requiring the asset to be carried at cost less any accumulated amortisation and accumulated impairment losses. Any expenditure so capitalised is amortised over the period of expected benefit from the related project on a straight line basis. The carrying value of an intangible asset arising from development expenditure is tested for impairment annually when the asset is not yet available for use, or more frequently when an indication of impairment arises during the reporting period.

TYPE 3:

Discussions in the annual reports containing terms from our list of R&D-related terms but where these terms do not relate to R&D or signify R&D activity and investment.

Extract from First Property Group (2021) UK

P41: Inventories – land and buildings. Trading properties held for resale are stated at the lower of purchase cost, together with incidental costs of acquisition and any subsequent development costs, and net realisable value. The latter is assessed by the Group having regard to suitable valuations performed by external valuers.

Extract from VISTIN PHARMA (2020), Norway

P23: 2.8 Property, plant and equipment. Land, buildings and fixtures comprise mainly of the metformin production facility in Kragerø. The production facility is used in production of pharmaceutical products sold by Vistin Pharma. Other equipment is mainly made up of machines used in production, as well as office related equipment and vehicles. Property, plant and equipment is stated at historical cost, less depreciation and/or impairment losses, if any. Such cost includes expenditures that are directly attributable to the acquisition of the items. Costs accrued for major replacements and upgrades to equipment are added to cost if it is probable that the costs will generate future economic benefits and if the costs can be reliably measured, and assets replaced are retired.

Extract from BOOKER GROUP (2017), UK

P65: There are two main types of supplier rebates: a) Terms, which are generally annual agreements not always coterminous with the Group's year end), are signed by the Group and the supplier. Rebates are determined relative to volumes purchased or by other conditional arrangements as follows: • Volume based rebates include guaranteed and targeted income. Rebates are accrued based on the Group's purchasing volumes and the current agreement with the supplier. • Non-volume based rebates include marketing support, range promotion and product development. Amounts are recognised when the rebate is earned through the completion of any required obligations and confirmed by suppliers.

Extract from JOE HOLDING (2020), Malaysia

P56: Depreciation of Property, Plant and Equipment The estimates for the residual values, useful lives and related depreciation charges for the property, plant and equipment are based on commercial and production factors which could change significantly as a result of technical innovations and competitors' actions in response to the market conditions.

Extract from GRAND OCEAN ADVANCED RESOURCES COMPANY LIMITED (2020), Hong Kong

P19: Mr. Wang Yun Lung Aged 57, the financial director of Inner Mongolia Yuan Yuan Energy Group Jinyuanli Underground Mining Company Limited, the Group's indirect non-wholly owned subsidiary. Mr. Wang graduated from the Jilin Radio and TV University in the PRC in 1989 with major in financial accounting. Prior to joining the Group in August 2007, Mr. Wang served as financial controller in construction and technology development companies and has more than 25 years of experience in financial management.

Extract from NH HOTEL GR (2021), Spain

P110: The ability to use a larger brand umbrella in new geographical areas, that is to say, take the NH brands into Minor geographical areas and vice versa.

Extract from AKUMIN (2019), Canada

P15-16: Information security risks have significantly increased in recent years in part because of the proliferation of new technologies, the use of the internet and telecommunications technologies to conduct our operations, and the increased sophistication and activities of organized crime, hackers, terrorists and other external parties, including foreign state agents. Our operations rely on the secure processing, transmission and storage of confidential, proprietary and other information in our computer systems and networks.

4. Practical implications and recommendations

4.1 Practical implications

This research was motivated by two differing lines of reasoning expressed in the academic and practice-based literatures. At a general level, firstly, concerns regarding the potential lack of relevance of financial reporting, not fully reflecting the increased importance of intangible assets. More specifically around R&D, secondly, evidence in studies that report in their sample selection large proportions of firms that do not report separately R&D as an asset and/or expense. These issues raise the question as to whether there is a disclosure versus recognition gap that effectively understates the investment in R&D by companies and also impairs the usefulness of financial reporting to users.

Overall, like prior studies, we identify and then designate about half of the listed firms as R&D-inactive, owing to their non-reporting of R&D as an asset and/or expense separately. However, we bring into light the conundrum that a sizable proportion of these firms are also seemingly R&D-active, owing to their high levels of disclosure about R&D related activities. This is particularly noticeable in what we classify as the High disclosers group. This practice would ordinarily signal that R&D activities are important and material for these companies and their future prospects. Hence, users may perceive the importance of R&D to such companies and arguably would expect to see a separately reported R&D-related asset and/or expense in the financial statements.

These key findings from our analysis raise important implications for standard setters and national/regional policymakers, firms and users of the company annual reports which are now considered. These are followed by policy recommendations which are outlined in Section 4.2.

First, these findings provide insights to the current debates in global accounting and regulatory bodies in relation to intangibles. They feed into 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. They speak to EFRAG's *Better Information on Intangibles* (2021) Discussion Paper (DP). They will also be of interest to the Financial Accounting Standards Board (FASB), which is engaged in a research project that 'will consider potential ways to improve the accounting for and disclosure of intangibles, including internally developed intangibles and research and development' (FASB 2023) as well as the UK Endorsement Board, which also has an active research project on intangibles (UKEB 2023). While proposals and discussions in these papers and projects so far revolve around 'additional disclosures [that] could be considered to provide better information on intangibles' (EFRAG, 2021: 7, paragraph ES7),[33] more explicit reporting and greater linkage with the disclosures provided would appear to also be relevant to these discussions.

Second, these findings bring into light weaknesses in firms' reporting behaviour around R&D. In 1998, when IAS 38 was issued, intangible assets, and R&D specifically, were not as significant for economies and related future growth as they are now. Arguably, the definitions and guidance in the standard are no longer adequate to assist preparers and auditors in having a clear view as to the kinds of expenditures relevant to R&D, and how they should be measured and reported in the financial statements. Further, whilst accepting issues of financial materiality applied to asset/expense reporting, our findings raise questions about what is considered material and how firms apply materiality judgement for disclosure versus recognition especially due to the apparent disconnection between them. In fact, this reporting behaviour around R&D may also be perceived as a red flag for the quality of reporting more widely. Importantly, these implications are not only relevant to the accountants in a company but also to those charged with governance (ie directors more generally). The board members must have expertise to discharge their stewardship responsibilities, including supervising management in producing high-quality corporate reports for users. This requires appropriate application of materiality for disclosures. Further, the board must review the relevance of disclosures and avoid redundant or excessive boilerplate disclosures.

Third, the findings suggest that, for a sizable proportion of firms, users of their financial statements are receiving mixed signals about the importance of R&D activities and ambiguity about the related level of investment. This is particularly important given recent evidence that investors, as users, while not being overly concerned as to the current accounting for R&D under IAS 38 (between expense vs. capitalisation) pay careful attention to the overall cash spend on R&D by a company as recognised and reported in its financial statements (Mazzi et al., 2022).

33 See also the IASB's staff paper and stakeholders' response to the IASB's agenda consultation (IASB 2022).

Thus, whilst accepting materiality, nonetheless where there is no R&D asset and/or expense shown in the annual report, users may, in comparison to other firms in the same industry with a reported R&D asset and/or expense, re-evaluate their opinion regarding future earnings and value. This supports the argument that they face difficulty in identifying the future drivers of value and the criticisms regarding the potential lack of relevance of financial reporting in relation to intangibles.

Finally, our findings also raise implications for official statistics concerning R&D due their reliance on companies' financial statements and related databases as to the actual level of R&D investment in the national economy. This may understate the real value of R&D and also the national R&D environment that is conducive towards attracting inward investment, the development of blue sky thinking and leading innovation and change.

4.2 Recommendations

4.2.1 Recommendations for standard setters and policymakers

First, there is the following guidance and examples of what constitutes research within IAS 38, namely:

a) activities aimed at obtaining new knowledge

b) the search for, evaluation and final selection of, applications of research findings or other knowledge

c) the search for alternatives for materials, devices, products, processes, systems or services, and

d) the formulation, design, evaluation and final selection of possible alternatives for new or improved materials, devices, products, processes, systems or services (IAS 38: para. 56).

This guidance is generic and does not include any requirement for disclosure beyond where such expenditure, if material, is to be separately disclosed. To address the issue of definitional vagueness, the IASB could start by revisiting the definition of 'research and development' and related terminology in IAS 38. To achieve this objective, the revised IAS 38 could include illustrative guidance with examples for applying the definition, the measurement requirements and reporting. This would better enable preparers and auditors to have a clearer view of the kinds of expenditures relevant to R&D and how they should be measured and reported in the financial statements. This should facilitate a change of reporting behaviour by preparers in relation to R&D reporting in the financial statements and its connectedness to separate disclosure of related information.

Further, the IASB could take many steps for introducing more, and more informative, disclosure requirements in IAS 38.[34] One step could be for the IASB to use the recently outlined improved approach for developing disclosure requirements (IASB 2023). The disclosure requirements of an accounting standard that will be drafted in accordance with this guidance will typically comprise three main components:

a) an overall disclosure objective that describes the overall information needs of users of financial statements

b) specific disclosure objectives that describe the detailed information needs of users, and

c) a description of the items of information that satisfy the specific disclosure objectives.

In relation to (b), information about a company's R&D will be useful to users of financial statements if it assists them in understanding how the R&D project will be linked to the company's business model. Useful information could include:

1. the part of the company (or segment in a group) that is conducting R&D, or the part of the company (or segment in a group) for which it is being conducted, and

2. a link to financial impact on the financial performance, financial position and/or cashflows (ie present expenditure as well as expected future economic benefits).

In fact, this process could be supported by revisiting the farsighted recommendations in the preamble to IAS 9 (effective from 1980; ie issued well before IAS 38), which stated that R&D-related disclosure 'enables the users of financial statements to consider the significance of such activities in relation to those of other enterprises' (paragraph 13) and 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' (paragraph 14). There is no such disclosure requirement in IAS 38.

Further, the IASB could consider the current disclosure requirement, imposed by the local regulator in China, whereby 'both financial and nonfinancial R&D expenditures are reported, including the background, investment amount, and progress' (Huang et al. 2023: 6; and see details in China Securities Regulation Commission 2017: article 27c). This requirement indicates a spill-over effect on what is reported separately in the financial statements, given that almost 90% of the listed firms report an R&D expense and/or asset separately. Arguably, the proposition for such focused disclosures is in the same direction as the DTR in the UK, particularly DTR 4.1.11R, which requires listed firms to give an indication of 'activities in the field of research and development' in the management report (FCA 2023a: 54).

34 The IASB is considering moving in this direction. In a recent interview, the IASB chair, Dr Andreas Barckow, noted that one of the three avenues the IASB might consider in the medium term is 'developing potential disclosures to improve transparency regarding an entity's intellectual capital and intangibles' (Street and Gordon, 2023: 5).

Similar requirements exist in many other IFRS-reporting countries. Nonetheless, these requirements do not mandate the disclosure of specific financial information and, not surprisingly, they do not lead to a spill-over effect on what is shown separately in the financial statements (judging from the large proportion of R&D-inactive firms, which, however, do refer to R&D activities in the front end of their annual report). One plausible explanation for the lack of such a spill-over effect in the UK, and other countries that already have similar requirements to the DTR 4.1.11R., might be that the amounts involved may not be considered material and hence not worthy of separate reporting.

We recognise that 'whether information is material is a matter of judgement and depends on the facts involved and the circumstances of a specific entity' (IASB 2017: 5). We also recognise that the proposition for increased and more focused mandatory R&D-related reporting may lead, initially, to reporting separately potentially immaterial amounts. However, in the long-run, this should enable a change in disclosure behaviour by assisting firms to apply a materiality judgement that would result in a more balanced and more consistent disclosure between what is discussed in the front-end and what is reported separately in the back-end, avoiding overload of immaterial information and related amounts.

4.2.2 Recommendations for preparers (firms) and auditors

Following on from the above, preparers of annual reports (ie accountants and board members) should more fully link front and back ends of annual reports by combining the qualitative materiality signalling in the front end with the back end and thus having a better balance between separately reported amounts and related disclosure information. Some of the examples we report highlight a volume of detailed R&D-related disclosure but no matching R&D expense/asset.

Further, assisted also by additional guidance from the IASB (see above), the accounting policies note specifically need to more closely reflect the IASB's guidance on the application of the materiality concept. For example, accounting policies need to refer to recognition of material expense/asset in the financial statements. Hence, one would not expect an accounting policy note on areas that are not applicable to a particular company (eg derivatives or foreign currency management for a firm that had no need of these). In practice, we found examples of accounting policy notes relating to R&D where there was both no separate reporting of expense/asset and, often, very little R&D-related disclosure in the narratives.

Other actions that preparers could take include the following:

- particularly in firms with a high volume of R&D-related disclosures, preparers are encouraged to engage with other parts of the business to identify activities that should be more appropriately classified and accounted for as a research or development asset or expense.
- preparers are encouraged to participate in standard setters' research project(s) on intangible assets and respond to requests for information, discussion papers and exposure drafts. For example, providing information about activities that they consider to be research or development but that do not fit into the current definitions in IAS 38 will greatly inform the IASB in updating the definition, terminology and accounting requirements.
- preparers are encouraged to seize opportunities to discuss application challenges and potential solutions with standard setters or policymakers to influence the creation of application guidance to assist with accounting and reporting of R&D expenditure.

Auditors should review the annual report for consistency of front-end voluntary disclosure with back-end financial statements. This raises an issue where firms have included a high volume of R&D-related disclosure content in the front-end of the annual report, sometimes reporting it in great detail. These cases would reasonably raise an expectation by users for there to be an R&D-related expense and/or asset. Hence, there should be greater scrutiny of the absence of separately disclosed R&D expense/asset, depending on the detail and associated signalling in the narrative reporting.

Relatedly, greater auditor scrutiny may reduce instances where an accounting policy note on R&D is included, even though there is no separately reported expense in the income statement or capitalised development cost on the balance sheet and where there is Minimal/Low disclosure.

4.2.3 Recommendations for users

Given that users are key audience for corporate reporting, to overcome these implications, users and especially investors are encouraged to increase participation in outreach and in informing standard setters by responding to requests for information about what users need to know about R&D. This information will help standard setters and/or policymakers improve disclosure requirements in the standards and develop guidance to assist implementation by companies.

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Appendix 1

R&D-inactive firms & exclusion rate by country/location and industry

TABLE A1.1: R&D-inactive firms and exclusion rate by country/location

	R&D–'inactive						R&D–'active'	TOTAL 2017–2021	EXCLUSION RATE	COUNTRY MEAN R&D TO GDP (%)
COUNTRY	2017	2018	2019	2020	2021	TOTAL	TOTAL 2017–2021			
Australia	725	755	737	746	786	3,749	1,050	4,799	78.12%	1.85
Austria	15	13	11	11	8	58	95	153	37.91%	3.12
Belgium	36	30	28	26	20	140	180	320	43.75%	3.04
Brazil	122	114	115	128	124	603	155	758	79.55%	1.16
Canada	618	638	722	845	844	3,667	1,071	4,738	77.40%	1.66
Chile	104	107	104	93	83	491	46	537	91.43%	0.35
China (mainland)	369	333	311	286	241	1,540	11,838	13,378	11.51%	2.23
Croatia	48	47	39	38	35	207	8	215	96.28%	1.03
Czech Republic	6	5	5	5	0	21	8	29	72.41%	1.90
Denmark	40	39	40	41	39	199	146	345	57.68%	2.94
Finland	43	40	36	38	40	197	292	489	40.29%	2.80
France	192	173	164	155	119	803	783	1,586	50.63%	2.24
Germany	125	136	135	130	111	637	926	1,563	40.75%	3.12
Greece	86	83	74	78	37	358	131	489	73.21%	1.28
Hong Kong SAR	773	835	860	900	852	4,220	1,588	5,808	72.66%	0.90
Hungary	11	15	13	16	8	63	10	73	86.30%	1.48
India	1,306	1,313	1,250	1,230	1,233	6,332	2,149	8,481	74.66%	0.66
Indonesia	271	307	342	381	222	1,523	159	1,682	90.55%	0.25
Ireland	12	13	12	13	12	62	46	108	57.41%	1.22
Israel	136	139	142	144	113	674	331	1,005	67.06%	5.01
Italy	103	107	100	112	71	493	344	837	58.90%	1.45
Republic of Korea	262	248	264	267	264	1,305	7,965	9,270	14.08%	4.56
Latvia	8	5	5	4	3	25	27	52	48.08%	0.62
Luxembourg	6	6	6	6	5	29	5	34	85.29%	1.18
Malaysia	528	525	578	646	623	2,900	226	3,126	92.77%	1.04
Mexico	63	68	67	68	63	329	43	372	88.44%	0.31
Netherlands	42	37	37	39	29	184	143	327	56.27%	2.20
Norway	54	61	57	61	66	299	178	477	62.68%	2.14
Peru	35	38	38	39	22	172	31	203	84.73%	0.14
Philippines	9	14	14	16	17	70		70	100.00%	0.32

	R&D–'inactive						R&D–'active'	TOTAL 2017–2021	EXCLUSION RATE	COUNTRY MEAN R&D TO GDP (%)
COUNTRY	2017	2018	2019	2020	2021	TOTAL	TOTAL 2017–2021			
Poland	179	175	172	156	141	823	335	1,158	71.07%	1.24
Portugal	24	21	22	19	16	102	27	129	79.07%	1.42
Romania	24	27	28	31	27	137	10	147	93.20%	0.49
Russia	54	58	58	62	36	268	51	319	84.01%	1.06
Singapore	42	38	272	390	383	1,125	112	1,237	90.95%	1.87
South Africa	141	142	132	131	124	670	130	800	83.75%	0.69
Spain	59	56	51	47	38	251	174	425	59.06%	1.28
Sweden	119	123	128	147	146	663	742	1,405	47.19%	3.40
Turkey	122	124	119	123	122	610	498	1,108	55.05%	1.03
United Kingdom	490	491	456	448	401	2,286	1,449	3,735	61.20%	1.69
Total	**7,402**	**7,499**	**7,744**	**8,116**	**7,524**	**38,285**	**33,502**	**71,787**	**53.33%**	**2.00**

TABLE A1.2: R&D-inactive firms and exclusion rate by industry

PANEL A: INCLUDING CHINA (MAINLAND)

	R&D-'inactive'						R&D- 'active'	TOTAL 2017–2021	EXCLUSION RATE
INDUSTRY*	2017	2018	2019	2020	2021	TOTAL	TOTAL 2017–2021		
Basic Materials	1,545	1,549	1,604	1,707	1,654	8,059	5,128	13,187	61.11%
Consumer Discretionary	1,710	1,715	1,746	1,789	1,626	8,586	5,527	14,113	60.84%
Consumer Staples	631	643	661	682	618	3,235	2,244	5,479	59.04%
Financials	204	236	237	245	229	1,151	330	1,481	77.72%
Healthcare	270	280	320	335	308	1,513	4,472	5,985	25.28%
Industrials	1,677	1,694	1,765	1,880	1,737	8,753	8,202	16,955	51.62%
Real Estate	396	411	434	474	412	2,127	315	2,442	87.10%
Technology	451	453	470	493	473	2,340	5,197	7,537	31.05%
Telecommunications	222	221	217	227	208	1,095	1,340	2,435	44.97%
Utilities	296	297	290	284	259	1,426	747	2,173	65.62%

PANEL B: CHINA (MAINLAND) ONLY

	R&D-'inactive'						R&D- 'active'	TOTAL 2017–2021	EXCLUSION RATE
INDUSTRY*	2017	2018	2019	2020	2021	TOTAL	TOTAL 2017–2021		
Basic Materials	38	29	26	26	22	141	2,152	2,293	6.15%
Consumer Discretionary	95	97	94	87	75	448	1,912	2,360	18.98%
Consumer Staples	25	22	18	14	10	89	714	803	11.08%
Financials	2	1	0	0	0	3	19	22	13.64%
Healthcare	7	6	4	4	4	25	1,109	1,134	2.20%
Industrials	76	57	58	57	47	295	3,312	3,607	8.18%
Real Estate	77	73	71	65	55	341	216	557	61.22%
Technology	1	3	3	3	3	13	1,595	1,608	0.81%
Telecommunications	1	1	3	3	2	10	466	476	2.10%
Utilities	47	44	34	27	23	175	343	518	33.78%

*The classification is based on the Industry Classification Benchmark taxonomy issued by FTSE Russell (Vass 2019).

Appendix 2

Variable definitions

TABLE A2.1: Variables used and their definitions

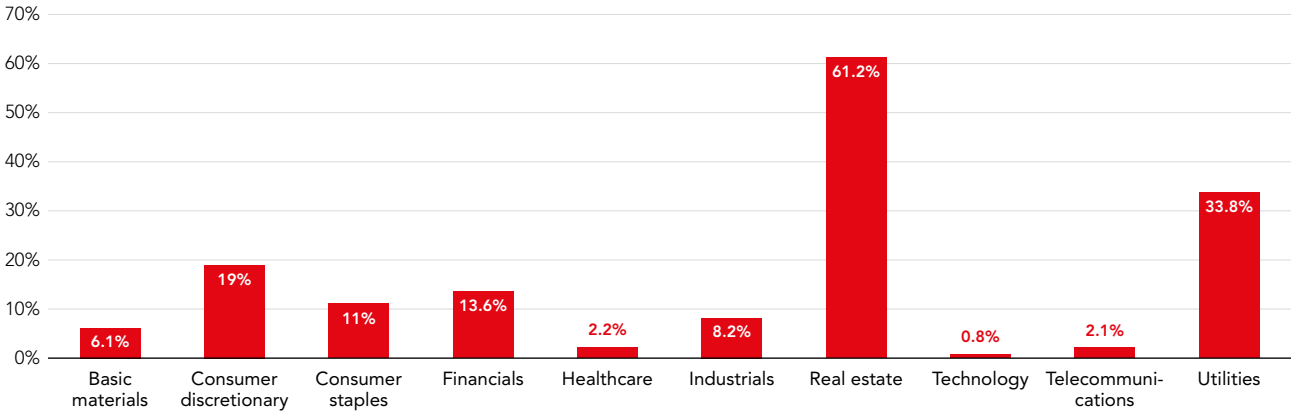
VARIABLE	DEFINITION	DATASTREAM CODE OR OTHER SOURCE
NonR&Dactive	Indicator variable that equals one if a company reports separately an amount relating to R&D expenses or amortisation of development costs or capitalisation of development assets in a given year. The capitalisation of development costs is defined as: Net development costs in year t minus Net development costs in t–1 plus Amortisation of R&D at time t.	R&D expense: WC01201 Net development costs: WC02504 Amortisation of R&D: WC01153
RDDISCLOSURE	Indicator variable that equals one if a firm's frequency of R&D-related disclosures is above the mean count of R&D-related terms across our full sample in each of the three documents, respectively, and zero (0) otherwise.	Self-constructed
ROA	Return on assets	Net income before extra items: WC01551 Total assets: WC02999
BM	Book to market ratio	Common equity: WC03501 Market Capitalisation: WC08001
Size	The natural logarithm of market values	Market Capitalisation: WC08001
BETA	Firm market beta	Datastream regression formula
LEV	Firm leverage measured as total debt to common equity	Total debt: WC03255 Common equity: WC03501
Big4AR	Indicator variable that equals one for firms audited by a Big Four auditor and zero otherwise	TR.BSAuditorCode
CAPEX	Capital expenditure	Capital Expenditure: WC04601 Market Capitalization: WC08001
TANGIBILITY	Tangibility measured at the sum of net property plant and equipment and inventories scaled by total assets	Property, plant and equipment (net): WC02501 Total inventories: WC02101 Total assets: WC02999
AGE	Firm age	Base date: BDATE
CLOSELYHELD%	The percentage of closely held shares	The % of closely held shares: WC08021
STRAOWN%	The percentage of shares owned by pension funds and institutional investors	The % of shares held by investment banks or institutions: NOSHIC The % of shares held by pension funds: NOSHPF
LIQUIDITY	Liquidity measured as the ratio of total current assets to total current liabilities	Current assets: WC02201 Current liabilities: WC03101
GOODWILL	The amount of net goodwill scaled by total assets	Goodwill: WC18280 Total assets: WC02999
MATBC	Indicator variable that equals one if firms have engaged into material business combination during the year (ie more than 5% of the book value of equity) and zero otherwise	Goodwill: WC18280 Amortisation of goodwill: WC18224 Common equity: WC03501

VARIABLE	DEFINITION	DATASTREAM CODE OR OTHER SOURCE
SDASSET	The amount of software development costs capitalised in the year scaled by the market value of the company	Net software development costs: WC18299 Amortisation of software: WC01157 Market Capitalisation: WC08001
SDCAPD	Indicator variable that equals one if firms capitalise software development costs during the year and zero otherwise	Net software development costs: WC18299 Amortisation of software: WC01157
INTSALES%	The % of foreign sales	IntSalesPerc: WC07101
SWITCH	Dummy variable that equals one if a firm changed from R&D-inactive to R&D-active and vice versa at least once during the sample period and zero otherwise.	Our sample. See section 2.1.2
OTHERINTA	Dummy variable that equals one if a firm reports other intangible assets on the balance sheet and zero otherwise.	Total intangible other assets net: WC02649
RDGDP	Mean country-level R&D expenditure to Gross Domestic Product (GDP) calculated over the sample period.	World Bank
AntidirectorIndex	Anti-director index as a measure of investor protection.	La Porta et al. (2008)
CPI	This is the Corruption Perceptions Index (CPI). The higher the CPI the less corrupt a country is perceived to be.	Transparency International
AudEnf2008	This is an index capturing the quality of audit function and degree of accounting enforcement in each country measured in 2008.	Brown et al. (2014)
Secrecy	The sum of uncertainty avoidance and power distance scores, less the individualism score.	Hofstede (1980)

Appendix 3

China (mainland) alone

FIGURE A3.1: % of R&D-inactive firms – 'exclusion rate' – by industry



The classification is based on the Industry Classification Benchmark taxonomy issued by FTSE Russell (Vass 2019).

TABLE A3.1: Characteristics of R&D-inactive vs active firms in China (mainland)

	R&D INACTIVE (1,540)				R&D ACTIVE (11,838)				TEST OF DIFFERENCES			
	Mean	Median	Min	Max	Mean	Median	Min	Max	Mean diff	t–stat	Median diff	z–stat
ROA	0.046	0.047	–0.543	0.578	0.059	0.056	–1.506	0.578	–0.012	4.725	–0.010	7.568
BM	0.651	0.561	0.029	8.340	0.466	0.399	0.029	5.757	0.185	20.051	0.162	14.312
Size	17.435	17.264	13.521	22.208	17.798	17.604	13.418	23.723	–0.362	13.134	–0.340	13.371
BETA	1.217	1.212	–1.430	3.642	1.246	1.221	–1.430	3.642	–0.029	2.070	–0.009	1.139
LEV	1.248	0.533	0.000	11.242	0.704	0.369	0.000	11.242	0.544	15.184	0.165	8.402
Big4AR	0.095	0.000	0.000	1.000	0.043	0.000	0.000	1.000	0.052	8.931	0.000	8.905
CAPEX	0.035	0.014	0.000	0.580	0.054	0.034	0.000	0.711	–0.019	11.387	–0.021	21.799
TANGIBILITY	0.438	0.461	0.001	0.950	0.374	0.368	0.001	0.930	0.063	12.302	0.093	10.868
AGE	19.374	21.000	1.000	36.000	12.106	10.000	1.000	38.000	7.268	35.435	11.000	31.321
CLOSELYHELD%	52.755	54.435	0.000	95.980	43.652	48.665	0.000	95.820	9.103	13.635	5.770	11.860
STRAOWN%	1.044	0.000	0.000	36.000	0.553	0.000	0.000	36.000	0.491	6.330	0.000	2.544
LIQUIDITY	2.176	1.423	0.198	27.521	2.195	1.608	0.198	32.779	–0.019	0.320	–0.185	8.870
GOODWILL	0.013	0.000	0.000	0.427	0.044	0.003	0.000	0.534	–0.031	13.980	–0.003	18.407
MATBC	0.029	0.000	0.000	1.000	0.061	0.000	0.000	1.000	–0.032	5.104	0.000	5.099
SDASSET	0.000	0.000	0.000	0.015	0.001	0.000	0.000	0.038	0.000	6.966	0.000	10.565
SDCAPD	0.613	1.000	0.000	1.000	0.714	1.000	0.000	1.000	–0.101	8.203	0.000	8.183
INTSALES%	6.763	0.000	0.000	100.000	15.546	3.880	0.000	100.000	–8.783	14.128	–3.880	31.701
OTHERINT	0.952	1.000	0.000	1.000	0.999	1.000	0.000	1.000	–0.047	21.286	0.000	20.935

TABLE A3.2: Multivariate analysis examining the likelihood of being classified as an R&D-inactive firm

VARIABLES	(1)	(4)
ROA	0.776**	1.078***
	(2.54)	(2.63)
BM	0.157	0.243**
	(1.55)	(1.96)
Size	–0.378***	–0.427***
	(–8.23)	(–6.90)
BETA	–0.064	–0.094
	(–1.01)	(–1.12)
LEV	0.042**	0.048**
	(2.15)	(2.04)
Big4AR	0.724***	0.843***
	(4.94)	(4.86)
CAPEX	–1.042*	–0.840
	(–1.83)	(–1.17)
TANGIBILITY	0.332*	0.586**
	(1.67)	(2.22)
AGE	0.455***	0.552***
	(7.74)	(6.77)
CLOSELYHELD%	0.008***	0.008***
	(4.65)	(3.76)
STRAOWN%	0.017*	0.019*
	(1.85)	(1.69)
LIQUIDITY	0.029**	0.033**
	(2.18)	(2.00)
GOODWILL	–2.374***	–2.711***
	(–3.55)	(–3.08)
MATBC	0.114	0.346***
	(1.09)	(2.91)
SDASSET	–98.762***	–144.316***
	(–3.38)	(–2.96)
SDCAPD	–0.118**	–0.072
	(–2.01)	(–0.99)
INTSALES%	–0.006***	–0.007***
	(–3.36)	(–2.90)
SWITCH	0.904***	
	(12.24)	
OTHERINT	–1.441***	–1.702***
	(–4.62)	(–4.33)
CPI	–0.161***	–0.083***
	(–12.28)	(–7.03)
Constant	11.605***	8.684***
	(10.11)	(6.08)
Observations	13,378	12,257
chi2	848.8	439.6

Note: The table presents the results of a Probit regression examining the likelihood of firms being R&D inactive using only firm-year observations from China (mainland). All variables are defined in Appendix 2. Robust z-statistics in parentheses. Given that the analysis includes only one country, time invariant variables measured at the country level (ie *RDGDP*, *AntidirectorIndex*, *AudEnf2008*, *Secrecy*) are excluded. *** p<0.01, ** p<0.05, * p<0.1

Appendix 4

List of R&D-related terms employed in this research

TABLE A4.1: R&D-related terms used

ability to sell	developing new product*	invention*	product development*	technical availability
ability to use	developing new technolog*	issued a patent	product engineering	technical development*
acquire patent*	development cost*	issued patents	projects in development	technical feasibility
announced a collaboration	development of new process*	joint research	prototype*	technological breakthrough*
application pending	development of new product*	joint venture to develop	R&D	technology acquisition*
applications pending	development of proprietary technolog*	key patent*	received a patent	technology breakthrough*
applied for patent*	development phase	new knowledge	received patents	technology development*
applied research	device development*	new medicin*	regulatory approval*	technology milestone*
availability of financial resource*	drug candidate*	new patent*	research activit*	test data
awarded patent*	drug development*	new project*	research and development	testing phase
basic research	entering development	new technolog*	research and evaluation project*	training activit*
breakthrough in	established a collaboration	obtain patent*	research and product development*	transformative medicin*
breakthrough innovation*	established collaborations	patent*	research center*	trial result*
claims in these patents	evaluating the potential of	patent expir*	research collaboration*	
claims in this patent	existence of a market	patent pending	research collaborative	
clinical candidate*	existence of markets	patent protection*	research development*	
clinical data	existing alliance*	patent registration*	research facilit*	
clinical development*	experimental phase*	patent right*	research finding*	
clinical program*	experimental stud*	patent strateg*	research initiative*	
clinical research	filed patent*	patent was awarded	research operation*	
clinical stud*	financial availability	patents awarded	research phase	
clinical trial*	generate future cashflow*	patents granted	research pipeline*	
collaborative initiative*	generate future economic benefit*	patents pending	research program*	
collaborative research	generate future value	patents received	research project*	
commercial resource*	granted a patent	pilot plant*	research unit*	
commercial success	granted patent*	pilot stud*	research venture*	
completion of key milestone*	important patent*	planned investigation*	research, development	
conduct research	innovation*	planned trial*	research, engineering, and development	
continuing development of	Innovative	platform development*	resource availability	
design of jig*	in-process development	possible alliance*	resources to demonstrate the economic value	
design of mould*	in-process research	preclinical data	safety stud*	
design of tool*	intellectual capital	preclinical development	scientific breakthrough*	
develop technolog*	intention to complete	process development*	service development*	
developing new process*	internally generated	product candidate*	software development*	

Appendix 5

R&D disclosure frequencies across country and industry

TABLE A5.1: R&D disclosure frequencies across country

	FINANCIAL STATEMENTS					NARRATIVES					ANNUAL REPORTS				
Country/Location	N	mean	median	min	max	N	mean	median	min	max	N	mean	median	min	max
Australia	1,442	6	4	1	87	1,302	7	3	1	133	1,657	11	7	1	220
Austria	25	8	4	1	35	26	26	16	4	100	26	34	28	5	112
Belgium	47	15	11	1	95	50	39	32	2	111	48	53	44	3	201
Brazil	87	7	4	1	52	49	12	6	1	76	52	13	8	1	81
Canada	1,346	4	2	1	110	822	9	5	1	598	863	13	8	1	606
Chile	13	5	4	1	12	16	50	31	5	183	14	50	30	7	195
China (mainland)	41	4	3	1	14	42	19	16	1	99	46	21	19	1	112
Croatia	4	5	1	1	17	5	18	11	5	37	5	22	11	6	46
Czech Republic	4	8	8	7	9	4	15	15	13	17	4	23	23	20	25
Denmark	50	5	5	1	13	62	10	8	1	34	64	14	11	1	40
Finland	82	10	6	1	46	83	18	7	1	151	84	27	15	2	168
France	179	11	6	1	141	178	52	37	1	373	175	63	47	1	402
Germany	156	8	6	1	50	170	17	12	1	151	171	23	18	1	200
Greece	41	3	1	1	13	59	11	6	1	85	58	14	7	1	97
Hong Kong SAR	1,465	4	2	1	96	1,769	8	4	1	388	1,951	10	5	1	399
Hungary	23	18	12	2	92	7	2	1	1	6	8	17	12	3	63
India	1,274	5	3	1	143	2,372	9	5	1	161	2,442	11	6	1	212
Indonesia	309	3	1	1	31	234	13	9	1	103	236	15	9	1	107
Ireland	34	7	3	1	40	33	13	5	2	49	38	17	8	1	89
Israel	12	7	5	1	18	9	28	26	10	53	11	30	30	1	71
Italy	133	11	7	1	92	130	21	13	1	204	133	31	21	1	226
Republic of Korea	1	7	7	7	7	0	.	.	.	.	0	.	.	.	.
Latvia	10	3	2	1	11	9	2	2	1	3	14	3	2	1	14
Luxembourg	16	4	4	2	9	13	12	7	1	32	17	13	9	2	36
Malaysia	1,109	9	3	1	108	1,227	9	5	1	129	1,334	16	9	1	166
Mexico	33	4	3	1	17	41	19	12	1	129	43	21	14	1	146
Netherlands	61	16	6	1	62	63	44	32	1	141	66	57	41	4	165
Norway	89	12	7	1	83	105	18	8	1	178	107	28	12	1	227
Peru	2	29	29	2	56	1	33	33	33	33	1	89	89	89	89
Philippines	16	9	8	1	27	10	6	4	1	20	13	12	11	1	29
Poland	54	5	3	1	18	60	14	6	1	100	63	16	9	1	105
Portugal	48	10	6	1	32	48	43	22	1	193	49	52	35	2	196
Romania	21	8	5	1	27	20	13	9	1	47	21	19	16	2	53
Russia	42	4	3	1	10	49	34	33	1	128	37	35	39	3	101
Singapore	411	4	2	1	44	416	6	4	1	64	494	9	5	1	70
South Africa	223	5	3	1	42	307	20	14	1	167	294	21	15	1	170
Spain	61	11	6	1	127	67	44	33	1	189	68	53	44	1	316
Sweden	181	7	5	1	46	212	25	14	1	166	214	31	18	1	202
Turkey	60	5	2	1	78	57	39	27	1	304	51	45	29	4	382
United Kingdom	849	6	3	1	69	986	13	7	1	132	1,057	17	10	1	151

TABLE A5.2: R&D disclosure frequencies across industry

INDUSTRY*	FINANCIAL STATEMENTS					NARRATIVES					ANNUAL REPORTS				
	N	mean	median	min	max	N	mean	median	min	max	N	mean	median	min	max
Basic Materials	2,470	4	3	1	108	2,092	8	4	1	151	2,453	11	6	1	220
Consumer Discretionary	1,982	4	2	1	53	2,496	10	5	1	183	2,678	12	7	1	195
Consumer Staples	702	5	3	1	93	886	12	6	1	178	963	14	8	1	227
Financials	284	5	3	1	54	268	9	4	1	95	304	11	6	1	102
Healthcare	462	9	4	1	83	525	25	9	1	598	540	32	14	1	606
Industrials	2,167	6	3	1	143	2,735	12	5	1	193	2,865	15	8	1	316
Real Estate	558	7	4	1	93	591	9	6	1	73	638	14	9	1	135
Technology	737	10	6	1	87	767	16	9	1	373	808	24	17	1	402
Telecommunication	340	11	5	1	96	374	20	9	1	304	394	27	13	1	382
Utilities	352	7	3	1	141	379	21	11	1	264	386	25	15	1	276

The classification is based on the Industry Classification Benchmark taxonomy issued by FTSE Russell (Vass 2019).

Appendix 6

Most and least popular R&D-related terms identified in R&D-inactive firms' narratives and/or financial statements

TABLE A6.1: Most and least common R&D-related terms

MOST COMMON R&D-RELATED TERMS	TOTAL COUNT	LEAST COMMON R&D-RELATED TERMS	TOTAL COUNT
Innovation	52,631	generate_future_cashflow	1
Innovative	26,827	design_of_tool	1
development_cost	18,294	development_of_proprietary_techn	1
*research_and_development***	15,190	entering_development	1
Patent	14,397	in_process_development	1
*r_d***	13,012	patents_awarded	1
*product_development***	7,237	received_a_patent	1
*new_technolog***	6,720	received_patents	1
new_project	5,383	awarded_patent	0
*ability_to_use***	4,585	claims_in_these_patents	0
*internally_generated***	4,487	claims_in_this_patent	0
*software_development***	3,846	design_of_jig	0
regulatory_approval	3,121	design_of_mould	0
*technical_feasibility***	3,055	experimental_stud	0
*clinical_trial***	2,235	issued_a_patent	0
*technology_development***	1,882	patent_was_awarded	0
intellectual_capital	1,735	patents_received	0
*development_phase***	1,462	research_and_evaluation_project	0
pilot_plant	1,208	research_collaborative	0
training_activit	1,068	research_venture	0
clinical_research	1,006	research__engineering__and_devel	0
Prototype	995	resources_to_demonstrate_the_eco	0
*research__development***	911		
research_project	853		
Invention	699		

Terms in red are those mentioned in IAS 38 frequently and most of them in relation to the criteria to be considered for the capitalisation of development costs.
Terms in *italics*** are also included in the top 15 most frequent terms identified in the annual reports of R&D-active firms in Mazzi et al. (2019b).

PI-INTANGIBLES-REPORTING-R&D

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