Capitalisation of R&D and the informativeness of stock prices: pre- and post-IFRS evidence

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ABSTRACT

We examine whether requiring (IFRS) versus allowing (UK GAAP) conditional capitalisation of development expenditure affects the extent to which capitalisation conveys more information about future earnings, relative to expensing. We show that capitalisation results in current returns incorporating more future earnings information than expensing under UK GAAP but not under IFRS. i.e., the amount of information incorporated into market prices of capitalisers is the same as that from firms expensing R&D under IFRS. This result holds irrespective of a firm's earnings management incentives or strength of corporate governance for the period under IFRS. We argue that this is because investors experience greater uncertainty regarding the realisation of future economic benefits associated with the development costs capitalised in the post-IFRS period. Consistent with this, we do find a positive association between capitalised R&D and future earnings variability in the post-IFRS period only, as well as short-term positive abnormal returns for capitalisers relative to expensers in the pre-IFRS period only. Overall, these findings suggest that when moving from a standard that offers an overt option to capitalise or expense, capitalisation comes with greater uncertainty, which is resolved only in the long term.

Keywords

Research and development, IFRS adoption, IAS 38, SSAP 13.

JEL classification:

O30, M41, M48.

1. Introduction

In this paper, we examine whether the stock market's ability to anticipate future earnings for UK companies that capitalise, relative to those that expense, development costs changes in the period after the implementation of International Financial Reporting Standards (IFRS).

Prior to the adoption of IFRS, UK firms had to comply with the Statement of Standard Accounting Practice (SSAP) 13 *Accounting for Research and Development* (R&D). SSAP 13 provided an overt option to capitalise or expense development costs expenditure (Nobes, 2013), where relevant criteria are met. Coopers and Lybrand, (1990) and Stark (2008) conjecture that SSAP 13 promoted expensing of development costs and empirical studies show that, indeed, the large majority of R&D active firms opted for the expensing option (e.g., Anagnostopoulou, 2010; Garcia Osma & Young, 2009; Nixon, 1997; Oswald, 2008; Zhao, 2002).

In contrast, following the mandatory adoption of IFRS, R&D reporting is governed by International Accounting Standard (IAS) 38 *Intangible Assets*. This also lists a number of asset recognition criteria regarding development costs. However, the standard explicitly urges firms to capitalise such costs when these criteria are fulfilled and, importantly, offers no overt option like that in SSAP 13 (c.f., Nobes, 2013) for firms that meet the criteria for capitalisation. Thus, the combination of the unavailability of an overt option to capitalise or expense development costs in IAS 38, compared to SSAP 13, and the different wording between SSAP 13 and IAS 38, whereby SSAP 13 basically was promoting the option for expensing, have resulted in a lower threshold for recognition in the IFRS era (Barker & McGeachin, 2015). This has been manifested by the increase in the frequency of the development costs capitalisation for UK firms (e.g., Tsoligkas and Tsalavoutas, 2011; Mazzi, Slack, Tsalavoutas & Tsoligkas, 2019b). This significant change in the reporting regime regarding development costs in the UK and the study by Oswald and Zarowin (2007) motivates the present research.

Oswald and Zarowin (2007) show that the option to capitalise development costs relative to expensing all R&D costs in the UK led to more informative stock prices. That is, current prices of firms capitalising R&D reflect more future earnings information relative to those which choose to expense. Because "conservatism finds consistency with the concept of reliability" (Barker & McGeachin, 2015, p. 182), the transition to IFRS would arguably lead to an impaired reliability of the amounts of development costs capitalised under IFRS (Hellman, 2008). In fact, Stark (2008) suggests that IAS 38, by removing the option to capitalise or expense development expenditure in the UK in particular, limits managers' ability to convey information. Therefore, it is an open question whether capitalisation relative to expensing of development costs continues to result in more informative stock prices after the adoption of IFRS in the UK – a question we address.

Considering that the benefits of current R&D activity are realised in the future and that capitalisation should signal probable future benefits, we employ the same research design as in Oswald and Zarowin (2007) and test the market response to *capitalisation relative to expensing* on the future earnings response coefficient (FERC), for both the pre- and post-IFRS periods. We effectively test whether capitalising, relative to expensing, continue "bringing the future forward" by revealing relevant news about future earnings (see Lundholm & Myers, 2002). In line with Stark (2008), we contend that, following the adoption of IFRS, investors would receive less reliable information. Investors would view the information conveyed by capitalisation of development costs about future earnings under IFRS with greater uncertainty, relative to the pre-IFRS period. Thus, we hypothesise that the relation between current returns and future earnings for firms that capitalise development costs, as compared to those expensing, would be weaker in the post-IFRS period relative to the pre-IFRS period.

Our sample comprises R&D-active firms listed in the UK during the period 1999-2013, which switched to IFRS on or after 2005. Our archival and manually extracted data show an

overall increase in the frequency of capitalisation between the pre- and post-IFRS periods and this increase occurs from the first year adopting IFRS. The significant difference in the propensity to capitalise development costs is reflective of a significant change in companies' accounting policies and underscores the importance of our research question.

The key finding of our empirical analysis is that, for the post-IFRS period, current returns of firms capitalising R&D no longer exhibit a stronger association with future earnings relative to those expensing R&D: the association for expensers is unchanged, while that for capitalisers is significantly reduced. Thus, the transition to IFRS does indeed affect "the mix of current versus future information that is reflected in the current stock return" (Lundholm & Myers, 2002, p. 810) and, importantly, capitalisation no longer improves the market's ability to anticipate future earnings performance.

In additional tests, first, we test whether lower incentives to manipulate earnings and stronger governance induces an increase in the reliability of the R&D asset, albeit only for the post-IFRS period due to data unavailability. We find that our results hold, independently of firms' strength of corporate governance and earnings management incentives. Second, we corroborate that, although R&D expenditure is indeed associated with uncertain future economic benefits across both periods, the increased frequency of capitalisation across the two periods is unlikely to be associated with a reduction in the uncertainty of R&D investment per se. Moreover, we find that capitalised development costs are associated with uncertain future benefits only in the post IFRS period, confirming their impaired reliability. Finally, capitalisers in the post-IFRS period exhibit greater abnormal returns relative to expensers, but only in the long run, whilst in the pre-IFRS period they over-perform expensers in both the short and long run. Overall, these results suggest that capitalisation of R&D under IFRS results in the recognition of assets with more uncertain future economic benefits compared to those recognised under the UK GAAP.

This study contributes to the literature in a number of ways. First, it is the first study to examine the effect of R&D reporting on the relationship between current returns and future earnings for the pre- and post-IFRS period. Prior literature has thus far examined the value relevance of R&D reporting by focusing on the contemporaneous relation between prices or returns and book values (e.g., Tsoligkas & Tsalavoutas, 2011; Shah, Liang, & Akbar, 2013). This line of research examines whether the actual amounts capitalised or expensed are related to price and returns i.e., are valued by the market. However, as Oswald and Zarowin (2007, p. 707) argue, these studies "…do not compare the effects of capitalisation vs. expensing" neither they examine whether or not capitalisation relative to expensing makes prices more informationally efficient. Second, we provide direct evidence that the findings of Oswald and Zarowin (2007), which is the only study showing that capitalisation relative to expensing prior to IFRS provides a signal about a firm's future profitability in the UK, cannot be extended into the post-IFRS period. Thus, future research should not uniformly assume that their findings still hold.

Our findings have important policy implications for the International Accounting Standards Board (IASB) and other regulators. They indicate that the transition from SSAP 13 to IAS 38 as regards accounting for R&D expenditure was a retrograde step. More specifically, considering that value relevance tests are joint tests of relevance and reliability (Barth et al., 2001), the decrease in reliability we document here, arguably, provides one explanation for the adverse effect in value relevance reported by Shah et al., (2013). Effectively, an accounting standard which promotes more prudence and the choice to expense R&D expenditure such as SSAP 13 appears to contribute to more informationally efficient prices than IAS 38. Given that more (less) informationally efficient prices facilitate more (less) efficient resource allocation (Durnev, Morck, Yeung, & Zarowin, 2003), this result shall be informative to the IASB which describes IFRS as standards "[which] contribute to economic efficiency … thus improving

capital allocation".[1] Effectively, we propose that, if IAS 38 was to be revised, the accounting treatment in SSAP 13 resulted in more informationally efficient equity prices. Such findings shall also be informative to the Financial Reporting Council (FRC) in the UK and the European Financial Reporting Advisory Group (EFRAG). Both have initiated projects to review the requirements for intangibles and propose further work in this area.[2] The Financial Accounting Standards Board in the US are also considering the usefulness of the R&D treatment by current accounting standards. Thus, the findings from this study should be of interest to them as well.[3]

The remainder of this paper is structured as follows. The next section describes the accounting for R&D before and after the adoption of IFRS in the UK. Section 3 discusses prior literature and develops our hypothesis. Section 4 discusses the research design, sample and data. Empirical results are presented and discussed in Section 5. Section 6 summarises additional and sensitivity tests. Section 7 draws concluding comments and elaborates the suggested policy implications, discusses limitations and sets out avenues for future research.

2. Accounting for R&D in the UK

From an accounting point of view, two reasons make the UK an ideal setting for this study. Following IFRS' mandatory adoption in 2005 (2007) for firms in the main (AIM) market in the UK, IAS 38 governs the reporting around R&D; SSAP 13 is no longer the relevant standard.

[1] https://www.ifrs.org/about-us/

[2] https://www.frc.org.uk/accountants/accounting-and-reporting-policy/research/intangibles-how-can-business-reporting-do-better and https://www.efrag.org/Activities/1809040410591417/EFRAG-research-project-on-better-information-on-intangibles respectively.

[3] https://www.fasb.org/cs/ContentServer?c=FASBContent_C&cid=1176175329473&d=&pagename=FASB%2FFASBContent_C%2FAdvisoryGroupsPage&rss=1

Both SSAP 13 and IAS 38 are very similar in that they require firms to write off research expenditure instantly[4] and the criteria for capitalising development costs are almost identical.[5]

However, even if the relevant criteria are met, SSAP 13 provides an overt option to capitalise or expense development costs (Nobes, 2013). Moreover, Paragraph 27 in SSAP 13 states: "Development expenditure **should be** written off in the year of expenditure except…when it **may be deferred** to future periods" (emphasis added). The functional significance of this wording seems to have promoted prudence by effectively prompting firms to expense R&D. Indeed, it has been generally perceived that the "tone of SSAP 13 … discourages capitalisation" (Coopers and Lybrand, 1990, p. 13) . In line with this, the majority of practitioners and senior financial officers of UK firms interviewed by Nixon (1997) and Ball, Thomas and McGrath (1991) respectively reported that chose not to capitalise development costs. Concerns about high uncertainty in R&D expenditure outcomes, prudence and fear of external judgements were the common justifications stated by interviewees. Archival studies also report that only a small proportion of UK firms opted for capitalisation (e.g., Anagnostopoulou, 2010, Garcia & Young, 2009; Oswald, 2008; Zhao, 2002). This background is captured by Stark's (2008, p. 277) statement that "overall, the history of the development of UK standards for the recognition and disclosure of R&D expenditure suggests that there was no enormous demand for any treatment other than immediate expensing. Certainly, there was no demand for any widespread capitalisation of research expenditures".

[4] This is in contrast to other jurisdictions including Australia, France, Italy and Portugal, which permitted the capitalisation of (certain) research costs only in the pre-IFRS regime. See in AASB 1011 in the Australian Generally Accepted Accounting Principles (GAAP) (Wyatt, 2005), Article 361-2 of Plan comptable général, 1999, in the French GAAP (Cazavan-Jeny, Jeanjean, & Joos, 2011), Principio Contabile n. 24 in the Italian GAAP (Markarian, Pozza, & Prencipe, 2008) and Directrizes Contabilísticas–DC 7 in the Portuguese GAAP (Oliveira, Rodrigues, & Craig, 2010) for the pre-IFRS periods.

[5] We present the capitalisation criteria as stated in Paragraph 25 of SSAP 13 and paragraph 57 of IAS 38 in the Supplemental Material (Table A) that is separately available on the Journal's' website. The similarity of the capitalisation criteria under SSAP 13 and IAS 38 is in contrast to other jurisdictions. For instance, the Australian and Portuguese GAAP have a single capitalisation criterion. French GAAP makes no reference to the availability of resources to complete the project (and, in contrast to UK GAAP, the amortisation period should not exceed five years). The capitalisation criteria under Italian GAAP do not explicitly refer to commercial viability.

Beyond not conveying an overt option like that in SSAP 13, Paragraph 57 of IAS 38 states that an "intangible asset arising from development (or from the development phase of an internal project) **shall be recognised** if, and only if, an entity can demonstrate" all of the capitalisation criteria (emphasis added). Thus, at least relative to SSAP 13, the combination of the lack of an option and the functional significance of the standard's wording convey a requirement to capitalise developments costs, when the criteria are met. So, "at least technically, the capitalisation of development costs is not considered a managerial choice'" (Mazzi et al. 2019b, p. 6). Similarly, Chen, Gavious and Lev (2017, p. 681) state that companies "do not self-select whether to capitalize or expense development costs; having met the criteria outlined by the standard, an IFRS firm is required to capitalise".

Indicative of the companies' own interpretation of IAS 38's wording regarding the requirement for conditional capitalisation and differences from SSAP 13 are the following quotes from the first IFRS accounts of two UK firms:

> "*IAS 38 also requires capitalisation of development costs incurred on an individual project if and only if specific criteria are met. Previously under UK GAAP this was an alternative treatment*" (Acambis Plc, 2005 Annual Report, p. 87)

> "*IAS 38 "Intangible assets" requires that development expenditure should be capitalised if relevant criteria are met and amortised over its useful economic life. Under UK GAAP all development expenditure was expensed as incurred.*" (600 Group Plc, 2006 Annual Report, p. 55)

Consequently, the propensity of capitalisation should be relatively higher under the IFRS regime in the UK. Indeed, Tsoligkas and Tsalavoutas (2011) report that 48% of their UK sample for 2006 – 2008 recognised an R&D asset under IFRS. Similarly, using a global sample of more than 20,000 observations of firms reporting under IFRS for 2006 – 2015, Mazzi et al. (2019b) find that almost 40% report an R&D asset, and that almost 50% of their sample of UK firms capitalise development costs.

The subjective nature of the capitalisation criteria gives rise to a covert option in capitalising development costs or not (Nobes, 2013).[6] Arguably, this could allow firms to continue reporting in a way similar to the pre-IFRS period (i.e. managers may continue their conservatism towards R&D reporting).[7] Nixon (1997, p. 272) notes that the strong preference of UK companies towards expensing "augurs badly for compliance in the UK with [a] requirement … that R&D *expenditure* should be capitalized if it meets certain criteria". In addition, auditors are unlikely to challenge such a conservative decision by management.[8] There are, however, several lines of reasoning that support the higher frequency of capitalisation in the post- relative to the pre-IFRS period.

First, the IAS 38 wording, absent of an option regarding capitalisation vs expensing, reduces the perceived reputational expected costs by capitalisation relating to riskier projects, given that management can defend capitalisation in conformity with the standard. Ding, Jeanjean and Stolowy (2013) illustrate this with reference to Renault's senior management claims that their capitalisation practices were compliant with rules and standards, and the subsequent periods write-offs are attributed to the 'rule' followed.[9] Second, the wording of IAS 38 creates an expectation to financial statements users that R&D expenditure meeting the capitalisation criteria will indeed be capitalised. Under IFRS, firms are expected to increase the visibility of their R&D activity and develop appropriate systems and processes to allow them

[6] "Covert options exist where no choice is explicitly offered but where the degree of judgement involved might allow scope for the preferences of the preparers of financial statements" (Nobes, 2013, p. 91).

[7] This is despite IFRS precluding managers from stating in the accounts the continuation or adoption of a policy to expense all R&D expenditure, irrespective of whether or not it meets the criteria.

[8] Auditors are likely to defer capitalisation to management since they tend to have less knowledge about R&D activities (Cheng, Lu, & Kuo, 2016). Even in the case of aggressive reporting, Hackenbrack and Nelson (1996) and Kadous, Kennedy and Peecher (2003) show that ambiguity in standards tends to allow auditors to support client-preferred accounting methods.

[9] The concept of 'hiding' behind rules is explored in the psychology literature on the internalisation of regulation. That literature (see, for example, Deci, Eghrari, Patrick, & Leone, 1994; Deci & Ryan, 1985) distinguishes between internalisation by 'introjection', which is imposed and where the recipient does not identify with the regulation or accept it as his/her own, and by 'integration', where the recipient identifies with the value of the activity/process and accepts responsibility. Conveying choice within the regulation is found to be supportive of self-determination, which, in turn, supports integration rather than introjection. IAS 38 conveys less choice than does SSAP 13. Thus, integration is likely to be diminished, and, along with it, a sense of responsibility.

to examine whether the capitalisation criteria are being met (PricewaterhouseCoopers, 2010). In this context, if (substantially) all of a firm's R&D is expensed, then there is the direct implication that either (i) the firm's R&D investments do not meet the capitalisation criteria and are unlikely to generate future economic benefits; and/or (ii) the firm is not compliant with reporting requirements. In either case, the absence of capitalised development costs represents a negative signal to the market, which was not the case with low (or zero) capitalisation under SSAP 13. Finally, firms are likely to be increasingly concerned about the comparability of their R&D reporting with that of their peers, leading to a contagion or 'herding' effect.[10]

To summarise, the unavailability of an overt option to capitalise or expense development costs in IAS 38 compared to SSAP 13 and the different wording between SSAP 13 and IAS 38 (whereby SSAP 13 basically was promoting the option for expensing) brought about a decrease in the recognition threshold for the development costs asset. We argue that this would result in an increase in the capitalisation frequency and, perhaps counterintuitively but more importantly, would adversely impact the capitalisation signalling role, relative to expensing, about future earnings documented in Oswald and Zarowin (2007).

3. Literature review and hypothesis development

3.1 Literature review

R&D investment is economically important and key to the competitive position of many firms and their ability to secure future cash flows (Lev, 2001). In the US, Sougiannis (1994, p. 65) finds that "on average, a one-dollar increase in R&D leads to a two-dollar increase in profit over a seven-year period". Consistently, R&D investments are associated with future positive abnormal profits and returns (Chan, Lakonishok, & Sougiannis, 2001; Duqi, Jaafar, &

[10] For instance, Ding, Jeanjean & Stolowy (2013) find that analysts compare the capitalisation rates among firms. Olsson (2010) argues that contagion in accounting choice is both present and unsurprising. Reppenhagen (2010) finds contagion in accounting for stock option expensing for firms reporting under SFAS 123, which provided an option between the fair value method and the intrinsic method.

Torluccio, 2015; Eberhart, Maxwell, & Siddique, 2004). Despite the value creating role of R&D expenditure, this is associated with substantial technical and commercial uncertainty (Ciftci & Darrough, 2016). This results in substantial risk and uncertainty about the future benefits of R&D investment (Kothari, Laguerre & Leone, 2002; Amir, Guan & Livne, 2007).

In addition, R&D expenditure is characterised by information asymmetry. Aboody and Lev (2000) argue that outsiders cannot easily infer relevant information by observing the productivity of R&D projects in other firms or by referring to an organised R&D market. Wyatt (2008, p. 224) notes that "[t]o outsiders of the firm, R&D *expenditures* are a bundle of unknown expenditures with unknown links to future benefits", whilst "the individual firm aggregates various types of expenditures into their R&D measure and has a good idea of the value creation process" (ibid, p. 223). This recognises that management is in an advantageous position as they can better observe the links between R&D projects and value creation compared to outsiders.

If permitted by the accounting standards, firms could opt to capitalise R&D as appropriate to reduce R&D-related information asymmetry.[11] The accounting treatment would then act as a channel of communication for signalling firm future prospects. Optional R&D capitalisation can provide a strong signal of management's faith in the R&D value: in the event of unsuccessful R&D, management is exposed to a write-off cost. Opting for capitalisation could convey expectations about the success of R&D expenditure which, in turn, could affect investors' expectations about R&D future payoffs (Mohd, 2005) and earnings arising from successful development expenditure (Healy, Myers, & Howe, 2002).

[11] Firms might seek to reduce this information asymmetry by providing voluntary disclosures. Voluntary disclosures, however, are unlikely to mitigate information asymmetry for a number of reasons. First, they are not audited, and so are not afforded the same degree of credibility as disclosures which are subject to independent verification. Second, extracting information from voluntary disclosures as opposed to mandatory disclosures is more costly for market participants (Palmon & Yezegel, 2012). Third, managers are reluctant to provide voluntary disclosures which might reveal proprietary information (see also Anton & Yao, 2002; Bellora & Guenther, 2013; Bhattacharya & Ritter, 1983; Palmon & Yezegel, 2012). According to Bellora and Guenther (2013, p. 266), "[t]he fear of proprietary costs may deter firms from quantitative, verifiable disclosure". Consistent with this, Mazzi et al. (2019b) find that firms reporting under IFRS globally do not provide much R&D-related information in annual reports despite a noted desire for more disclosure by financial statement users.

Indeed, Ahmed and Falk (2006), using Australian firms (which were permitted to capitalise certain R&D costs) show that capitalised R&D is positively associated with future earnings. Ahmed and Falk (2006, p. 259) conclude that managers are able "to credibly signal their superior information by either capitalizing successful R&D investment or expensing unsuccessful R&D investment". This is in line with Dahmash, Durand and Watson (2009) and Wyatt (2005) suggesting that providing some discretion to managers with regards to the accounting treatment of intangible assets (in this case SSAP 13) could reduce the error/bias with which intangible assets are reported in financial statements (Choi, Kwon, & Lobo, 2000) (thus improving their reliability). This results in reduced information asymmetry between management and investors (Godfrey & Koh, 2001), effectively mitigating uncertainty around the future economic benefits of the assets capitalised.

Consistent with this, prior research does provide evidence that, when the decision to capitalise development costs was an overt option in the UK, these costs contributed relevant information to investors. Shah et al. (2013) show that R&D assets reported under UK GAAP are positively related to prices, suggesting that investors perceived the R&D capitalised portion to be an asset that would generate future economic benefits. Oswald (2008) finds that, in terms of value relevance, appropriate R&D capitalisation decisions appear to have been made by UK firms prior to the adoption of IFRS. Oswald (2008) concludes that managers employed the discretion permitted under SSAP 13 to communicate information about the likely success of R&D expenditure. Additionally, Anagnostopoulou (2010) documents that companies expensing R&D experience greater forecast errors compared to firms capitalising R&D, confirming that development costs capitalisation under SSAP 13 provided a signal to professional investors to predict future earnings. Oswald and Zarowin (2007) also demonstrate that capitalisation relative to expensing under SSAP 13 resulted in current prices incorporating more future earnings information relative to expensing.

Capitalising R&D expenditure requires significant managerial judgement. On the one hand, managers are expected to use their accounting discretion to provide relevant and useful information. On the other hand, managers could exploit their discretion to obfuscate the performance of the firm and so adversely affect the usefulness of reported information. Prior research shows that R&D accounting choice is employed for earnings management or earnings smoothing,[12] in line with the adverse effect upon the usefulness of reported information.[13] However, UK analysts "did not seem to be misled by the higher earnings reported for the company capitalizing R&D expenditure" (Goodacre & McGrath, 1997, p. 155) and they "act neither mechanistically nor myopically" (ibid, p. 173) with respect to the R&D treatment.[14]

Overall, optional capitalisation of development costs relative to expensing, under SSAP 13 has helped analysts and investors to form future earnings expectations. We examine whether the market's ability to anticipate earnings for UK companies capitalising development costs changes after IFRS implementation, given the lower threshold of asset recognition in IAS 38.

3.2 Hypothesis development

As discussed above, SSAP 13 promoted an implicit high asset recognition threshold whereby only a small proportion of firms exercised their discretion to capitalise R&D. This is consistent with the notion that under SSAP 13 managers were inclined to capitalise only the R&D expenditure with a high probability of successful outturn. By comparison to SSAP 13, IAS 38 introduces a lower threshold for recognition with regards to internally generated intangible

[12] See Cazavan-Jeny and Jeanjean (2006) for the French setting, Markarian et al. (2008) for the Italian setting, Dinh, Kang and Schultze (2016) for German firms reporting under IFRS and Mazzi et al. (2019b) for firms reporting under IFRS in an international setting.

[13] For instance, in the French setting, Cazavan-Jeny and Jeanjean (2006) show that the R&D asset was negatively related to firm values and contemporaneous returns, while Cazavan-Jeny et al., (2011) show that the future sales and earnings performance of companies which capitalise R&D expenditure does not differ from those which expense all their R&D. Dinh et al. (2016), using a sample of German firms, find that the R&D asset is value relevant only when firms are both performing well and have little (or no) incentive to manage earnings.

[14] Prior research in the US which uses hypothetical capitalisation rules shows that earnings management would not hinder the ability of capitalisation to communicate useful information (Chambers, Jennings, & Thompson, 2003; Healy et al., 2002).

assets by leaving too limited choice (or, no choice) with respect to the capitalisation of development costs when the IAS 38 criteria are met. This took effect by the unavailability of an overt option to capitalise or expense development costs in IAS 38 compared to SSAP 13 and the different wording between SSAP 13 and IAS 38, whereby SSAP 13 basically was promoting the option for expensing. "Importantly, the underlying assumption is that uncertainty can safely be ignored, or at least overcome by a process of unbiased estimation" (Barker & McGeachin, 2015, p. 193). Thus, management responding to the adoption of IAS 38 should capitalise development costs more frequently and this is in line with evidence in recent archival research (Tsoligkas & Tsalavoutas, 2011; Mazzi et al., 2019b). However, "it is usually impossible for outside users of the statements to assess whether or how a company exercised its preferences when capitalising (or not) development costs" (Nobes, 2013, p. 93). By removing the overt option to capitalise or expense development expenditure in the UK, IAS 38 limits managers' ability to convey information about the success of R&D projects (Stark, 2008).

Following along these lines, in the present study, we contend that this decrease in asset understatement, or, unconditional conservatism has the potential to affect the mix of current versus future information that is reflected in the current stock return. Specifically, insofar "conservatism finds consistency with the concept of reliability" (Barker & McGeachin, 2015), lowering the prudence in the recognition of the development costs asset is likely to have adverse implications for its usefulness. In fact, a first indication about the changing role of the development cost asset comes from Shah et al. (2013) who show that its value relevance decreases from the pre- to the post-IFRS period in the UK. We build upon this finding to argue that a loss in the value relevance of the capitalised cost asset under IAS 38 denotes a wider deterioration of this mechanism's ability to signal increased probability of future benefits. Hence, we anticipate that the evidence in Oswald and Zarowin (2007) that the stock market's

ability to better anticipate future earnings for companies that capitalise R&D relative to those expensing in the pre-IFRS period would be weaker in the post-IFRS period. We formally hypothesise this as follows:

H1: The relationship between current returns and future earnings for firms that capitalise compared to those expensing development costs is weaker in the post- relative to the pre-IFRS period.

4. Research design

4.1 Sample selection process and sample properties

Table 1 (Panel A) presents a summary of the sample selection process that describes how we arrive at our final sample. Testing our hypothesis requires a relatively large window for both the pre-and post IFRS periods for which necessary and reliable data is available. Focusing on the years between 1999 and 2013 sufficiently satisfies these conditions. Given that we need data for one lag year and one year ahead, we obtain data from Datastream for the period 1998 to 2014 for all UK firms featured in the research lists of active and dead firms constructed by Datastream (GRP1-GRP6 and DEADUK1-DEADUK7). From these lists, we eliminate Financial firms and firms in the Oil and Gas industry[15] and firms which do not report either an R&D expense or R&D asset.[16] Because the tests regarding the share price anticipation of future earnings require returns (earnings) to be available for at least two (three) consecutive years, we eliminate observations for which such data are missing. Observations for which information on the accounting standards followed is absent and observations with non-UK GAAP or non-

[15] Financial firms are excluded because of the differences in the nature of their financial statement items and they are subject to significantly more regulations than other firms. Oil and Gas firms are excluded because IFRS 6 *Exploration for and Evaluation of Mineral Resources* permits, but does not specify, firms to use any of three different accounting policies with regard to exploration and evaluation costs. Hence, even if such capitalised costs may have been captured by Datastream as development costs, such capitalisation is a pure choice among three alternative policies that companies may apply. This is not the case with development costs we are focusing on.

[16] R&D-related accounting information is sourced from Extel up to and including 2005, given that the coverage in Datastream items is generally poor for this period. From 2005 onwards, reliable Datastream R&D-related items consistently became available. A comparison of R&D-related items from Extel and Datastream for 2005, the year that R&D-related items were available from both sources, yielded no significant differences.

IFRS standards are excluded.[17] In addition, for each firm, we eliminate the last firm-year reported under UK GAAP and the first firm-year reported under IFRS.[18] This exclusion allows us to avoid confounding transitional effects. Further, we eliminate firm-year observations for any firm appearing to have adopted IFRS outside the window of 2005 to 2008. Such firms would be classified as early or late IFRS adopters and thus could be described as "special cases" which could have exercised some flexibility around the accounting standards and hence accounting policies they follow (see also footnote 19). Moreover, firms reporting under UK GAAP had an overt option to capitalise or expense development costs and the majority of firms opted for expensing such costs. However, switching to IFRS meant that firms where constrained in exercising that option. Thus, we wished our sample to be confined to firms which were able to exercise the option to capitalise development costs as permitted in SSAP 13 but then potentially constrained in this respect under IAS 38 and we chose our sample firms to have data available for both the pre-and post IFRS periods.[19] Following Haw, Hu, Lee and Wu (2012), firm-years where the magnitude of net income or net loss exceeds firm market value are considered as outliers and hence deleted. Finally, we remove observations for which we are unable to estimate the probit models for deriving the inverse Mills ratio (see section 4.2. and Appendix 1) because there is no within-industry variation between expensers and capitalisers. Our final sample comprises 2,399 firm-year observations for 260 companies.[20]

[17] Kreß, Eierle and Tsalavoutas, (2019) and Mazzi et al., (2019a) use the Worldscope item 'Accounting Standards Followed' (WC07536) to capture companies' reporting standards for the period under investigation.

[18] IFRS were required to be adopted by companies listed on the UK main market (Alternative Investment Market (AIM)) for all accounting periods beginning on or after 1 January 2005 (1 January 2007). Since UK firms can choose the date of their year-ends, "information [about the adoption of IFRS] was published gradually according to the different year ends" (Aisbitt, 2006, p. 120). For instance, companies with a year-end in September 2005 would adopt IFRS for the first time for the year-end September 2006. Thus, not all firms listed on the main market (AIM) are expected to adopt IFRS for the first time in 2005 (2007).

[19] Requiring a balanced panel of firms is common in the IFRS literature which examines pre-post- IFRS adoption consequences (e.g., Brochet, Jagolinzer, & Riedl, 2013; Jeanjean & Stolowy, 2008).

[20] To ensure the accuracy of the Worldscope item 'Accounting Standards Followed' (WC07536), we manually check the annual reports of the firms included in our sample for the first year of IFRS adoption and the last year reporting under UK GAAP. For all 238 firms (out of the 260) for which we are able to find the annual reports for both the last year under SSAP 13 and first under IFRS, the Worldscope item is accurate.

Table 1 (Panel B) presents the sample composition based on the accounting treatment of R&D expenditure. We classify as a capitaliser those firm-year observations which report an R&D asset, and as an expenser otherwise. The data show that capitalisers account for just 10.3% of firm-years in the pre-IFRS period. The low frequency of capitalisation under UK GAAP is in line with the evidence in prior literature and consistent with the argument that SSAP 13 promoted prudence with respect to the development costs recognition on the balance sheet. Further, we observe that the frequency of capitalisation rises after IFRS adoption – dramatically so, to 52%. This result is consistent with the notion that IAS 38 introduces less conservative accounting and lowers the threshold for asset recognition (André et al., 2015; Hellman, 2008). The high frequency of capitalisation under IFRS is in line with previous studies employing UK firms (e.g., Mazzi, et al., 2019a; Tsoligkas and Tsalavoutas, 2011).

In order to ensure that this higher frequency of capitalisation is indeed a result of IFRS adoption, we collect the annual reports of the companies included in our sample for the first year of IFRS adoption and the last year reporting under UK GAAP. Of the 238 firms for which we found annual reports for both years, only 35 firms report an R&D asset and 14 firms state in the notes to the accounts that they capitalise R&D only when the capitalisation criteria are met in the last year reporting under UK GAAP. Of the remaining firms, 186 have a policy of immediately expensing all R&D expenditure.[21] Of these 186 firms, we find that 87 (47%) switched to capitalising a portion of development costs in the first year of IFRS adoption.[22] These results suggest that the higher frequency of capitalisation under IFRS is indeed driven by the adoption of IFRS, and companies did adjust how they report for R&D.

Table 1 (Panel C) presents the sample composition by industry, across capitalisers and expensers. With respect to the pre-IFRS period, we observe a low frequency of capitalisation

[21] The remaining three firms do not report an R&D asset and do not state the policy for the accounting treatment of R&D.
[22] The Supplemental File contains the details for the 238 firms for which we find annual reports (Table B).

across all industries in our sample. Following the adoption of IFRS, we note a significant increase in the number of capitalisers across all industries. The constituents of Technology, Industrials and Healthcare industries exhibit the highest increase in the frequency of capitalisation. More specifically, the percentage of firm-year observations classified as capitalisers in the pre-IFRS period is 9%, 13% and 4% for these industries, respectively. In the post-IFRS period, these increase to 68%, 56% and 44% respectively. The constituents of the Basic Resources industry exhibit the smallest increase in the frequency of capitalisation, with 22% of the firm-year observations being classified as capitalisers in the post-IFRS period compared to 12% prior to the adoption of IFRS.

TABLE 1 ABOUT HERE

Figure 1 shows the percentage of capitalisers and expensers relative to the year of IFRS adoption. The figure confirms our earlier finding (Table 1 Panel B) that capitalisation occurs more frequently under IFRS than UK GAAP. The main insight is that the percentage of capitalisers is consistently low (high) in the years prior to (after) the adoption of IAS 38. This implies that the higher frequency of capitalisation we observe following the adoption of IFRS is unlikely to be driven by factors other than the change in accounting standards.

FIGURE 1 ABOUT HERE

4.2 Capitalisation and share price anticipation of future earnings

The methodological approach to earnings anticipation is based on the premise that returns over a year are due to changes in expectations about future earnings and due to the unexpected portion of the current year's earnings realisation (Collins, Kothari, Shanken & Sloan, 1994). This model, which has been extensively used in (and adapted by) prior literature (e.g., Chou, 2013; Hussainey & Walkerm 2009; Schleicher, Hussainey & Walker, 2007; Tucker & Zarowin, 2006), expresses returns as a function of levels of past, current and future earnings as follows:

$$R_{i.t} = \alpha + \beta_1 E_{i,t+1} + \beta_2 E_{i,t} + \beta_3 E_{i,t-1} + \beta_4 R_{i,t+1} + \varepsilon_{i,t} \quad (1)$$

where *i* and *t* represent firm and time subscripts, respectively; $R_{i,t}$ represents the market return on the shares of firm *i* in the period from nine months before the end of year *t* to three months after the end of year *t*; $E_{i,t}$ represents the accounting earnings of firm *i* in year *t*, scaled by the market value of the firm at the end of year *t* (see Dargenidou, McLeay, & Raonic, 2011; Haw et al., 2012; Lundholm & Myers, 2002; Oswald & Zarowin, 2007);[23] and ε is an error term. Following Collins et al. (1994), the model includes $R_{i,t+1}$ as a control variable, because using actual future earnings could introduce measurement error inasmuch as actual earnings deviate from (unobservable) expected future earnings.

Coefficient β_1 denotes the market response to information about future earnings that is anticipated but not captured by current and past earnings; it is predicted to be positive. It is known as the future earnings response coefficient (FERC), and is the indicator of anticipation of future earnings in share price. Coefficient β_2 represents the market response to the unexpected portion of current earnings. This is known in the literature as the contemporaneous earnings response coefficient (ERC), and is predicted to be positive. The coefficient of $E_{i,t-1}$ (β_3) captures the already anticipated portion of current earnings ($E_{i,t}$) and is predicted to be negative (Lundholm & Myers, 2002). If realised earnings are higher (lower) than expected, stock price should increase (decrease) accordingly in *t+1*. This would lead in to a negative loading on $R_{i,t+1}$ (Tucker and Zarowin, 2006). Accordingly, β_4 is predicted to be negative.

To test our hypothesis, we follow Oswald and Zarowin (2007) and introduce in Equation (1) a binary variable $CAP_{i,t}$ which differentiates capitalisers from expensers. We also include $CAP_{i,t}$ and its interactions with the other independent variables. This leads to Equation (2):

$$\begin{aligned} R_{i,t} = \alpha + \beta_1 E_{i,t+1} + \beta_2 E_{i,t} + \beta_3 E_{i,t-1} + \beta_4 R_{i,t+1} + \beta_5 CAP_{i,t}.E_{i,t+1} + \beta_6 CAP_{i,t}.E_{i,t} \\ + \beta_7 CAP_{i,t}.E_{i,t-1} + \beta_8 CAP_{i,t}.R_{i,t+1} + \beta_9 CAP_{i,t} + \beta_{10} IMR_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

[23] Our results remain robust when we use total assets or average market value for years *t* and *t-1*, or average total assets for years *t* and *t*-1. The results from these tests are presented in the Supplemental Material (Table C).

where $IMR_{i,t}$ is the inverse Mills ratio for firm *i* in year *t* and is included to control for endogeneity (see discussion later in this section). Following prior literature (e.g., Dargenidou et al., 2011; Ettredge, Kwon, Smith & Zarowin, 2005), we use one year ahead earnings. The use of one year ahead earnings is consistent with the investment practices of market participants who rely extensively on one-year forecasts (Demirakos, Strong, & Walker, 2010; Imam, Barker, & Clubb, 2008). All other variables are as defined as above.

We first run Equation (2) as a panel regression for the full sample in order to examine the effect of capitalisation on the relation between current returns and future earnings overall. The focus is on β_1 (i.e., the FERC), and β_5 (i.e., the incremental FERC associated with firms' capitalising R&D expenditure). Given that we are interested in the implications arising from IFRS adoption, subsequently, we estimate Equation (2) separately for the periods prior to and after the adoption of IFRS (see also Aharony, Barniv, & Falk, 2010) and compare the magnitude of the coefficients β_5 across the two periods using Wald tests. In line with the results presented in Oswald and Zarowin (2007), we expect the coefficient β_5 (incremental FERC) to be positive and significant for the period before the adoption of IFRS. In line with H1, we expect a reduction in the magnitude of the coefficient β_5 for the post-IFRS period. This would indicate a reduction in the stock market's ability to better anticipate future earnings for capitalisers, relative to expensers, as investors view the capitalisation signal with greater uncertainty.

Given that we are interested on the consequences of an overt and covert accounting choice, it is important to control for self-selection in that choice. Specifically, firms may capitalise certain R&D-related costs based on factors that affect the earnings-return relation, leading to concerns of potential endogeneity in our model (Oswald & Zarowin, 2007). To control for this, we apply the estimation technique of Heckman (1979) and Lee (1979) and include the

estimated inverse Mills ratio from a probit model.[24] The explanatory variables used in this probit model are drawn from those used in related research (e.g., Cazavan-Jeny et al., 2011; Dinh et al., 2016; Oswald & Zarowin, 2007). Given the change in the treatment of R&D expenditure and that we estimate the effect of capitalisation relative to expensing separately for the two periods, we also estimate the probit model separately for the pre- and post-IFRS periods. The results of estimations of these probit models are presented in Appendix 1.

Further, we add industry dummy variables using ICB Level 1 industry classifications in all regressions. In addition, we cluster standard errors at the firm level and add year fixed effects in all our models. Moreover, all continuous variables are winsorised at the 1% level of their distribution and, similar to Haw et al. (2012), we trim scaled earnings variables below -1 and beyond +1. Finally, to check for any multicollinearity among the variables in all models, we have produced two sets of Pearson and Spearman correlations coefficients and, in all Tables, we present the mean and maximum VIF values of each reported model.[25] Both approaches show that multicollinearity is unlikely to be a concern for our results. The definitions and sources of all variables employed in our models are reported in Appendix 2.

5. Results

5.1 Descriptive statistics

Table 2 shows descriptive statistics for all the variables used in our models. These are presented separately for the periods before and after the adoption of IFRS (Panels A and B, respectively). These reveal that capitalisers tend to be smaller than expensers in both periods (differences in *SIZE* are 0.416 and 0.657; significant at 5% and 1%, respectively). Further, in both periods, capitalisers tend to have greater volatility of R&D expenditure (differences in *CV_RD* are 0.187

[24] In line with Oswald and Zarowin (2007), we repeat our analysis with CAP and IMR interacted. Our conclusions are unchanged. These results are available upon request.
[25] Tables D and E in the Supplemental File present these correlation matrices.

and 0.060; significant at 1%, respectively). In the pre-IFRS period, market returns (*R*) of capitalisers are greater than those of expensers (difference in mean *R* is 0.221; significant at 5%). Little differentiates expensers and capitalisers in terms of market risk (*BETA*) (differences in *BETA* are 0.014 and 0.013; insignificant for both periods). On balance, we observe greater R&D intensity amongst expensers than amongst capitalisers. The extent of R&D activity does not, therefore, appear to provide a simple explanation of the decision of whether to capitalise (pre-IFRS period) or the need to capitalise (post-IFRS adoption). We do observe that the development expenditure capitalised by capitalisers (*RDE_CAP*) is higher in the post-IFRS period (significant at 10%), indicating that capitalisers tend to capitalise greater amounts of R&D in the post-IFRS period. Therefore, firms not only capitalise development costs more frequently but also tend to capitalise larger amounts in the post-IFRS period.

TABLE 2 ABOUT HERE

5.2 Multivariate analysis and discussion

Table 3 (Panel A) reports the results of the multivariate analysis testing our hypothesis that the stock market's ability to better anticipate future earnings for companies that capitalise R&D relative to those expensing in the pre-IFRS period is moderated in the post-IFRS period. The columns show the results of estimations based on our full sample of firm-years, pre-IFRS adoption and post-IFRS adoption firm-years, respectively.

The coefficient of future earnings (E_{t+1}) is positive and significant across all three columns (coefficients 0.899, 0.801 and 1.071 respectively; significant at 1%). This finding confirms that current returns incorporate future earnings information. The coefficient of current earnings (E_t) is also positive and significant, as expected, across all three columns (coefficients 0.567, 0.601 and 0.525; significant at 1% in the first and second columns and at 5% in the last column). Further, the coefficients of past earnings (E_{t-1}) and future returns (R_{t+1}) are negative and

significant, as expected, at the 1% level for all three columns (E_{t-1} presents coefficients of -0.722, -0.764, -0.720; R_{t+1} presents coefficients of -0.163, -0.191, -0.119).

The incremental effect of capitalisation is given by the coefficient of $CAP*E_{t+1}$. The coefficient of $CAP*E_{t+1}$ (0.093) is insignificant for the full sample. Perhaps counterintuitive at first, this indicates that capitalisation does not result in current returns incorporating more future earnings information than expensing. Importantly, when we split the sample, we note that this result is driven by the sub-sample of firms reporting under IFRS. Specifically, the coefficient of $CAP*E_{t+1}$ is positive (1.171) and significant (at 5%) in the pre-IFRS period. This result is in line with the findings in Oswald and Zarowin (2007) and suggests that companies that capitalised development expenditure under UK GAAP exhibited greater share price anticipation of future earnings information relative to those that expensed R&D. By contrast, this coefficient (-0.301) is insignificant (p-value>0.10) in the post-IFRS period.

Table 3 (Panel B) shows that the difference of -1.472 between the two coefficients is significant (at 1%, using Wald tests). Taken together, the results are consistent with H1. The finding of no significant coefficient for CAP_t*E_{t+1} for the post-IFRS period, which then drives the results for the full sample, suggests that capitalisation under IFRS no longer provides additional information relative to expensing. This finding suggests that investors consider that capitalisation conveys the same information as expensing, in line with our argument that investors experience greater uncertainty with respect to the future benefits associated with R&D assets reported under IFRS compared to those reported under the UK GAAP. Overall, our results suggest that capitalisation conveys additional information about future value creation only in the pre-IFRS period, when the accounting standard promoted prudence in its application and offered an explicit option for capitalisation if companies wished to do so, unlike IFRS.

TABLE 3 ABOUT HERE

The significant decrease of CAP_t*E_{t+1} should result, *ceteris paribus*, in current returns for firms that capitalise development costs under IFRS to impound less information about future earnings compared to firms that capitalised R&D under UK GAAP. Because investors experience greater uncertainty with respect to the information conveyed by capitalisation about future earnings under IFRS relative to the pre-IFRS period, current returns of capitalisers should exhibit a weaker association with future earnings in the post-IFRS period as compared to the pre-IFRS period. Consistently, the Wald test presented in Table 3 (Panel B) confirms the weaker association between returns and future earnings for capitalisers under IFRS (change: -1.202; significant at 5%). Thus, current returns of capitalisers reflect less forward-looking information in the post-IFRS period and become less informationally efficient. This finding is in line with our hypothesis and contentions regarding potential loss of information following the adoption of IFRS (Stark, 2008).

5.3 Further analysis

In this section, we shed some light on whether our findings, which focus on the change of accounting standards, depend on the strength of internal and external monitoring of management, management discretion and potentially higher economic uncertainty of the R&D expenditure in the post-IFRS period. This analysis reflects on Wyatt's (2008) assertions that the reliability of accounting numbers in relation to R&D expenditure is affected by, inter alia: (i) GAAP rules; (ii) economic uncertainty; and (iii) management discretion. As a final test, we explore whether the uncertainty associated with capitalised developed costs is resolved as time passes and more earnings information becomes available (cf. Mazzi et al., 2019a).

5.3.1 The strength of corporate governance

Board and ownership structure are two important governance features that can act as effective managerial monitoring mechanisms, protecting shareholders' interests, and consequently

constraining aggressive financial reporting (e.g., Cotter, Shivdasani, & Zenner, 1997; McConnell & Servaes, 1990; Klein 2002; Ahmed & Duellman, 2007). In our setting, strong governance would induce an increase in the reliability of the R&D reporting and hence reduce the uncertainty associated with capitalised R&D. Thus, capitalisation of R&D, relative to expensing, may be perceived as a more credible signal about a firm's future profitability for firms with stronger governance and investors could incorporate this information in current returns. We test this proposition.

Based on prior literature, we employ the following proxies: board size (Xie, Davidson III, & DaDalt, 2003); the percentage of non-executives board members (Beekes, Pope & Young, 2004; Ahmed & Duellman, 2007); strategic ownership (Chung, Firth & Kim, 2002; Cornett, McNutt, & Tehranian, 2009); and ownership concentration (Kim & Yi, 2006). Constrained by the unavailability of data for the pre-IFRS period, we perform the analysis only for the post IFRS period. Based on the industry year median of each proxy, we construct eight sub-samples which disaggregate our firm-year observations based on having weak or strong internal or external governance, respectively. We present the results of this analysis in Table 4.

The results from this analysis show that the coefficient of interaction between future earnings and capitalised R&D ($CAPt^{*}E_{t+1}$) remains insignificant when we distinguish between firms with strong and poor internal or external monitoring. This finding suggests that our results hold independently of the strength of firms' corporate governance strength.[26]

TABLE 4 ABOUT HERE

5.3.2 The influence of earnings management incentives

Our results show that capitalisation under IFRS no longer provides additional information relative to expensing. While we have attributed this finding to investors experiencing greater

[26] For completeness of these additional tests, we expand the probit models employed for the computations of the IMR and explore whether corporate governance (captured by the four different proxies) is a determinant of development costs capitalisation. The results (available upon request) indicate that corporate governance is not associated with a firm being a capitaliser or expenser.

uncertainty about future benefits, investors could also respond in a similar way to the information conveyed by capitalisation about future earnings if companies have incentives to manipulate earnings. It may be that investors value the capitalisation signal more if companies have little incentive to manipulate earnings and thus treat capitalisation as more genuine. To explore this alternative explanation, we split our sample firms according to their incentives to manipulate earnings. Like Kreß et al. (2019), we consider that a firm has little incentive to manipulate earnings when its capitalised amount of R&D is neither associated with accrual earnings management incentives nor with real earnings management incentives. Specifically, we identify firms which are more likely to have managed earnings if any of these conditions hold: R&D expenditure at time *t* is below the R&D expenditure at time *t-1*; earnings at time *t-1* are greater (lower) than earnings at time *t* assuming full expensing (capitalisation); and zero earnings threshold is greater (lower) than earnings at time *t* assuming full expensing (capitalisation). Due to unavailability of sufficient data for the pre-IFRS period, this analysis is focused on the post-IFRS period only.

We present the results of this analysis in Table 5. The first column presents the results based on the firm-years which are more likely to have managed earnings (suspect firm-years), and the second column presents the results for the remaining firm-years (non-suspect firm-years). Our results show that the coefficient of $CAP*E_{t+1}$ is insignificant for both sub-samples. Thus, our results hold independently of firms having earnings management incentives.

TABLE 5 ABOUT HERE

5.3.3 Uncertainty associated with the future benefits of R&D expenditure

Our hypothesis relies on the assumption that IAS 38 lowers the asset recognition threshold with respect to development costs on the balance sheet. We establish that managers responded to the change in accounting standard as indicated by the higher frequency of capitalisation of under IFRS. Arguably, this increase could still occur because firms invest in fewer risky

projects in the post-IFRS period. If this was indeed the case, the uncertainty associated with R&D expenditure would diminish in the post-IFRS period relative to the pre-IFRS period. Under such circumstances, our results would be driven by the riskiness of R&D expenditure as opposed to the argument that underlies our hypothesis.

To explore this alternative explanation, we examine the relation between R&D expenditure and uncertainty of future benefits arising from such activities. Following prior studies (e.g., Ahmed & Falk, 2009; Amir et al., 2007), we estimate Equations (3) and (4) as follows:

$$SDE_{i,t} = \alpha + \beta_1 RDE_{i,t} + \beta_2 LEV_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 CAPEX_{i,t} + \beta_5 IMR_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$SDE_{i,t} = \alpha + \beta_1 RDE\_CAP_{i,t} + \beta_2 RDE\_EXP_{i,t} + \beta_3 CAPRD_{i,t} + \beta_4 LEV_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 CAPEX_{i,t} + \beta_7 IMR_{i,t} + \varepsilon_{i,t} \quad (4)$$

where i and t represent firm and time subscripts, respectively; $SDE_{i,t}$ is the standard deviation of the firm's operating income before depreciation, amortisation and R&D expense, over the years t+1 to t+5 scaled by the market value of equity; $RDE_{i,t}$ is the total R&D expenditure of firm i in year t, scaled by market value at the end of year t; $RDE\_CAP_{i,t}$ and $RDE\_EXP_{i,t}$ divide $RDE_{i,t}$ between amounts capitalised and expensed, respectively, in year t; $CAPRD_{i,t}$ is an indicator variable, equal to one if firm i capitalises any R&D expenditure in year t and zero otherwise; $LEV_{i,t}$ is the leverage of firm i at the end of year t, defined as the difference between the firm's total assets and its book value of equity, scaled by book value of equity, at the end of year t; $SIZE_{i,t}$ is the natural logarithm of the market value of firm i at the end of year t; $CAPEX_{i,t}$ is the capital expenditure of firm i in year t, scaled by the market value of the firm at the end of year t; and $IMR_{i,t}$ is as previously defined. Equation (3) differs from Equation (4) in the following respect. The former is designed to investigate the association between total R&D expenditure and the uncertainty associated with these investments, while the latter allows us to investigate this association separately for the portions of R&D expenditure capitalised and expensed. The underlying sample is the same as in the main analysis, albeit reduced, due to data unavailability for implementing this estimation.

Table 6 (Panel A) reports the results of these tests. The coefficient of R&D expenditure (RDE_t) is positive and significant, as expected, for both pre- and post-IFRS (coefficients 0.267 and 0.220 respectively; significant at 1%). This suggests that R&D expenditure is indeed associated with uncertain future economic benefits. Further, the Wald test comparing the magnitude of the coefficients between the two periods indicates that their difference is not significant (p-value>0.10). This result indicates that the uncertain nature of R&D does not change after the adoption of IFRS, and the increased frequency of capitalisation following the adoption of IFRS is unlikely to be driven by a change in the uncertain nature of R&D.

The coefficient of capitalised R&D expenditure (RDE_CAP_t) is insignificant in the pre-IFRS period (coefficient: -0.092; p-value>0.10) but becomes significant in the post-IFRS period (coefficient: 0.368; significant at 1%). The coefficient of expensed R&D expenditure (RDE_EXP_t) is positive and significant, as expected, across both periods (coefficients: 0.279 and 0.182; significant at 1% and 5% respectively). Arguably, the significant coefficient in the post-IFRS period reflects the increased uncertainty and impaired reliability of the R&D assets.

Table 6 (Panel B) repeats the analysis reported in Panel A, after eliminating firm-year observations which are more likely to have managed earnings (suspect firm-years, as defined in Section 5.3.2). The results in Panel B are consistent with those presented in Panel A and indicate that our results hold independently of firms having earnings management incentives.

TABLE 6 ABOUT HERE

Overall, and on reflection of Wyatt's (2008) conjectures of what affects the reliability of accounting numbers in relation to R&D expenditure, the results from these additional tests indicate the following. The uncertain nature of R&D expenditure remains unchanged after the transition to IFRS. However, capitalised R&D expenditures under IFRS are associated with greater uncertainty than those recognised under UK GAAP. Therefore, the change in accounting standards appears to drive the recognition of less reliable and hence more uncertain

intangible assets.[27] This assertion is also supported by the additional analysis which indicates that our results hold independently of firms' strength of corporate governance or earnings management incentives in the post-IFRS period. Overall, these findings are consistent with the discussion which underpins our hypothesis that investors experience greater uncertainty with respect to the information conveyed by capitalisation about the success of R&D projects and the associated probable future economic benefits under IFRS.

5.3.4 Market performance: capitalisers versus expensers

We now examine whether this increased uncertainty is reflected on returns, and whether it is resolved as time passes and more earnings information becomes available. To do this, we follow Mazzi et al. (2019a) and examine whether or not capitalisers, relative to expensers, exhibit greater abnormal returns in the short and long term (taken as one year and five years ahead, respectively).[28] The choice of the long-term window is consistent with our earlier tests and the findings in prior literature that the benefits associated with R&D expenditure can take (on average) five years to accrue (e.g. Lev & Sougiannis, 1996; Mazzi et al., 2019a; Nadiri & Prucha, 1996). If the market considers that development costs capitalised convey a more uncertain signal with respect to their future benefits under IFRS, we would expect uncertainty to have an impact on prices and returns in the short term, but for that impact to be reduced in the longer term as the arrival of new information enables the market to resolve this uncertainty. Therefore, capitalisers in the post-IFRS period should generate greater abnormal returns relative to expensers only in the long term. By contrast, capitalisers in the pre-IFRS period

[27] Considering that value relevance tests are joint tests of relevance and reliability (Barth, Beaver, & Landsman, 2001), the decrease in reliability we document here arguably explains the adverse effect upon the value relevance of the capitalised R&D documented by Shah et al. (2013).

[28] Similar to Mazzi et al. (2019a), we employ buy-and-hold size-adjusted abnormal returns measured from three months after the year end. Portfolios are rebalanced annually by ranking all firms in the UK based on their market capitalisation at the beginning of the year and subsequently allocating them to five portfolios. The returns of the portfolios are equally weighted. Buy-and-hold returns are calculated using monthly firm returns constructed based on Datastream's Return Index (RI). We also consider a monthly return to be missing when the return of a given month or the previous month is greater than 300% and the return over those two months together is less than 50%.

should earn greater abnormal returns relative to expensers both in the short and long term. We present the findings of our analyses in Table 7. Specifically, Table 7 Panel A presents the results over the short term, and Panel B the results for the longer term.

TABLE 7 ABOUT HERE

The results reported in Table 7 (Panel A) show that capitalisers in the pre-IFRS period earn positive excess returns relative to expensers which are statistically significant (at 10%). Capitalisers in the post-IFRS period, however, no longer exhibit one-year excess returns relative to expensers (p-value>10%). By contrast, the results in Panel B show that capitalisers outperform expensers in the long term, both in the pre- and the post-IFRS periods. Taken together, our findings are consistent with the argument that in the post-IFRS period, investors are unable to infer the true implications of R&D capitalisation in the short term, but in line with the findings of Mazzi et al. (2019a, p.2), this is resolved "in the longer term as more information becomes available". In the pre-IFRS period, however, investors are able to infer the implications of R&D capitalisation earlier. Overall, these findings suggest that capitalisation under IFRS is associated with greater uncertainty, which is resolved only with time.

6. Sensitivity analyses

We conduct nine sensitivity checks to assert that our findings are not affected by various research design choices we have made. Although we summarise these additional tests here, their presentation is available in the Supplemental Material (Tables F-K). We confirm that our inferences remain unchanged when we consider these sensitivity checks.

First, we consider the potential concern that our research design does not control for firm-specific characteristics which may impact upon the market's ability to anticipate future earnings. To alleviate this concern, we follow Lundholm and Myers (2002) and Ettredge et al.

(2005) and extend Equation (2) by including control variables both as a main effect and as an interaction term with past, current and future earnings and future returns as follows:

$$\begin{aligned} R_{i,t} = {} & \alpha + \beta_1 E_{i,t-1} + \beta_2 E_{i,t} + \beta_3 E_{i,t+1} + \beta_4 R_{i,t+1} \\ & + \beta_5 CAP_{i,t}.E_{i,t-1} + \beta_6 CAP_{i,t}.E_{i,t} + \beta_7 CAP_{i,t}.E_{i,t+1} + \beta_8 CAP_{i,t}.R_{i,t+1} \\ & + \beta_9 CON_{i,t}.E_{i,t-1} + \beta_{10} CON_{i,t}.E_{i,t} + \beta_{11} CON_{i,t}.E_{i,t+1} + \beta_{12} CON_{i,t}.R_{i,t+1} \\ & + \beta_{13} CAP_{i,t} + \beta_{14} CON_{i,t} + \beta_{15} IMR_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (5)$$

where $CON_{i,t}$ is an additional control variable, and all other variables are as previously defined. $CON_{i,t}$ represents variables which control for the firm's information environment, earnings persistence, variability and firm growth, and are based on firm size, existence of losses, standard deviation of earnings and book-to-market ratio, respectively. The addition of these variables controls for those circumstances in which the market's ability to accurately predict future earnings might be expected to be reduced, namely in the cases of small and/or loss-making firms, firms with high earnings volatility and firms undergoing high growth.

Second, we check the sensitivity of our results when we eliminate the second year following the adoption of IFRS for each firm. This adjustment ensures that our results are not driven by some learning effect subsequent to firms' adoption of IFRS.

Third, to alleviate concerns that the global financial crisis influences our results, we remove 2007 and 2008 from our sample. This is necessary because: (i) the turmoil in financial markets, including equity markets, may have impacted upon the market returns of firms in our sample; and (ii) heightened exogenous uncertainty may have impacted upon the risk assessments of managers and market analysts, and their assessments of likely R&D outturns.

Fourth, we measure earnings 'as reported' using the Datastream item 'Net income before extra items' (item code WC01551). To improve the comparability of the accounting figures between expensers and capitalisers, Oswald and Zarowin (2007) employ 'as-if-expensed'

earnings, being reported earnings adjusted to reverse the effects of capitalised R&D, and so restate them on the assumption of full expensing of R&D.[29]

Fifth, we examine the possibility that our results are driven by the more general transition to IFRS. To address this concern, we repeat our analysis and drop $CAP_{i,t}$. Effectively, we estimate Equation (1) separately for the periods prior to and after the adoption of IFRS. We find the relation between current returns and future earnings remaining unchanged in the post-IFRS period, suggesting that our results are not driven by the general transition to IFRS.

Sixth, also in line with Oswald and Zarowin (2007), we repeat our analysis excluding 'mandatory expensers' (i.e., firm-year observations belonging in an industry that all firms expense all R&D expenditure, and expensers with either negative RDVALUE or RDVALUE lower than the minimum RDVALUE of a capitaliser in the same industry/year).

Seventh, we use one year ahead earnings. Possible future economic benefits usually exceed a one-year ahead and, thus, our tests may not capture the signalling effect of capitalised development costs. Hence, we repeat our analysis using three years ahead earnings, as in Oswald and Zarowin (2007). This results in a sample size reduction of about 22%. It is also noted that, in order to preserve a reasonable sample size, we must allow cases of pre-IFRS period returns being regressed against post-IFRS period earnings.

Eighth, we use a dummy variable to capture the potential information role of R&D capitalisation versus expenditure. Arguably, the proportion of capitalised development costs relative to total R&D expenditure could equally capture information signalling. We test this proposition and we replace the dummy variable with the proportion of capitalised R&D relative to total R&D expenditure in a given year.

[29] In this case, we have also re-estimated the inverse Mills ratio using as-if-expensed control variables.

Finally, we repeat our analysis using three-way interactions. We interact all variables in Equation (2) with *IFRS*, an indicator variable taking the value of one when a firm reports under IFRS and zero otherwise, instead of performing the pre- and post-IFRS analysis separately.

7. Conclusions

Focusing on the UK market, we examine whether requiring versus allowing conditional capitalisation of development expenditure affects the extent to which capitalisation conveys more information about future earnings, relative to expensing. We find that capitalisation under UK GAAP improves the stock market's ability to anticipate future earnings relative to expensing. By contrast, we do not find similar evidence in the post-IFRS period. Specifically, our results show that capitalisation under IFRS does not result in current returns incorporating more future earnings information than expensing. Moreover, share prices of capitalisers become less information-efficient in the post-IFRS period compared to the pre-IFRS period, as they reflect less forward-looking information. Our conclusions for the post-IFRS period are independent of firms' strength of corporate governance and earnings management incentives.

In further tests, we find that the capitalised development costs asset is positively associated with uncertain future benefits only in the post-IFRS period. This result holds even after eliminating firms with the greatest incentives to manipulate earnings. Insofar "conservatism finds consistency with the concept of reliability" (Barker & McGeachin, 2015), this finding suggests the suppression of conservatism in the recognition threshold of the R&D asset is associated with the loss of its reliability and its compromised ability to communicate the success of R&D projects. This is in line with additional findings, which demonstrate that capitalisers in the post-IFRS period exhibit greater abnormal returns relative to expensers only in the long term, whilst in the pre-IFRS period they outperform expensers both in the short and long run. Taken together, our findings suggest that capitalisation under IFRS is associated with

greater uncertainty, which is resolved in the long run, as the economic benefits are gradually realised in the future.

Our study makes a number of contributions to the literature. First, this is the first study to examine the effect of R&D reporting on the relationship between current returns and future earnings under IFRS. Hence, we provide direct evidence that the findings of Oswald and Zarowin (2007), cannot be extended into the post-IFRS period and future research should not uniformly assume that their findings still hold. Second, our study complements and extends the value relevance studies which focus on the contemporaneous relation between prices or returns and book values of R&D reporting (e.g., Tsoligkas & Tsalavoutas, 2011; Shah et al., 2013). We demonstrate that the accounting *treatment* of R&D under IFRS relative to that of the UK GAAP fails to reliably convey forward looking information. In fact, Shah et al., (2013) document an adverse effect upon the value relevance of capitalised R&D in the post IFRS period. Considering that value relevance tests are joint tests of relevance and reliability (Barth et al., 2001), the decrease in reliability we document here arguably provides one explanation for this adverse effect.

Our findings should inform future developments in accounting standard setting, particularly the recognition of development costs. We find that the transition from SSAP 13 to IAS 38 in relation to accounting for R&D expenditure was a retrograde step. Effectively, an accounting standard which provides a choice to capitalise R&D expenditure and promotes more prudence appears to result in more informationally efficient prices. More (less) informationally efficient prices facilitate more (less) efficient resource allocation (Durnev et al., 2003). Hence, this result shall be informative to the IASB whose mission includes the development of IFRS "[which] contribute to economic efficiency … thus improving capital allocation". It shall also be informative to the FRC in the UK and EFRAG, which have initiated projects to review the current requirements for intangibles and propose further work in this

area. Our inference is substantiated by Nobes' (2013, p 93) explanation that "it is usually impossible for outside users of the statements to assess whether or how a company exercised its preferences when capitalising (or not) development costs". Our findings are in support of Stark (2008) who conjectures that by removing the overt option to capitalise or expense development expenditure in the UK, IAS 38 limits managers' ability to convey information.

As is the case with every study, this is also subject to a number of caveats. First, our main tests rely on one year ahead earnings which arguably could not be sufficiently long to capture the benefits arising from R&D. We attempt to circumvent this issue by using three years ahead of earnings in the sensitivity tests while noting that adding more years in this model adds little explanatory power (Collins et al., 1994; Lundholm & Myers, 2002). Further, we note that our analysis excludes firms that adopt IFRS outside the window of 2005 to 2008. We classify such firms as early and late adopters of IFRS. In the absence of a readily available and time varying variable indicating whether a firm is listed in the AIM (main) market, our sample may include AIM listed firms which adopted IFRS earlier (later) than 2007/2008 (2005/2006). Finally, we acknowledge that due to data unavailability, our tests with respect to the strength of corporate governance and earnings management incentives are limited to the post-IFRS period.

Appendix 1. Estimations of probit model of the decision to capitalise R&D

Variables	Pre-IFRS	Post-IFRS
Constant	-1.073	-0.462
	(-1.32)	(-0.73)
$PAST\_BEAT_t$	0.363***	0.474***
	(3.00)	(4.96)
$ZERO\_BEAT_t$	0.442***	0.435***
	(2.61)	(2.85)
$SIZE_t$	-0.080	-0.049
	(-1.36)	(-1.23)
ROA_t	0.008	0.886**
	(0.03)	(2.26)
LEV_t	-0.039	-0.026
	(-0.97)	(-1.00)
$CAPEX_t$	1.942	-1.458
	(1.54)	(-1.36)
$BETA_t$	0.030	0.085
	(0.22)	(0.70)
$RDINT_t$	-1.493	-1.265*
	(-1.53)	(-1.74)
RD_VALUE_t	-0.000	-0.000
	(-0.65)	(-0.60)
BM_t	-0.333	0.066
	(-1.35)	(0.52)
CV_RD	1.180***	0.451*
	(3.38)	(1.79)
CV_EARN	0.010	0.018
	(0.53)	(0.95)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	1,072	1,327
Pseudo-R^2	0.117	0.108
χ^2-statistic	53.71***	110.5***
Mean VIF	1.33	1.37
Max. VIF	1.95	1.99

Notes: Explanatory variables used in the probit model are drawn from those used in the prior literature on capitalisation of R&D. Standard errors are clustered at the firm level. *t*-statistics in parentheses. The detail of industry and year fixed effects are omitted in the interests of brevity. All variables are defined in Appendix 2. *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Appendix 2. Definition of variables: calculation and underlying data items

Variable	Definition[a]	Data items used, source and code[b]
$CAP_{i,t}$	Indicator variable, equal to one if an R&D asset or R&D amortisation is reported in the financial accounts.[d]	Net development costs (DS WC02504 from 2005; Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005, Extel prior to 2005)
$PAST\_BEAT_{i,t}$	Equal to one if both (i) earnings in year *t-1* exceed earnings in year *t*, assuming full expensing of R&D expenditure, and (ii) earnings in year *t* exceed earnings in year *t-1*, assuming full capitalisation of R&D expenditure; zero otherwise.[e]	Net income before extra items (DS WC01551); R&D expense (DS WC01201); net development costs (DS WC02504 from 2005, Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005, Extel prior to 2005)
$ZERO\_BEAT_{i,t}$	Equal to one if both (i) earnings are less than zero, assuming full expensing of R&D expenditure, and (ii) earnings are greater than zero, assuming full capitalisation of R&D expenditure; zero otherwise.[e]	Net income before extra items (DS WC01551); R&D expense (DS WC01201); net development costs (DS WC02504 from 2005, Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005, Extel prior to 2005)
$BETA_{i,t}$	Equity beta estimated via the market model, using monthly returns to the end of year *t*. We require a minimum of twelve months' returns and use a maximum of 60 months' returns.	Returns index (DS RI)
$SIZE_{i,t}$	Natural logarithm of market value of equity.	Market capitalisation (DS WC08001)
$BM_{i,t}$	Book-to-market ratio.	Common equity (DS WC03501); market capitalisation: (DS WC08001)
CV_RD_i	Coefficient of variation in R&D expenditure, being the standard deviation of R&D expenditure scaled by the mean value of R&D expenditure. Calculated separately for pre- and post-IFRS periods.	R&D expense (DS WC01201); net development costs (DS WC02504 from 2005, Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005, Extel prior to 2005)
$RDINT_{i,t}$	R&D intensity, measured as R&D expenditure divided by total assets.	R&D expense (DS WC01201); net development costs (DS WC02504 from 2005, Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005; Extel prior to 2005); Total assets (DS WC02999)
CV_EARN_i	Coefficient of variation in earnings, being the standard deviation of earnings scaled by the mean value of earnings. Calculated separately for pre- and post-IFRS periods.	Net income before extra items (DS WC01551)
$LEV_{i,t}$	Difference between total assets and book value of equity, scaled by book value of equity.[e]	Total assets (DS WC02999); common equity (DS WC03501)
$ROA_{i,t}$	Return on assets.	Net income before extra items (DSWC01551); total assets (DS WC02999)
$CAPEX_{i,t}$	Capital expenditure scaled by market value of equity.	Capital expenditure (DS WC04601); market capitalisation (DS WC08001)
$RD\_VALUE_{i,t}$	R&D value measured as the difference between the market value of equity and book value of equity at the end of year *t*, divided by the sum of R&D expenditures in years *t-1* and *t*. R&D expenditure for a year is R&D expense in that year plus the amount of R&D capitalised in that year.	Common equity (DS WC03501); market capitalisation (DS WC08001); R&D expense (DS WC01201); net development costs (DS WC02504 from 2005, Extel prior to 2005); amortisation of R&D (WC01153 from 2005, Extel prior to 2005)

(*Continued*)

Appendix 2. Continued

Variable	Definition[a]	Data items used, source and code[b]
$R_{i,t}$	One-year market return on equity, measured from nine months prior to the end of year *t* to three months after the end of year *t*.	Returns index (DS RI)
$E_{i,t}$	Net income scaled by firm market value.[c]	Net income before extra items (DS WC01551); market capitalisation (DS WC08001)
$IMR_{i,t}$	See Section 4.2. Inverse Mills ratio, calculated via the probit estimations set out in Appendix 1.	See Appendix 1 for estimation results and in this table for the definition of the variables.
$SDE_{i,t}$	The standard deviation of operating income before depreciation, amortisation and R&D expense, scaled by the market value of equity, calculated using the earnings of years t+1 to t+5 (inclusive).	Operating income (DS WC18155); R&D expense (DS WC01201); Market capitalisation (DS WC08001)
$RDE_{i,t}$	The R&D expenditure for the year scaled by the market value of equity.	R&D expense (DS WC01201); net development costs (DS WC02504 from 2005, Extel prior to 2005); amortisation of R&D (WC01153 from 2005, Extel prior to 2005); Market capitalisation (DS WC08001)
$RDE\_EXP_{i,t}$	The R&D expense for the year scaled by the market value of equity.	R&D expense (DS WC01201); Market capitalisation (DS WC08001)
$RDE\_CAP_{i,t}$	The capitalised amount of R&D in the year scaled by the market value of equity.	Net development costs (DS WC02504 from 2005; Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005, Extel prior to 2005); Market capitalisation (DS WC08001)
$CAPRD_{i,t}$	Indicator variable, equal to one if a company capitalises R&D expenditure during the year, and zero otherwise.	Net development costs (DS WC02504 from 2005; Extel prior to 2005); amortisation of R&D (DS WC01153 from 2005, Extel prior to 2005); Market capitalisation (DS WC08001)
Board size	The total number of directors on the board.	Boardex
% of non-executives on the board	The percentage of non-executive directors calculated as the number of non-executive directors to the board size.	Boadrex
Strategic ownership	The sum of percentage holdings by investment banks or institutions and pension funds.	% of shares held by investment banks or institutions (DS NOSHIC); % of shares held by pension funds (DS NOSHPF);
Ownership concentration	The % of closely held shares	% Closely held shares (DS WC08021)

Notes:

[a] For ease of exposition, firm and time subscripts are not referred to unless necessary; scaled variables are winsorized at the 1st and 99th percentile points by year.

[b] DS indicates a Datastream item.

[c] Following Haw et al.(2012), we delete observations where this variable is greater than 1 or less than -1.

[d] Thus indicating a capitaliser. This is similar to Oswald and Zarowin (2007) and Oswald (2008).

[e] In constructing these variables we follow Dinh et al. (2016).

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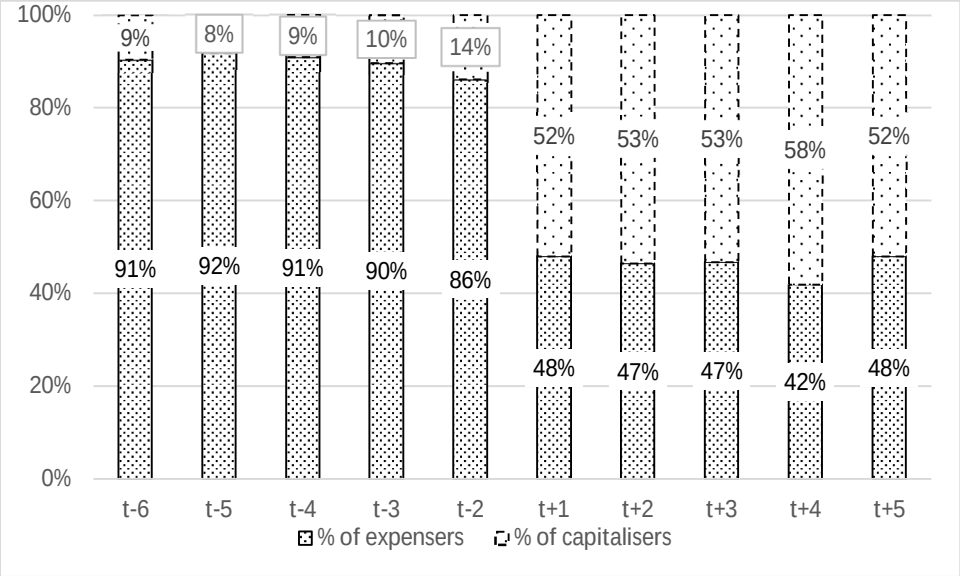

Figure 1. Percentage of capitalisers and expensers before and after the adoption of IFRS.

Table 1. Sample generation process and sample properties

Panel A: Sample selection process

Stage	Selection/exclusion	Firm-years	
1	Firm years of all UK publicly-listed companies in the period between 1999 and 2013[a]		27,285
Exclude firm years:			
2	Firms classified as Financials	(4,653)	
3	Firms classified as Oil and Gas	(1,488)	
4	No R&D expense or R&D asset disclosed in financial statements	(13,410)	
5	Missing returns data (This includes restriction to have data for two consecutive years)	(1,612)	
6	Missing accounting data (This includes restriction to have data for three consecutive years)	(989)	
7	Observations with missing 'Accounting Standards Followed' in Datastream (code WC07536) (or companies with Non-UK GAAP or Non-IFRS)	(46)	
8	Last year of UK GAAP usage and first year of IFRS	(748)	
9	Firm-year observations of firms not adopting IFRS in 2005, 2006, 2007 or 2008	(796)	
10	Firm-year observations relating to firms not appearing in both periods	(995)	
11	Firm-year observations with extreme values (Outliers)[b]	(65)	
12	Inability to estimate probit model[c]	(84)	
	Total firm-years excluded		(24,886)
	Final sample [representing 260 firms]		2,399

Panel B: Sample composition by financial accounting reporting treatment of R&D

	Under UK GAAP		Under IFRS	
Accounting treatment of R&D	Firm-years	Proportion	Firm-years	Proportion
Expensed only (expensers)	961	89.7%	637	48.0%
Capitalisation and/or amortisation (capitalisers)	111	10.3%	690	52.0%
Total	1,072		1,327	

Panel C: Sample composition by industry

	Pre-IFRS		Post-IFRS	
Industry	Expensers	Capitalisers	Expensers	Capitalisers
Basic Resources	57	8 (12%)	73	21 (22%)
Consumer Goods	107	11 (9%)	101	55 (35%)
Consumer Services	12	2 (14%)	6	9 (60%)
Health Care	156	6 (4%)	114	88 (44%)
Industrials	359	56 (13%)	233	295 (56%)
Technology	259	26 (9%)	100	215 (68%)
Telecommunications	11	2 (15%)	10	7 (41%)
Total	961	111	637	690

[a] Based on Datastream's research lists of active (GRP1-6) and dead (DEADUK1-7) companies, with eliminations of: (i) duplicates; (ii) instruments which are not classified as equity; (iii) non-primary issues; (iv) firms reporting in a foreign currency; and (v) firms not geographically located in the UK.

[b] Following Haw et al. (2012), we delete firm-years where the magnitude of net income or net loss exceeds firm market value.

[c] See Section 4.2. for derivation of the inverse Mills ratio, and the results of the probit model estimations in Appendix 1. These are cases where there is no within-industry variation between expensers and capitalisers, all– which are, therefore, removed from our sample.

Table 2. Descriptive statistics

Panel A: Firm-years pre-IFRS adoption												
	Expensers (*n=961*)					Capitalisers (*n=111*)					Comparison	
Variable	Mean	SD	Min	Median	Max	Mean	SD	Min	Median	Max	*t-test*	*Mann-Whitney test*
R_t [a]	0.215	0.844	-0.945	0.034	5.362	0.437	1.870	-0.924	0.077	12.191	-0.221**	-0.044
E_{t+1} [b]	-0.003	0.150	-0.990	0.031	0.302	-0.008	0.199	-0.929	0.045	0.302	0.005	-0.014
E_t [b]	-0.013	0.153	-0.894	0.030	0.277	-0.018	0.171	-0.811	0.023	0.277	0.005	0.007
E_{t-1} [b]	-0.012	0.157	-0.912	0.033	0.319	-0.009	0.154	-0.685	0.020	0.246	-0.003	0.012
R_{t+1} [a]	0.145	0.643	-0.954	0.069	5.278	0.258	0.995	-0.911	0.071	5.278	-0.113*	-0.002
SIZE	11.404	2.231	6.103	11.142	19.180	10.989	2.018	7.825	10.736	16.873	0.416**	0.406*
ROA [a]	-0.041	0.245	-2.535	0.034	0.243	-0.021	0.163	-0.751	0.023	0.175	-0.021	0.011
LEV [a]	1.416	2.674	0.030	0.793	50.012	1.452	1.991	0.044	1.145	19.968	-0.035	-0.352
CAPEX [a]	0.050	0.059	0.000	0.031	0.535	0.065	0.073	0.001	0.043	0.354	-0.014***	-0.011***
CV_RD [a]	0.529	0.283	0.122	0.465	1.974	0.716	0.336	0.233	0.658	1.805	-0.187***	-0.193**
CV_EARN [a]	0.108	4.643	-22.347	0.656	32.767	0.088	2.932	-9.369	0.779	5.337	0.021	-0.123
ZERO_BEAT	0.122	0.327	0.000	0.000	1.000	0.153	0.362	0.000	0.000	1.000	-0.031	0.000
PAST_BEAT	0.211	0.408	0.000	0.000	1.000	0.261	0.441	0.000	0.000	1.000	-0.050	0.000
BETA [a]	1.033	0.805	-0.631	0.857	4.510	1.047	0.815	-0.421	0.896	4.987	-0.014	-0.039
RDINT [a]	0.088	0.121	0.000	0.041	0.818	0.062	0.091	0.000	0.039	0.667	0.026**	0.002
RDVALUE [a]	32.953	119.230	-188.315	7.171	1851.895	44.292	159.129	-188.315	5.660	1327.000	-11.339	1.511
BM [a]	0.602	0.518	0.008	0.463	3.287	0.636	0.578	0.028	0.496	3.287	-0.034	-0.034
RDE [a]	0.060	0.085	0.000	0.035	0.736	0.066	0.090	0.000	0.034	0.482	-0.006	0.001
RDE_CAP [a]	0.000	0.000	0.000	0.000	0.000	0.024	0.040	0.000	0.013	0.380	-0.024***	-0.013***
RDE_EXP [a]	0.060	0.085	0.000	0.035	0.736	0.039	0.076	0.000	0.008	0.473	0.021***	0.027***
IMR	0.739	0.049	0.576	0.740	0.900	0.693	0.050	0.545	0.695	0.806	0045***	0.045***

(*Continued*)

Table 2. Continued

Panel B: Firm-years post-IFRS adoption												
	Expensers (*n=637*)					Capitalisers (*n=690*)					Comparison	
Variable	Mean	SD	Min	Median	Max	Mean	SD	Min	Median	Max	*t-test*	*Mann-Whitney test*
R_t [a]	0.179	0.539	-0.857	0.100	3.054	0.194	0.571	-0.857	0.114	3.054	-0.015	-0.013
E_{t+1} [b]	0.027	0.137	-0.784	0.059	0.626	0.034	0.152	-0.938	0.060	0.445	-0.007	-0.001
E_t [b]	0.015	0.148	-0.961	0.054	0.443	0.022	0.160	-0.855	0.055	0.828	-0.007	-0.001
E_{t-1} [b]	0.011	0.172	-1.000	0.048	0.863	0.037	0.154	-0.763	0.050	0.863	-0.026***	-0.002**
R_{t+1} [a]	0.161	0.551	-0.901	0.087	3.281	0.177	0.581	-0.923	0.096	3.281	-0.016	-0.009
SIZE	12.077	2.774	6.977	11.625	18.687	11.420	2.322	6.884	11.020	18.293	0.657***	0.605***
ROA [a]	-0.015	0.241	-1.610	0.047	0.252	0.032	0.151	-1.506	0.057	0.277	-0.047***	-0.009***
LEV [a]	1.588	2.491	0.011	0.932	23.338	1.200	2.096	0.011	0.752	23.338	0.389***	0.180***
CAPEX [a]	0.049	0.068	0.000	0.027	0.509	0.044	0.060	0.000	0.023	0.499	0.005*	0.004
CV_RD [a]	0.525	0.335	0.122	0.440	2.158	0.585	0.279	0.122	0.514	1.805	-0.060***	-0.074***
CV_EARN [a]	-0.071	3.494	-22.347	0.621	11.492	0.134	4.785	-17.345	0.669	32.767	-0.205	-0.048**
ZERO_BEAT	0.085	0.279	0.000	0.000	1.000	0.151	0.358	0.000	0.000	1.000	-0.066***	0.000***
PAST_BEAT	0.179	0.384	0.000	0.000	1.000	0.307	0.462	0.000	0.000	1.000	-0.128***	0.000***
BETA [a]	0.965	0.544	-0.619	0.933	2.647	0.978	0.602	-0.355	0.893	2.985	-0.013	0.040
RDINT [a]	0.080	0.145	0.000	0.022	1.008	0.068	0.080	0.000	0.041	0.621	0.011**	-0.019***
RDVALUE [a]	48.211	168.810	-352.083	7.893	1961.733	27.667	185.660	-150.002	4.788	3178.567	20.544**	3.105***
BM [a]	0.646	0.633	0.004	0.474	5.990	0.795	0.745	0.019	0.536	5.363	-0.149***	-0.062***
RDE [a]	0.056	0.085	0.000	0.024	0.807	0.082	0.116	0.000	0.041	0.779	-0.027***	-0.016***
RDE_CAP [a]	0.000	0.000	0.000	0.000	0.000	0.031	0.058	0.000	0.008	0.643	-0.031***	-0.008***
RDE_EXP [a]	0.055	0.082	0.000	0.024	0.611	0.050	0.086	0.000	0.022	0.631	0.005	0.002***
IMR	0.540	0.097	0.321	0.523	0.985	0.470	0.079	0.255	0.471	0.714	0.070***	0.052***

Notes:
[a] Winsorised up to 1% and beyond 99%.
[b] Trimmed below -1 and beyond +1.
All variables are defined in Appendix 2. *, ** and *** denote significance at the 10%, 5% and 1% respectively.

Table 3. Capitalisation of R&D and the informativeness of stock prices.

Panel A: Empirical results from estimation of Equation (2)				
Variables	Predicted sign	Full sample	Pre-IFRS	Post-IFRS
Constant	?	0.356*	0.478*	-0.081
		(1.73)	(1.88)	(-0.78)
E_{t+1}	+	0.899***	0.801***	1.071***
		(7.69)	(5.68)	(4.50)
E_t	+	0.567***	0.601***	0.525**
		(4.26)	(4.12)	(2.32)
E_{t-1}	–	-0.722***	-0.764***	-0.720***
		(-5.83)	(-4.19)	(-5.05)
R_{t+1}	–	-0.163***	-0.191***	-0.119***
		(-5.76)	(-4.69)	(-3.81)
CAP_t*E_{t+1}	+	0.093	1.171**	-0.301
		(0.52)	(2.52)	(-1.05)
CAP_t*E_t	?	0.032	-0.255	0.099
		(0.17)	(-0.66)	(0.35)
CAP_t*E_{t-1}	?	-0.406	-1.971**	-0.173
		(-1.46)	(-2.05)	(-0.76)
CAP_t*R_{t+1}	?	0.007	-0.224	0.054
		(0.14)	(-1.40)	(1.26)
CAP_t	?	0.113**	0.363**	0.051*
		(2.40)	(2.17)	(1.89)
IMR_t	?	0.151***	0.081	0.133**
		(2.98)	(0.87)	(2.12)
Industry fixed effects		Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes
Observations		2,399	1,072	1,327
Adj. R^2		0.188	0.184	0.227
F-statistic		25.97	16.36	20.04
Mean VIF		2.05	1.58	2.75
Max. VIF		2.87	2.04	4.16

Panel B: Testing change in FERC and ERC between pre- and post-IFR adoption phases			
	Predicted sign	Difference	*z*-statistic
Incremental FERC			
ΔIncremental FERC	–	-1.472***	
Capitalisers			-2.60
FERC			
ΔFERC Expensers	?	0.270	0.97
ΔFERC Capitalisers	–	-1.202**	-2.42
ERC			
ΔERC Expensers	?	-0.076	-0.31
ΔERC Capitalisers	?	0.277	0.68

Notes: Standard errors are clustered at the firm level. *t*-statistics in parentheses. The detail of industry and year fixed effects are omitted in the interests of brevity. All variables are defined in Appendix 2. *, ** and *** denote significance at the 10%, 5% and 1% respectively.

Table 4. Capitalisation of R&D and the informativeness of stock prices, conditional on corporate governance strength.

	Poor corporate governance				Strong corporate governance			
Variables	Small boards	Low % of non-executives on the board	Low strategic ownership	High ownership concentration	Large boards	High % of non-executives on the board	High strategic ownership	Low ownership concentration
Constant	-0.153	-0.005	-0.030	-0.106	-0.159	-0.270**	-0.002	-0.020
	(-1.42)	(-0.05)	(-0.23)	(-0.66)	(-1.51)	(-2.23)	(-0.01)	(-0.11)
E_{t+1}	1.266***	1.122***	0.936***	0.762***	1.392**	1.407***	1.551***	1.999***
	(5.19)	(3.57)	(2.92)	(2.79)	(2.23)	(3.73)	(4.39)	(4.40)
E_t	0.708***	0.665***	0.295	0.542**	0.300	0.369	0.338	0.247
	(3.16)	(2.74)	(0.77)	(2.28)	(0.40)	(0.58)	(0.95)	(0.50)
E_{t-1}	-0.619***	-0.710***	-0.613*	-0.746***	-1.285***	-0.612*	-0.684***	-0.853***
	(-3.52)	(-3.66)	(-1.97)	(-4.89)	(-3.46)	(-1.80)	(-3.18)	(-2.85)
R_{t+1}	-0.138***	-0.150***	-0.165***	-0.103**	-0.099	-0.106**	-0.063	-0.151**
	(-3.23)	(-3.09)	(-3.68)	(-2.52)	(-1.64)	(-2.25)	(-1.11)	(-2.51)
CAP_t*E_{t+1}	-0.508	-0.192	-0.314	-0.101	-0.154	-0.732	-0.344	-0.746
	(-1.64)	(-0.50)	(-0.84)	(-0.30)	(-0.21)	(-1.58)	(-0.79)	(-1.63)
CAP_t*E_t	-0.046	-0.011	0.340	0.139	-0.053	0.188	0.117	0.052
	(-0.16)	(-0.04)	(0.78)	(0.46)	(-0.06)	(0.27)	(0.27)	(0.10)
CAP_t*E_{t-1}	-0.229	-0.218	-0.417	-0.031	0.278	-0.197	-0.182	-0.356
	(-0.85)	(-0.65)	(-1.06)	(-0.12)	(0.53)	(-0.45)	(-0.61)	(-0.77)
CAP_t*R_{t+1}	0.042	0.065	0.097	0.031	0.057	0.057	0.015	0.094
	(0.71)	(1.06)	(1.54)	(0.56)	(0.72)	(0.76)	(0.22)	(1.27)
CAP_t	0.078**	0.057	0.077**	0.048	0.019	0.075**	0.045	0.066
	(2.15)	(1.47)	(1.99)	(1.20)	(0.39)	(2.13)	(1.14)	(1.61)
IMR_t	0.235***	0.178**	0.140	0.124	0.191***	0.210**	0.056	0.084
	(2.88)	(2.37)	(1.62)	(1.34)	(2.64)	(2.13)	(0.54)	(0.75)
Industry/Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	740	714	665	638	503	529	563	663
Adj. R^2	0.237	0.256	0.217	0.224	0.232	0.196	0.263	0.233
F-statistic	16.66	17.92	11.49	10.69	9.225	7.614	11.26	15.55
Mean VIF	2.72	2.68	3.92	2.71	3.30	3.43	2.36	3.02
Max. VIF	4.14	3.91	6.92	3.83	5.25	6.80	3.53	4.97

Notes: Firms are considered to have poor (strong) corporate governance if: i) the size of the board is below (above) the industry and year median of all firms in the sample; ii) the % of non-executives on the board is below (above) the industry and year median of all firms in the sample; iii) the level of ownership by pension funds and institutional investors (i.e., strategic ownership) is below (above) the industry and year median of all firms in the sample; and iv) the ownership concentration is above (below) the industry and year median of all firms in the sample. All variables are defined in Appendix 2. Standard errors are clustered at the firm level. *t*-statistics in parentheses. *, ** and *** denote significance at the 10%, 5% and 1% respectively.

Table 5. Capitalisation of R&D and the informativeness of stock prices conditional on earnings management incentives.

Variables	Suspect firm-years	Non-suspect firm-years
Constant	-0.112	0.237
	(-0.81)	(0.90)
E_{t+1}	0.960***	1.197***
	(2.86)	(4.83)
E_t	0.307	0.772***
	(0.88)	(3.28)
E_{t-1}	-0.422**	-1.276***
	(-2.35)	(-5.77)
R_{t+1}	-0.088*	-0.150***
	(-1.80)	(-3.18)
CAP_t*E_{t+1}	-0.216	-0.451
	(-0.56)	(-1.20)
CAP_t*E_t	0.388	-0.296
	(0.95)	(-0.91)
CAP_t*E_{t-1}	-0.465*	0.345
	(-1.67)	(0.81)
CAP_t*R_{t+1}	0.025	0.091
	(0.42)	(1.04)
CAP_t	0.060	0.044
	(1.50)	(1.00)
IMR_t	0.189**	-0.123
	(2.48)	(-0.70)
Industry/Year fixed effects	Yes	Yes
Observations	782	545
Adj. R^2	0.212	0.270
F-statistic	12.12	17.64
Mean VIF	2.60	3.00
Max. VIF	3.97	4.54

Notes: Standard errors are clustered at the firm level. *t*-statistics in parentheses. Suspect firm-years meet one of these conditions: this year's R&D expenditure is below last year's R&D expenditure; prior year's earnings are greater than this year's earnings assuming full expensing, and lower than this year's earnings assuming full capitalisation; zero earnings threshold is greater than this year's earnings assuming full expensing, and lower than this year's earnings assuming full capitalisation. All variables are defined in Appendix 2. *, ** and *** denote significance at the 10%, 5% and 1% respectively.

Table 6. Uncertainty of R&D expenditure.

Panel A: Empirical results from estimation of Equations (3) and (4) for the full sample					
		Equation (3)		Equation (4)	
Variables	Predicted sign	Pre-IFRS	Post-IFRS	Pre-IFRS	Post-IFRS
Constant	?	0.189***	0.179***	0.189***	0.182***
		(7.01)	(3.95)	(6.86)	(3.82)
RDE_t^a	+	0.267***	0.220***		
		(4.71)	(3.48)		
RDE_CAP_t	+			-0.092	0.368***
				(-0.88)	(3.75)
RDE_EXP_t	+			0.279***	0.182**
				(4.79)	(2.52)
$CAPRD_t$	?			0.016	-0.012
				(1.20)	(-1.25)
LEV_t	+	0.003***	0.004**	0.003***	0.004**
		(2.69)	(2.20)	(2.63)	(2.13)
$SIZE_t$	–	-0.009***	-0.007***	-0.009***	-0.007***
		(-5.08)	(-2.95)	(-5.18)	(-2.91)
$CAPEX_t$	+	0.139**	0.327***	0.137**	0.319***
		(2.24)	(4.11)	(2.23)	(4.03)
IMR_t	?	-0.023**	-0.051***	-0.023**	-0.051***
		(-2.44)	(-3.29)	(-2.54)	(-3.07)
Industry fixed effects		Yes	Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes	Yes
Observations		1,058	819	1,058	819
Adj. R^2		0.273	0.283	0.277	0.289
F-statistic		11.10	10.10	9.939	10.44
Mean VIF		1.15	1.17	1.42	1.24
Max. VIF		1.23	1.33	1.23	1.37

(*Continued*)

Table 6. Continued

Panel B: Empirical results from estimation of Equations (3) and (4) for non-suspect firm-years					
		Equation (3)		Equation (4)	
Variables	Predicted sign	Pre-IFRS	Post-IFRS	Pre-IFRS	Post-IFRS
Constant	?	0.220***	0.282***	0.218***	0.281***
		(5.94)	(3.12)	(5.92)	(3.06)
RDE_t^a	+	0.385***	0.239***		
		(3.53)	(2.91)		
RDE_CAP_t	+			-0.543	0.231**
				(-1.01)	(2.18)
RDE_EXP_t	+			0.407***	0.216*
				(3.52)	(1.88)
$CAPRD_t$	?	0.011	-0.016	0.032*	-0.016
		(0.71)	(-1.30)	(1.67)	(-1.30)
LEV_t	+	0.004***	0.008*	0.004***	0.008
		(3.10)	(1.66)	(3.05)	(1.65)
$SIZE_t$	–	-0.009***	-0.004	-0.008***	-0.004
		(-3.73)	(-1.16)	(-3.61)	(-1.19)
$CAPEX_t$	+	0.111	0.392***	0.129	0.395***
		(1.03)	(3.43)	(1.22)	(3.45)
IMR_t	?	-0.036***	-0.154***	-0.038***	-0.152***
		(-2.62)	(-2.78)	(-2.75)	(-2.71)
Industry fixed effects		Yes	Yes	Yes	Yes
Year fixed effects		Yes	Yes	Yes	Yes
Observations		496	352	496	352
Adj. R^2		0.317	0.240	0.323	0.237
F-statistic		7.018	5.294	6.629	4.980
Mean VIF		1.19	1.23	1.44	1.22
Max. VIF		1.37	1.47	1.99	1.47

Notes: Panel A shows the results for all firm-years with available data. Panel B shows the results when we exclude suspect firm-years (as defined in Table 4). Standard errors are clustered at the firm level. *t*-statistics in parentheses. All variables are defined in Appendix 2. *, ** and *** denote significance at the 10%, 5% and 1% respectively.

Table 7. Short and long term market performance of capitalisers and expensers, before and after the adoption of IFRS.

	Capitalisers	Expensers	Comparison	*t*-statistic
Panel A: 1-year abnormal returns				
Pre-IFRS	0.152**	0.067***	0.084*	1.39
	(108)	(952)		
Post-IFRS	0.143***	0.117***	0.026	0.85
	(530)	(506)		
Panel B: 5-year abnormal returns				
Pre-IFRS	0.629***	0.320***	0.309**	2.14
	(108)	(952)		
Post-IFRS	0.938***	0.721***	0.217**	1.77
	(530)	(506)		

Notes: Number of observations is shown in brackets. *, ** and *** denote significance at the 10%, 5% and 1% respectively. Differences in mean returns are tested with a t-test.