Capitalizing Research & Development: Signaling or Earnings Management?

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ABSTRACT This paper analyzes the capitalization of Research & Development (R&D) expenditures under International Financial Reporting Standards (IFRS). Discretionary R&D capitalization can be exercised by managers to signal private information on future economic benefits to the market. It can, however, also serve as opportunistic earnings management. We analyze a unique, hand-collected sample of highly R&D intensive German IFRS firms during 1998–2012. We find that market values are not associated with capitalized R&D for the overall sample, indicating that earnings management may be a concern. We identify firm-years for which R&D capitalization is possibly used for pushing their earnings above a specific threshold (e.g. analysts' forecasted earnings, prior year's earnings). Our results show that both the decision to capitalize and how much to capitalize are strongly associated with benchmark beating. Consistently, we find that market values are negatively associated with capitalized R&D for firms who are likely to use capitalization for benchmark beating (about one third of the overall sample). On the other hand, the market values R&D capitalization positively for well-performing firms, for which capitalizing does not matter to beat an earnings benchmark (about half of the overall sample). This finding is robust to controls for endogeneity, various deflators, and different measures for earnings management.

1. Introduction

The accounting for Research & Development (R&D) remains a controversial issue. While some argue that R&D expenditures are investments and should be capitalized (e.g. Lev & Sougiannis, 1996), others question the reliability of such information (e.g. Kothari, Laguerre, & Leone, 2002). The International Accounting Standards Board (IASB) prescribes capitalization when economic benefits can be demonstrated. However, other standard setters (e.g. Financial Accounting Standards Board (FASB)) fear possible earnings management and prefer the immediate expensing of R&D, implying that they believe 'the cost of possible misstatement to exceed the benefits of signaling' (Ahmed & Falk, 2006, p. 234). The extant literature has found conflicting evidence in different settings.

Proponents of R&D capitalization suggest that managers can use discretion to signal their private information about the expected success of R&D ventures and the related future benefits

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to the market (Abrahams & Sidhu, 1998; Oswald & Zarowin, 2007; Ritter & Wells, 2006). In some settings, capitalizing R&D has been found to be informative (e.g. Ahmed & Falk, 2006 under Australian generally accepted accounting principles (GAAP); Oswald & Zarowin, 2007 under UK GAAP). In other settings, research has found evidence that the discretion involved in R&D capitalization can be used for opportunistic earnings management, resulting in capitalization being uninformative (Cazavan-Jeny & Jeanjean, 2006; Markarian, Pozza, & Prencipe, 2008; Prencipe, Markarian, & Pozza, 2008).

While R&D capitalization was historically allowed on a discretionary basis in some countries under domestic GAAP (e.g. Australia, France, and the UK), R&D capitalization under IAS 38 is mandatory when meeting the restrictive conditions in IAS 38.57.[1] By imposing these restrictions, the IASB arguably reduces the discretion involved in R&D capitalization (Markarian et al., 2008; Matolcsy & Wyatt, 2006). The criteria in IAS 38.57 test for technical and commercial feasibility are intended to evaluate the likelihood that future economic benefits (FEBs) will flow to the firm as a consequence of the project. Applying such restrictive conditions would lead us to expect that, under International Financial Reporting Standards (IFRS), only development expenditures from those R&D projects, which are highly likely to be successful, are capitalized. However, since the application of these conditions requires managers to make judgment, R&D capitalization[2] under IAS 38 remains subject to managerial discretion and possible earnings management. In fact, the recognition criteria are almost identical to those in SFAS 86 (now ASC 350–40) for software development under US GAAP. Aboody and Lev (1998), Ciftci (2010), and Mohd (2005) analyze the determinants driving this decision and confirm the discretion involved. Since R&D can involve even more uncertainty than software development, we expect capitalization under IAS 38 to be subject to substantial discretion.

As Oswald and Zarowin (2007, p. 705) point out, 'whether or not capitalization provides information benefits to the market, resulting in more informative prices, is ultimately an empirical question'. So far, no empirical study that we are aware of has analyzed the trade-off between signaling and earnings management for R&D capitalization under IFRS. This paper seeks to fill this gap.

Our analysis is based on the 150 largest German publicly listed firms between 1998 and 2012. We choose the German setting for the following reasons. First, R&D is a significant activity for many German firms, which largely rely on R&D as a source of economic success. The average R&D intensity in our sample is 3.8%, which is high compared to the average R&D intensity of the German economy (2.5%) and the European average of 2% (OECD, 2009). Second, the accounting for R&D under IAS 38 is considered highly discretionary in Germany (Baetge & von Keitz, 2006; Leibfried & Pfanzelt, 2004). The application of the criteria for R&D

[1]IAS 38 prescribes a general expensing rule for research expenditures. Development expenditures need to be capitalized if the entity can demonstrate all of the following (IAS 38.57):
(a) the technical feasibility of completing the intangible asset so that it will be available for use or sale.
(b) its intention to complete the intangible asset and use or sell it.
(c) its ability to use or sell the intangible asset.
(d) how the intangible asset will generate probable future economic benefits. Among other things, the entity can demonstrate the existence of a market for the output of the intangible asset or the intangible asset itself or, if it is to be used internally, the usefulness of the intangible asset.
(e) the availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset.
(f) its ability to measure reliably the expenditure attributable to the intangible asset during its development.

[2]Note that only development expenditures can be capitalized under IAS 38. Research expenditures generally have to be expensed. Development expenditures are only capitalized from the point in time when the criteria are met. Development expenditures which occurred before that date are expensed. For brevity, we refer to 'R&D capitalization' as the fact that some portion of the overall R&D expenditures is capitalized. Hence, 'capitalized R&D' in this context includes development expenditures only.

capitalization in IAS 38.57 has been one of the main areas of material misrepresentations detected by the German Financial Reporting Enforcement Panel (Meyer & Naumann, 2009). For example, firms within the same industry and with similar structures have capitalized very different percentages of R&D. We can therefore expect to find large variation in the application of the standard and that there is a need for the market to thoroughly analyze the underlying economic fundamentals.

In our first set of analyses, we study the determinants of R&D capitalization. In addition to variables that have been found relevant in prior literature (e.g. Oswald, 2008), we include measures for benchmark beating (e.g. analysts' forecasted earnings, prior year's earnings). We identify firm-years for which R&D capitalization is relevant in pushing their earnings above a specific threshold; that is, when the benchmark falls into the range between earnings assuming R&D expensing and earnings assuming R&D capitalization. We expect that firm-years falling within this range (the 'suspect group') may be more inclined to use R&D capitalization as a means for earnings management.

We find that the pressure to beat past year's earnings and analysts' forecast of earnings increases the probability of a firm capitalizing R&D in the current period. In addition, we also find that firms are capitalizing higher amounts of R&D when they have lower growth opportunities and higher leverage. This evidence is in line with the notion of firms opportunistically managing earnings via R&D capitalization. The findings are consistent for both the decision to capitalize and how much to capitalize.

Second, we analyze market prices regarding the question of how investors interpret R&D capitalization when earnings management is likely (the suspect group). For the overall sample, we find that the market does not price capitalized R&D. For the suspect group (about one third of the overall sample), we find that R&D capitalization is negatively associated with market values, while for the non-suspect firm-years it is not significantly priced by the market. When analyzing the 'non-suspect group' in more detail, we observe a positive association between R&D capitalization and market values for a subsample of firms that are performing well independent of the R&D accounting (positive earnings before R&D). Our results are robust to various sensitivity checks and controls for self-selection and endogeneity of the capitalization decision.

We contribute to the debate regarding the accounting for internally generated intangibles, an area where major differences between US GAAP and IFRS still exist. Our results show that the capitalization of R&D under IAS 38 is informative under certain conditions, but the presence of earnings management counteracts the signaling value of capitalization.

We also contribute to the literature on the consequences of earnings management. Prior studies have found evidence for both positive and negative consequences of benchmark beating (e.g. Athanasakou, Strong, & Walker, 2011; Bartov, Givoly, & Hayn, 2002; Herrmann, Hope, Payne, & Thomas, 2011; Hribar, Jenkins, & Johnson, 2006; Skinner & Sloan, 2002). Different responses to benchmark beating may be explained by the fact that some types of earnings management are more easily detected than others (Dechow, Ge, & Schrand, 2010; De Jong, Mertens, Van der Poel, & Van Dijk, 2014). De Jong et al. (2014) find that while analysts view all earnings management actions to reach a benchmark as value destroying, they are not able to unravel earnings management (Burgstahler & Eames, 2003; Eames & Kim, 2012). Our analysis provides a setting in which market participants seem to be able to distinguish between the cases of earnings management and signaling. We show that while R&D capitalization in the context of benchmark beating is punished by the market, investors seem to be able to identify cases of 'truthful' R&D capitalization.

Our findings also contribute to the literature on accounting choice. The research question analyzed is at the heart of the accounting choice literature: generally, accounting choice can be informative or self-serving. 'In practice, it is difficult to distinguish between these two situations, but it is the presence of such mixed motives that makes the study of accounting choice

interesting' (Fields, Lys, & Vincent, 2001, p. 259). Our study sheds light on this distinction and provides evidence for both fundamental and opportunistic drivers of R&D capitalization in conjunction with benchmark beating. Our findings have important implications for future studies: we establish that the market can identify cases of earnings management and acts accordingly, implying a need to control for the degree of earnings management when studying the informativeness of accounting choice.

The remainder of the paper is organized as follows. Theoretical background and research questions are provided in Section 2. Section 3 explains our research design. Section 4 describes the sample and presents the main empirical results. Concluding remarks are in Section 5.

2. Theoretical Background and Research Questions

2.1. R&D Capitalization and earnings management

Various studies provide evidence for the value relevance of R&D capitalization from different institutional settings where capitalization was permitted under national GAAP, pre-IFRS adoption. For example, Abrahams and Sidhu (1998), Ahmed and Falk (2006), and Ritter and Wells (2006) all demonstrate the value relevance of R&D capitalization for Australian firms; Smith, Percy, and Richardson (2001) for a sample of Canadian and Australian firms; Callimaci and Landry (2004) for Canadian firms; and Oswald and Zarowin (2007) for UK firms.

For other settings, the literature finds that managers use the discretion involved in R&D capitalization for opportunistic earnings management. For example, Cazavan-Jeny and Jeanjean (2006) find a negative association between capitalized R&D and stock prices in a sample of French firms and attribute the results to an opportunistic use of R&D capitalization. In addition, Cazavan-Jeny, Jeanjean, and Joos (2011) show that the decision to capitalize is associated with a negative or neutral impact on future performance. For an Italian sample, Prencipe et al. (2008) and Markarian et al. (2008) find that discretionary accounting for R&D is used as a tool for managing earnings, resulting in lower explanatory power of earnings. They attribute the negative coefficient on capitalized R&D to the fact that investors are concerned with, and react negatively to, capitalization of R&D. For a German sample, Dinh, Eierle, Steeger, and Schultze (2015) find that R&D capitalization under IAS 38 increases individual analyst forecast errors. For a US sample, Ciftci (2010) shows that the capitalization of software development under SFAS 86 (now ASC 350–40) reduces earnings quality.

In the earnings management literature, R&D is a prime example used for both real and accounting earnings management (e.g. Dechow & Skinner, 2000). Real earnings management exists in multiple forms, but the most frequently cited form is the reduction of discretionary spending on R&D, advertising and maintenance (Graham, Harveya, & Rajgopal, 2005). Several studies have analyzed how the capital market responds to reductions in R&D investments for meeting earnings goals (Baber, Fairfield, & Haggard, 1991; Bushee, 1998; Dechow & Sloan, 1991; García Osma & Young, 2009; Mande, File, & Kwak, 2000; Perry & Grinaker, 1994). For example, García Osma and Young (2009) find that earnings increases, accompanied by unexpected cuts in R&D spending, receive a lower valuation, depending on the perceived reason for the cut.

Real and accounting earnings management are used interchangeably by managers (Zang, 2012). Given that real earnings management is costly due to its negative effects on the future prospects of the firm, managers may prefer accounting earnings management (Bushee, 1998; Mande et al., 2000). By using discretionary accounting rather than discretionary spending, managers may be able to achieve the same results in a less costly manner. In the current study, we therefore focus on accounting earnings management related to benchmark beating, but control for real earnings management.

Cazavan-Jeny et al. (2011) discuss the implications of the R&D capitalization decision for the financial statements and related ratios in both the year of the decision and subsequent periods. The decision to capitalize will affect the income statement and the balance sheet, as well as the cash flow statement. While understating performance in the current period, expensing will result in overstated performance measures in future periods, as well as in greater volatility (Cazavan-Jeny et al., 2011). Given the multitude of these dynamic effects, the link between the capitalization decision and different earnings management motives is ambiguous. Firms may decide to capitalize in order to improve current performance but may also decide to expense to improve future performance, for example, in cases of a 'Big Bath'. Hence, R&D accounting may be used for various earnings management strategies.[3]

Common motives to conduct earnings management are: to avoid earnings decreases or losses (Burgstahler & Dichev, 1997), to meet or beat analysts' forecasts, and to maintain or improve market valuation (Dechow & Skinner, 2000). The literature uses different proxies to capture these different forms of earnings management. For example, Dechow et al. (2010) distinguish between three main categories: variables to capture smoothing (earnings persistence), abnormal accruals, and target beating. In this study, we focus on target beating (Dechow et al., 2010; Harris, Shi, & Xie, 2013) and expect that beating a particular benchmark influences management's capitalization decision.

2.2. Fundamental and Opportunistic Determinants of R&D Capitalization

Prior research has shown that the choice to capitalize R&D is driven by various factors (Oswald, 2008; Oswald & Zarowin, 2007). These factors can be fundamental in nature; that is, they can represent fundamental differences between firms, which lead to differences in their ability to meet the requirements of the standard in order to capitalize. For example, Aboody and Lev (1998) show that firm characteristics drive the decision to capitalize software development expenditures under SFAS 86 (now ASC 350−40) with recognition criteria similar to IAS 38. Oswald (2008) finds that the capitalization decision depends on firm-specific factors, such as firm size, earnings sign, and leverage for UK firms. On the other hand, managers may have incentives to act opportunistically and use the discretion involved in R&D capitalization for earnings management. Accordingly, the literature has used several variables to capture these incentives, for example, growth opportunities, leverage, or profitability (Markarian et al., 2008). While studying this distinction is at the heart of the accounting choice literature, it is, however, difficult to clearly distinguish between fundamental and opportunistic determinants (Fields et al., 2001).

In this study, we consider variables commonly used to capture earnings management (Dechow et al., 2010) in order to explain part of the R&D capitalization decision. Cazavan-Jeny et al. (2011) find in their sample of French GAAP firms that the R&D capitalization decision is related to meeting earnings benchmarks. Similarly, we expect R&D capitalization under IAS 38 to be associated with variables capturing different earnings management strategies (Degeorge, Patel, & Zeckhauser, 1999). We expect that firms may have incentives to capitalize more R&D when this helps in beating benchmarks, such as analysts' forecasts or past year's earnings. Also, firms may want to avoid a loss and try to lift earnings above the threshold of a zero profit (zero benchmark). These motives are similar to the ones analyzed in the literature examining the effects of cutting R&D spending (e.g. García Osma & Young, 2009).

[3]Note that while earnings management may also occur for tax purposes, R&D capitalization for accounting versus tax purposes is not relevant in our study. Under German tax regulations, R&D generally has to be expensed as incurred and, hence, provides no incentives for earnings management for tax purposes.

Cutting R&D spending can also be used to meet earnings benchmarks (Cohen, Dey, & Lys, 2008; Graham et al., 2005). As an ongoing activity during the fiscal year, it is linked closely to last year's performance. García Osma and Young (2009) find that firms cut R&D spending when they failed to meet an earnings benchmark in the previous year. By using accounting earnings management, the firm can react to contemporaneous performance and use R&D capitalization to beat current benchmarks. In this paper, we focus on R&D capitalization and control for cutting R&D spending.

Based on prior research on the drivers of R&D capitalization (Oswald, 2008; Oswald & Zarowin, 2007), we expect that benchmark beating can be an additional opportunistic factor for firms to capitalize R&D. Hence, the first research question we examine is stated as follows:

RQ1: Is beating earnings targets an important driver of management's decision to capitalize R&D under IFRS?

Overall, we expect that beating earnings benchmarks is an important driver of the decision to capitalize R&D. Given this expectation, the next question we examine is how the capital market responds to R&D capitalization when it is associated with earnings management.

2.3. Benchmark Beating and the Market Pricing of R&D Capitalization

Prior studies find evidence for both positive and negative consequences of target beating (Athanasakou et al., 2011; Bartov et al., 2002; Herrmann et al., 2011; Hribar et al., 2006; Skinner & Sloan, 2002). Firms that meet earnings benchmarks consistently over time are priced at a premium (Bartov et al., 2002; Kasznik & McNichols, 2002). At the same time, investors discount downward earnings management of which they are aware (Dechow et al., 2010). Different responses to target beating may be explained by the fact that some types of earnings management are more easily detected than others (Dechow et al., 2010; De Jong et al., 2014). Analytical models of earnings management, where the capital market has partial knowledge about management's objectives, show that reporting bias in the manager's report reduces its value relevance (Fischer & Verrecchia, 2000). In a recent survey, De Jong et al. (2014) find that chief financial officers (CFOs) believe that investors expect them to meet earnings benchmarks because missing them is considered a signal for negative future prospects. On the other hand, analysts view all earnings management actions to reach a benchmark as value destroying. In addition, prior literature shows that while being aware of earnings management, analysts are not able to unravel earnings management (Burgstahler & Eames, 2003; Eames & Kim, 2012). De Jong et al. (2014) therefore conclude that analysts' inability to unravel certain earnings management actions explains CFOs' preferences for earnings management. How investors react to R&D capitalization when it is possibly perceived as earnings management is an open question.

Prior literature analyzes the relevance of discretionary R&D capitalization primarily against the background of signaling theory. The discretion involved in R&D capitalization can be used by managers to signal their private information about the success of R&D projects to the market. Ahmed and Falk (2006, p. 232) argue that 'when a firm capitalizes expenditure and reports the amount as an asset in its financial statements, it signals good news'. Matolcsy and Wyatt (2006) show that, in Australia where capitalization of intangibles has been routine, analysts expect firms with relatively certain intangibles to signal this by capitalizing them.

Generally, signaling theory (Riley, 1975, 2001) establishes that, for a signal to be informative, there need to be costs involved (Dye, 2001; Verrecchia, 1983). A signal is credible only when it is costly for a firm to signal; otherwise all firms could equally benefit from signaling. In the context of R&D capitalization, two types of firms can be distinguished: firms whose R&D

Type of firm	Capitalizing R&D	Expensing R&D
FEBs firm	True signal	False signal (EM)
No FEBs firm	False signal (EM)	True signal

Figure 1. Types of signals regarding R&D accounting

activities result in FEBs and others, where no future benefits are expected. For the capitalization signal to be informative, the net benefits from capitalization should be positive for the 'FEBs' firms only, in order for the 'no FEBs' firms to refrain from capitalizing. If not, both types would engage in signaling and the particular firm-type cannot be inferred. Consequently, investors would not be able to distinguish between a true and a false signal, that is, earnings management. Hence, under such circumstances, it is unclear whether a capitalizing firm belongs to one group or the other. Figure 1 summarizes the different types of signals.

While the costs and benefits of sending a signal may differ across firms, it is not evident that they also differ between the 'FEBs' and 'no FEBs' firms. For two identical firms, with the prospects of an R&D project being the only difference, the costs of preparing and disseminating information are likely to be identical, *ceteris paribus*. Also, the incurred costs of the R&D venture need to be borne in full in either case; different methods of accounting will only affect the timing. If the project fails, even though it was capitalized, the true type is not verifiable in hindsight, as different states of nature equally well explain deviations from expectations. Given the high uncertainty of R&D projects, it is very likely that projects can fail even at a late stage, giving management a large leeway for explanations. Consequently, later sanctions for sending false signals are also not likely. If the market is not able to distinguish between a true and a false signal, the costs as well as the benefits would, *ceteris paribus*, be identical. When managers do not need to fear negative consequences of opportunistic behavior in the future, they may have incentives to use R&D capitalization for earnings management in the current period.

Analysts in many markets have been found to be skeptical of R&D capitalization. For example, Goodacre (1991) finds that UK analysts prefer firms to expense R&D in the period incurred. The same is true for Canadian analysts (Entwhistle, 1999). AIMR (1994) also argues for expensing rather than capitalizing R&D. In Germany, with its long tradition of conservative accounting, analysts are reported to fear the potential earnings management stemming from the R&D capitalization and prefer expensing as incurred (Haller et al., 2008). When market participants are wary of earnings management, capitalization of R&D expenditures can be perceived as bad news (Chan, Faff, Charghori, & Ho, 2007).

If R&D capitalization is 'truthful' in the sense that it is associated with future benefits, we expect market prices to be positively associated with R&D capitalization. If, however, R&D capitalization is subject to earnings management, no positive association with market prices should exist. Cazavan-Jeny and Jeanjean (2006) find a negative association between price and R&D capitalization, which they attribute to opportunistic earnings management. This negative association is consistent with the market's negative perception of capitalization. Given the evidence about the market's negative reaction to perceived earnings management outlined in the previous section, we can expect the market to negatively price R&D capitalization when it is perceived to be used for managing earnings. Our second research question is as follows:

RQ2: How does the market price R&D capitalization under IFRS when it is associated with earnings management?

3. Research Design

3.1. Benchmark Beating as Determinant of R&D Capitalization

We start our analysis with the determinants of R&D capitalization including benchmark beating (RQ1). We build our analysis on prior research showing that the decision to capitalize R&D is endogenous and depends on a number of factors (Cazavan-Jeny et al., 2011; Markarian et al., 2008; Oswald, 2008; Oswald & Zarowin, 2007). In addition, we introduce proxies for benchmark beating as potential determinants. We create dummy variables, which capture whether a firm is more or less likely to use R&D capitalization to beat specific targets. We begin by adjusting earnings in two ways: first, we undo existing R&D capitalization by adding back amortized and impaired R&D to earnings, and subtracting capitalized R&D from earnings. The subsequent adjusted earnings figure therefore assumes that all R&D is expensed (E_adjexp). Secondly, we add back total R&D expenditures to E_adjexp in order to compute a second adjusted earnings figure E_adjcap, which assumes that all R&D is capitalized. If a benchmark, such as the zero threshold, falls inside the range between E_adjexp and E_adjcap, management could potentially beat the benchmark by capitalizing R&D.[4] Based on different benchmarks, we can identify situations in which firms may have used R&D capitalization for benchmark beating. We call these firm-years the 'suspect group'. Our approach is similar to García Osma and Young's (2009) partitioning the sample based on the level of 'pre-managed' earnings relative to target, in order to identify firm-years that cut R&D to meet or beat a specific target. Cazavan-Jeny et al. (2011) also allocate their firm-years to groups in a similar way.

We create a dummy variable BEAT_FORECAST, which equals 1 if the benchmark 'consensus earnings forecast by analysts' is larger than E_adjexp but smaller than E_adjcap. If the benchmark falls outside the range of [E_adjexp; E_adjcap], we set BEAT_FORECAST equal to 0, representing the non-suspect group for this benchmark. In the same fashion, we create a dummy variable for beating prior year's earnings BEAT_PAST_E and the zero line of earnings BEAT_ZERO. Finally, we combine all three benchmark proxies and construct a summary earnings management measure EM_OVERALL, which is 1 if any of the prior individual proxies is 1, and 0 otherwise. We treat each of our earnings management indicator variables as additional determinants for R&D capitalization.

Our study is the first to analyze the determinants of R&D capitalization under IFRS. Given the seemingly stricter recognition criteria under IAS 38 compared to other GAAP, the results may differ from previous evidence, where the capitalization of R&D was optional. We analyze the determinants from two different perspectives: (1) what drives the decision to capitalize and (2) what drives the decision of how much is capitalized? For Equation (1) we run a regression as a probit model with the dummy variable d_cap_{it} as the dependent variable. For Equation (2) we run a Tobit model with the continuous left-censored variable RDCAP_{it} (amount capitalized).

$$\begin{aligned}\text{d\_cap}_{it} = {} & \beta_0 + \beta_1 \text{SIZE}'_{it} + \beta_2 \text{MB}'_{it} + \beta_3 \text{RD\_GROWTH}_{it} + \beta_4 \text{RDINT}_{it} \\ & + \beta_5 \text{LAG\_CAP\_RATIO}_{it} + \beta_6 \text{LEV}'_{it} + \beta_7 \text{ROA}'_{it} + \beta_8 \text{RD\_VALUE}_{it} \\ & + \beta_9 \text{CUT\_RD}_{it} + \beta_{10} \text{BEAT\_BENCH}_{it} + \text{YEAR} + \text{IND} + \varepsilon_{it}, \end{aligned} \quad (1)$$

[4]In Germany, companies report under German GAAP for tax purposes where R&D is immediately expensed. Hence there is no need to make adjustments for tax effects.

$$\begin{aligned}\mathrm{RDCAP}_{it} = {} & \beta_0 + \beta_1 \mathrm{SIZE}'_{it} + \beta_2 \mathrm{MB}'_{it} + \beta_3 \mathrm{RD\_GROWTH}_{it} + \beta_4 \mathrm{RDINT}_{it} \\ & + \beta_5 \mathrm{LAG\_RDCAP}_{it} + \beta_6 \mathrm{LEV}'_{it} + \beta_7 \mathrm{ROA}'_{it} + \beta_8 \mathrm{RD\_VALUE}_{it} \\ & + \beta_9 \mathrm{CUT\_RD}_{it} + \beta_{10} \mathrm{BEAT\_BENCH}_{it} + \mathrm{YEAR} + \mathrm{IND} + \varepsilon_{it}, \end{aligned} \tag{2}$$

where $\mathrm{d\_cap}_{it}$ is an indicator variable that equals 1 if a firm capitalizes R&D, and 0 otherwise, and RDCAP_{it} is the amount capitalized by firm i in year t. Fundamental determinants are SIZE'_{it} (natural logarithm of adjusted total assets), MB'_{it} (adjusted market-to-book (MB) ratio), $\mathrm{RD\_GROWTH}_{it}$ (percentage change in R&D expenditures), RDINT_{it} (R&D intensity = R&D expenditures/total sales), $\mathrm{LAG\_CAP\_RATIO}_{it}$ (capitalization of R&D in the previous year scaled by total R&D expenditures), $\mathrm{LAG\_RDCAP}_{it}$ (capitalization of R&D in the previous year scaled by lagged adjusted total assets), LEV'_{it} (adjusted leverage), ROA'_{it} (adjusted return on assets), $\mathrm{RD\_VALUE}_{it}$ ([market capitalization − book value of equity − net accumulated R&D capitalization]/[current R&D expenditures + lagged R&D expenditures]), $\mathrm{CUT\_RD}_{it}$ (1 if decrease in R&D expenditures, 0 otherwise), and $\mathrm{BEAT\_BENCH}_{it}$ (placeholder for earnings management benchmark being either $\mathrm{BEAT\_FORECAST}_{it}$, $\mathrm{BEAT\_PAST\_E}_{it}$, $\mathrm{BEAT\_ZERO}_{it}$, or $\mathrm{EM\_OVERALL}_{it}$). The regression includes year and industry dummy variables (YEAR and IND).

Variables marked with $'$ are adjusted to values before R&D capitalization (see the appendix).

We start our analysis using the determinants of R&D capitalization from prior studies:

(1) *Firm size*: Our first fundamental factor is SIZE'_{it}. Smaller firms tend to capitalize more R&D expenditures than larger firms since the latter typically perform more basic research (Aboody & Lev, 1998; Smith et al., 2001). On the other hand, capitalizing R&D under IAS 38 requires firms to have internal management accounting systems to determine and demonstrate the future benefits from the R&D venture. Since large firms have more elaborate internal control systems to manage R&D projects more effectively, we can expect large firms to capitalize more R&D. We therefore do not have an *ex ante* expectation for the sign of the relationship.

(2) *Growth opportunities*: We use the MB-ratio before R&D capitalization as a measure of the growth prospects of a firm (MB'_{it}). Growth prospects may be positively related to capitalized R&D (Markarian et al., 2008; Smith et al., 2001). However, the higher the growth expectations for a firm, the riskier the R&D projects regarding their future expected benefits. In the case of young, high growth firms, the portion of research expenditures is likely to be much higher than those of development expenditures. Such firms should have more difficulties to fulfill the cumulative recognition criteria under IAS 38, which would lead to lower capitalization. We therefore do not have an *ex ante* expectation for the sign of the association.

(3) *R&D growth:* $\mathrm{RD\_GROWTH}_{it}$ is used as a proxy for the life-cycle stage of a firm. For steady-state firms, expensing and capitalizing plus amortizing results in the same income, so only few benefits are attainable from capitalizing. Hence, such firms are more likely to expense as this is less costly than capitalization. On the other hand, for firms in the growth stage of R&D activities, capitalization of such expenditures may be value relevant (Oswald, 2008). We have no *ex ante* expectation for R&D growth.

(4) *R&D intensity:* RDINT_{it} determines whether the magnitude of R&D expenditures influences the decision to capitalize versus expense. Oswald and Zarowin (2007) find evidence of R&D intensity as a factor of influence, but with changing signs depending on the type of industry. These results are largely confirmed by Oswald (2008). Furthermore, Wyatt (2005) shows that R&D intensity is an indicator for innovation and rent seeking. We do not have an *ex ante* expectation for the sign of R&D intensity.

(5) *R&D capitalization lag:* Markarian et al. (2008) find that R&D capitalization follows a continuous pattern: the more R&D expenditures had been capitalized in the prior year, the

more likely a firm will capitalize R&D in the current year. We expect a positive sign for $\text{LAG\_CAP\_RATIO}_{it}$ and LAG_RDCAP_{it}, respectively.

(6) *Leverage*: Leverage before R&D capitalization (LEV'_{it}) as a proxy for financial health of a firm is expected to be positively related to the amount of R&D capitalized (e.g. Aboody & Lev, 1998; Wyatt, 2005). Managers are likely to have incentives to capitalize intangible assets in order to meet debt covenants.

(7) *Profitability*: Based on the notion that firms with lower performance have incentives to increase earnings by capitalizing R&D, profitability is expected to be negatively associated with R&D capitalization (Aboody & Lev, 1998; Cazavan-Jeny & Jeanjean, 2006; Oswald, 2008; Markarian et al., 2008; Wyatt, 2005). On the other hand, successful firms are more likely to have projects that meet the recognition criteria for R&D capitalization and hence, are more likely to capitalize. We therefore do not have an *ex ante* expectation for ROA'_{it}.

(8) *R&D program success:* Finally, RD_VALUE_{it}, a proxy for the success of a firm's R&D program, is measured by the MB-difference relative to the cumulative R&D expenditures (R&D assets). The measure captures the value of R&D generated in relation to the input (Oswald, 2008). Firms with higher program success are more likely to capitalize.

We expect that both real earnings management and accounting earnings management as benchmark beating are prevalent in our sample. Hence, we control for real earnings management by integrating a dummy variable CUT_RD_{it} for firms that are cutting R&D expenditures (García Osma & Young, 2009). CUT_RD_{it} takes the value 1 if a firm reports lower R&D expenditures in the current year compared to the previous year, and 0 otherwise. We expect a significantly negative regression coefficient on CUT_RD_{it} since both cutting R&D and capitalizing R&D have the same income-increasing effect.

Consistent with our expectation that the decision to capitalize R&D and the amount capitalized is driven by accounting earnings management, we expect a significant and positive regression coefficient for all four measures of benchmark beating. While we use contemporaneous earnings management proxies in our main analyses, we also investigate the impact of lagged earnings management on future R&D capitalization in our robustness checks.

3.2. Market Pricing of R&D Capitalization and earnings management

Next, we analyze the association of market values and R&D capitalization when considering the impact of earnings management (RQ2). Our regression is based on an Ohlson-type (1995) model as follows:

$$\begin{aligned}\text{MV}_{it+3\text{months}} = {} & \beta_0 + \beta_1 E'_{it} + \beta_2 \text{BV}'_{it} + \beta_3 \text{RDCAP}_{it} + \beta_4 \text{RDEXP\_EXP}_{it} \\ & + \beta_5 \text{RDEXP\_CAP}_{it} + \beta_6 \text{SIZE}'_{it} + \beta_7 \text{LEV}'_{it} + \beta_8 \text{SALES\_GROWTH}_{it} \\ & + \beta_9 \text{RD\_GROWTH}_{it} + \beta_{10} \text{LOSS}'_{it} + \beta_{11} \text{EVAR}'_{it} + \beta_{12} \text{BETA}_{it} \\ & + \text{YEAR} + \text{IND} + \varepsilon_{it}, \end{aligned} \tag{3}$$

where $\text{MV}_{it+3\text{months}}$ is market value of equity three months after fiscal year-end, E'_{it} is net income plus R&D expenses including amortization and write-offs, BV'_{it} is book value of equity minus net R&D asset less E_{it}, RDCAP_{it} is capitalized R&D expenditures, RDEXP_EXP_{it} is expensed R&D for expensing firm-years, RDEXP_CAP_{it} is expensed R&D and both R&D amortization and write-offs for capitalizing firm-years, SIZE'_{it} is natural logarithm of adjusted total assets, LEV'_{it} is adjusted leverage, SALES_GROWTH_{it} is the percentage change in total sales, RD_GROWTH_{it} is the percentage change in R&D expenditures, LOSS'_{it} is a dummy

variable equal to 1 if adjusted earnings are negative, $EVAR'_{it}$ is the variance of adjusted earnings over a four-year rolling window, and $BETA_{it}$ is a firm-year's one-year beta based on HDAX. The regression includes year and industry dummy variables (YEAR and IND). Variables marked with $'$ are adjusted to values before R&D capitalization (see the appendix).

We expect market value of equity as of three months after fiscal year-end to show a significantly positive association with book value of equity and earnings (eliminating the effect of R&D capitalization for both). If R&D capitalizations were a good indication of the future success of the R&D venture, $RDCAP_{it}$ should show a significantly positive sign while R&D expenses for capitalizers ($RDEXP\_CAP_{it}$) as well as for expensers ($RDEXP\_EXP_{it}$) should exhibit a significantly negative sign. However, if investors perceive R&D capitalization as being subject to earnings management, the coefficient of $RDCAP_{it}$ should be insignificant or negative (Cazavan-Jeny et al., 2011).

Our study aims to identify conditions when R&D capitalization is perceived as a signal for FEBs versus as a means for earnings management. We therefore run model (3) for subsamples where earnings management is more (benchmark proxy equal to 1: suspect group) or less likely (benchmark proxy equal to 0: 'non-suspect group'). We use the benchmark proxies as in Equations (1) and (2); that is, $BEAT\_FORECAST_{it}$, $BEAT\_PAST\_E_{it}$, and $EM\_OVERALL_{it}$.[5] For each benchmark proxy, we run our market value regression separately for the suspect group and non-suspect group, respectively. If the market sees through opportunistic behavior, $RDCAP_{it}$ should show a significantly negative coefficient for firm-years with $BEAT\_FORECAST_{it} = 1$, $BEAT\_PAST\_E_{it} = 1$ and $EM\_OVERALL_{it} = 1$.

We further split the non-suspect group into two subgroups for each benchmark proxy. In the case of beating analyst forecast, firm-years with $BEAT\_FORECAST_{it} = 0$ are allocated as follows: (1) '$FORECAST\_BELOW_{it}$' if E_adjcap_{it} is below the benchmark of forecasted earnings and R&D capitalization would not by itself suffice to beat the benchmark; (2) '$FORECAST\_ABOVE_{it}$' if E_adjexp_{it} is above the benchmark, that is, the firm has reached its target without capitalizing R&D. For both subgroups, the use of R&D capitalization for earnings management is less likely but due to different reasons. Similarly, we identify the subgroups PAST_E_BELOW, PAST_E_ABOVE, ZERO_BELOW, and ZERO_ABOVE. Firm-years belonging to one of these groups may capitalize without opportunistic reasons and the market may recognize and perceive capitalization as a signal for positive prospects of the R&D venture.

Since the decision to capitalize R&D may be endogenous, we run tests for endogeneity and use 2SLS regressions when the test suggests that endogeneity exists (Oswald, 2008). The first stage of the 2SLS is based on the determinants of R&D capitalization in Equation (2), excluding the earnings management variables as instruments.

4. Sample and Main Empirical Results

4.1. Sample Selection and Descriptive Statistics

Our initial sample consists of the 150 largest German public firms listed on the H-DAX for the years 1998–2012, comprising companies of the former DAX 100, nowadays represented by the Prime Standard. We obtain financial accounting information through hand-collection from the annual reports and further information from Datastream, Bloomberg, and Compustat Global.

Table 1 displays our sample selection. We exclude 450 observations from the financial services industry due to their specific accounting regulations. Since our analysis is restricted to IFRS firms, we exclude 172 firm-year observations under German GAAP and 231 firm-years

[5]Due to the small number of firm-years with $BEAT\_ZERO_{it} = 1$, we do not run model (3) separately for the firm-years that may try to beat the zero line through R&D capitalization.

Table 1. Sample observations

	No. of firm-years
Total observations (15 years × 150 German listed firms)	2250
Less firm-years from financial services industry	−450
Less firm-years under HGB	−172
Less firm-years under US GAAP	−231
Less inactive firm-years	−431
Less firm-years with missing information on the test variables	−79
Final number of observations (all IFRS)	**887**
Number of 'capitalizers'	401
Number of 'expensers'	486

Note: This table shows the sample selection and final number of observations in our study (sample period: 1998–2012).

under US GAAP.[6] Our sample is further reduced by 431 inactive firm-years and we exclude 79 firm-years with missing information. Our final sample consists of 887 IFRS firm-years.

Table 2 provides the descriptive statistics of the main test variables for the final sample. Out of the 887 observations, 486 observations are 'expensers' (Panel A) and 401 observations are 'capitalizers' (Panel B).[7] All continuous variables are deflated by lagged total assets before R&D capitalization (i.e. total assets minus the net accumulated R&D capitalization) and winsorized at the 1st and 99th percentile. The mean (median) for R&D intensity (RDINT) shows that R&D plays a significant role in our sample with 0.035 (0.008) for the expensers and 0.041 (0.028) for the capitalizers, respectively.

On average, firms capitalize 36.2% (median 23.3%) of R&D expenditures incurred in the period (with CAP_RATIO_{it} equaling the amount capitalized relative to overall R&D expenditures in the period).[8] This is much lower than the average of 62% (median 77%) for the UK firms documented in Oswald (2008). One reason may be the different historical background of accounting standards in the two countries with respect to R&D accounting. While R&D capitalization has been allowed under UK GAAP, it is fairly novel in Germany. Before IFRS became mandatory, German firms had to immediately expense all R&D, similar to the existing US regulations. However, a median capitalization ratio of 23.3% is still substantial in our setting compared to previous studies in other environments; for example, 4% in Australia (Abrahams & Sidhu, 1998) and 9% in Italy (Markarian et al., 2008).

The descriptive statistics further suggest that expensers, on average, show higher book and market values of equity than capitalizers. For our proxies for real earnings management and accounting earnings management, Table 2 Panels A and B show the percentages of 'suspect' firm-years for expensers and capitalizers, respectively. For example, 16.9% of expensing firm-years are suspects based on $BEAT\_FORECAST_{it}$ compared to 41.4% of capitalizing firm-years.[9] We also find more suspects in the capitalizing group for our proxies $BEAT\_PAST\_E_{it}$ and $BEAT\_ZERO_{it}$. The percentage of firm-years cutting R&D (CUT_RD_{it}), our control for real earnings management, is also higher for capitalizers than for expensers (34.7% versus 24.5%).

[6]Since 1998, listed firms in Germany were allowed to voluntarily adopt IFRS or US GAAP, before IFRS became mandatory in 2005. Our sample period therefore starts in 1998 and includes all existing firm-years under IFRS.

[7]A firm-year is defined as 'capitalizer' if R&D capitalization is larger than 0 for a specific year and 'expenser' otherwise.

[8]The standard IAS 38 requires companies to disclose the aggregate amount of R&D expenditures, including the amount recognized as an expense during the period. For some firms, this information is missing and we therefore set the amount of R&D expense equal to 0.

[9]Note that for each proxy of accounting earnings management, the suspect firm-years and non-suspect firm-years (below and above the benchmark) add up to 100%.

Table 2 Panel C presents the Pearson (Spearman) correlation coefficients for the main test variables below (above) the diagonal with bold figures showing significance at the .05 level. Naturally, we observe the highest correlations between our test variables related to R&D capitalization (d_cap_{it}, $RDCAP_{it}$, and $RDEXP\_CAP_{it}$), with coefficients of above 0.8 (p-value $< .01$). We report variance inflation factors (VIF) with our ordinary least squares (OLS) regression results to demonstrate that multicollinearity is not of a major concern in our models.

We observe a significantly positive correlation for both d_cap_{it} and $RDCAP_{it}$ with all measures for benchmark beating, suggesting that R&D capitalization may be used opportunistically. Our proxies for earnings management also show significant and positive correlation coefficients between them, implying that several earnings management motives may exist at the same time.

Table 2. Descriptive statistics

Panel A: For expensers ($n = 486$)

Variable	Mean	Median	SD	Min	Max
$RDEXP\_EXP_{it}$	0.029	0.007	0.045	0	0.229
$RDINT_{it}$	0.035	0.008	0.074	0	0.570
BV'_{it}	0.489	0.467	0.261	0	2.129
E'_{it}	0.081	0.069	0.125	−0.383	0.465
$MV_{it+3months}$	1.295	0.691	1.570	0.023	11.856
CUT_RD_{it}	0.245	0	0.430	0	1
$BEAT\_FORECAST_{it}$	0.169	0	0.375	0	1
$FORECAST\_BELOW_{it}$	0.346	0	0.476	0	1
$FORECAST\ ABOVE_{it}$	0.485	1	0.500	0	1
$BEAT\_PAST\_E_{it}$	0.094	0	0.293	0	1
$PAST\_E\_BELOW_{it}$	0.274	0	0.446	0	1
$PAST\_E\_ABOVE_{it}$	0.632	1	0.483	0	1
$BEAT\_ZERO_{it}$	0.018	0	0.135	0	1
$ZERO\_BELOW_{it}$	0.132	0	0.338	0	1
$ZERO\_ABOVE_{it}$	0.850	1	0.358	0	1
$EM\_OVERALL_{it}$	0.220	0	0.415	0	1

Panel B: For capitalizers ($n = 401$)

Variable	Mean	Median	SD	Min	Max
$RDCAP_{it}$	0.008	0.004	0.011	1.10e−06	0.042
$RDEXP\_CAP_{it}$	0.028	0.021	0.029	0	0.105
$RDINT_{it}$	0.041	0.028	0.058	0	0.570
CAP_RATIO_{it}	0.362	0.233	0.348	0	1
BV'_{it}	0.407	0.338	0.304	0	2.129
E'_{it}	0.071	0.068	0.102	−0.383	0.465
$MV_{it+3months}$	0.983	0.597	1.499	0	11.856
CUT_RD_{it}	0.347	0	0.476	0	1
$BEAT\_FORECAST_{it}$	0.414	0	0.493	0	1
$FORECAST\_BELOW_{it}$	0.269	0	0.444	0	1
$FORECAST\ ABOVE_{it}$	0.317	0	0.466	0	1
$BEAT\_PAST\_E_{it}$	0.202	0	0.402	0	1
$PAST\_E\_BELOW_{it}$	0.252	0	0.435	0	1
$PAST\_E\_ABOVE_{it}$	0.546	1	0.498	0	1
$BEAT\_ZERO_{it}$	0.065	0	0.247	0	1
$ZERO\_BELOW_{it}$	0.127	0	0.334	0	1
$ZERO\_ABOVE_{it}$	0.808	1	0.394	0	1
$EM\_OVERALL_{it}$	0.484	0	0.500	0	1

(*Continued*)

Table 2. Continued

Panel C: Correlation matrix ($n = 887$)

		1	2	3	4	5	6	7	8	9	10	11	12	13
d_cap_{it}	1	1	**0.943**	**−0.677**	**0.842**	**0.288**	**−0.237**	−0.029	**−0.125**	**0.112**	**0.272**	**0.153**	**0.118**	**0.277**
$RDCAP_{it}$	2	**0.501**	1	**−0.638**	**0.841**	**0.356**	**−0.189**	0.003	**−0.081**	**0.097**	**0.324**	**0.194**	**0.176**	**0.339**
$RDEXP\_EXP_{it}$	3	**−0.391**	**−0.196**	1	**−0.569**	**0.340**	**0.291**	**0.322**	**0.239**	−0.027	−0.017	0.031	−0.041	0.018
$RDEXP\_CAP_{it}$	4	**0.612**	**0.610**	**−0.239**	1	**0.489**	**−0.160**	**0.106**	−0.063	0.062	**0.344**	**0.233**	**0.177**	**0.350**
$RDINT_{it}$	5	0.050	**0.210**	**0.634**	**0.343**	1	**0.145**	**0.463**	**0.197**	0.004	**0.408**	**0.330**	**0.206**	**0.463**
BV'_{it}	6	**−0.143**	**0.081**	**0.255**	0.019	**0.187**	1	**0.565**	**0.678**	**−0.167**	−0.032	−0.042	−0.033	−0.022
E'_{it}	7	−0.044	0.062	**0.418**	**0.151**	**0.350**	**0.555**	1	**0.599**	**−0.186**	**0.141**	**0.127**	**−0.097**	**0.133**
$MV_{it+3months}$	8	**−0.100**	**0.068**	**0.267**	−0.042	**0.143**	**0.704**	**0.514**	1	**−0.145**	−0.000	−0.059	−0.028	0.001
CUT_{it}_RD	9	**0.112**	0.024	**−0.069**	−0.004	−0.003	**−0.128**	**−0.135**	**−0.101**	1	0.021	−0.014	**0.087**	0.050
$BEAT\_FORECAST_{it}$	10	**0.272**	**0.276**	0.044	**0.320**	**0.227**	−0.011	**0.095**	−0.025	0.021	1	**0.333**	**0.158**	**0.869**
$BEAT\_PAST\_E_{it}$	11	**0.153**	**0.201**	**0.112**	**0.221**	**0.260**	−0.042	**0.098**	−0.051	−0.014	**0.333**	1	**0.149**	**0.570**
$BEAT\_ZERO_{it}$	12	**0.118**	**0.311**	−0.012	**0.224**	**0.170**	−0.005	−0.023	0.005	**0.087**	**0.158**	**0.149**	1	**0.283**
$EM\_OVERALL_{it}$	13	**0.277**	**0.321**	**0.076**	**0.315**	**0.267**	−0.014	**0.098**	−0.029	0.049	**0.869**	**0.570**	**0.283**	1

Notes: This table shows descriptive information about the sample. Panels A and B show the mean, median, standard deviation, minimum, and maximum of the main test variables for the group of expensers and capitalizers, respectively. Panel C displays the Pearson/Spearman (below/above the diagonal) correlation coefficient (bold if significant at the .05 level or less). Continuous variables (except for RDINT) are all scaled by lagged total assets (adjusted for R&D capitalization, that is, minus net accumulated R&D capitalization) and winsorized at the 1st and 99th percentile. All variables are defined as in the appendix.

The positive correlation of R&D capitalization under IFRS with accounting earnings management proxies is accompanied by a negative correlation of R&D capitalization with market values.[10] This suggests that the market may perceive R&D capitalization negatively due to possible earnings management and, consequently, values such amounts at a discount. We investigate this conjecture in our multivariate analyses below.

4.2. *Determinants of R&D Capitalization*

Table 3 displays univariate test statistics for differences in the determinants of R&D capitalization between capitalizers and expensers. The two groups are significantly different in virtually all firm characteristics, as confirmed by *t*-tests and Mann–Whitney tests. As expected, our highly R&D intensive sample firms have MB-ratios (before R&D capitalization) well above 1. For all our earnings management proxies, the percentage of suspects in the capitalizing group is significantly higher than in the expensing group. For example, 20.2% of the capitalizing firm-years are suspects of using R&D capitalization to beat prior year's earnings compared to 9.5% of the expensing firm-years (*t*-statistic −4.591).

These conjectures also hold in our probit and Tobit regressions (Table 3 Panels B and C). All continuous variables are scaled by adjusted lagged total assets and winsorized at the 1st and 99th percentile. We use alternative deflators in our robustness checks. All regressions in our analyses include industry and year dummy variables, and all regression results are based on robust standard errors using the Huber (1967)–White (1980) sandwich variance estimator.

Table 3 Panel B displays the results of a probit regression with the dummy variable d_cap_{it} as the dependent variable and Panel C displays the results of a Tobit regression with the continuous variable $RDCAP_{it}$ as the dependent variable.[11] Both Panels report marginal effects ey/ex, that is, elasticities, rather than coefficient estimates, allowing us to refer to the economic, and not just statistical, significance when interpreting the results (Williams, 2012).[12] For each column, we analyze the separate effect of our individual proxies for benchmark beating on d_cap_{it} ($RDCAP_{it}$) controlling for a firm's fundamentals and real earnings management (CUT_RD_{it}). The probability to capitalize R&D increases by 12.7% ($p < .01$) or 3.1% ($p < .05$) for firms where capitalization allows them to beat analysts' forecasts or past year's earnings. Pushing earnings above zero via R&D capitalization only loads marginally (0.9%, $p < .10$), probably due to the relatively low number of observations in the range around zero ($n = 29$). Overall, for the combined measure for earnings management (EM_OVERALL) comprising the prior three proxies, the probability to capitalize increases by 15% ($p < .01$). Hence, beating an earnings benchmark, such as analysts' forecasts and prior year's earnings, seems to be an important driver for the decision to capitalize R&D.

Further analyses of the firm characteristics show similar findings. While being fundamental in nature, growth opportunities (MB'_{it}), leverage (LEV'_{it}), and profitability (ROA'_{it}) have also been interpreted as opportunistic variables in previous studies (e.g. Cazavan-Jeny et al., 2011; Markarian et al., 2008). The argument is that: (1) firms with less growth opportunities are more inclined to boost earnings to improve their market valuation; (2) firms with higher leverage are more likely to

[10]The only exception is the Pearson correlation coefficient for $RDCAP_{it}$ and $MV_{it+3months}$.

[11]The number of observations drops to 776 because we lose 111 observations in the probit regression due to perfect failure prediction.

[12]The displayed elasticities ey/ex are based on average marginal effects; of the three alternative marginal effects for Tobit regressions that exist, we select the marginal effect on the censored observed variable since we are interested in the effect that the regressors have on the observable amount of capitalized R&D, which is censored at 0, that is, $E(RDCAP^* | RDCAP > 0)$ as opposed to the marginal effect on the latent variable or the marginal effect on the probability of being uncensored (Greene, 2003, p. 764).

Table 3. Determinants of R&D capitalization

Panel A: Determinants of R&D capitalization – univariate tests

	Expensers ($n = 486$)	Capitalizers ($n = 401$)	t-Test	Expensers ($n = 486$)	Capitalizers ($n = 401$)	Mann–Whitney test
Determinant	Mean values			Median values		
Fundamentals						
$SIZE'_{it}$	21.651	22.215	−4.646***	21.582	21.693	−3.415***
MB'_{it}	2.885	1.733	3.939***	1.312	1.464	0.057
RD_GROWTH_{it}	0.019	0.145	−3.800***	0	0.058	−3.320***
$RDINT_{it}$	0.035	0.041	−1.503***	0.008	0.027	−8.558***
LAG_CAP_{it}	0.026	0.305	−16.325***	0	0.176	−22.258***
LEV'_{it}	2.090	3.187	−4.387***	1.359	2.273	−9.315***
ROA'_{it}	0.038	0.020	2.551***	0.048	0.034	4.967***
RD_VALUE_{it}	27.721	36.870	−1.356*	2.368	4.486	−2.377**
Real earnings management						
CUT_RD_{it}	0.245	0.347	−3.339***	0	0	−3.320***
Accounting earnings management						
$BEAT\_FORECAST_{it}$	0.169	0.414	−8.407***	0	0	−8.095***
$BEAT\_PAST\_E_{it}$	0.095	0.202	−4.591***	0	0	−4.540***
$BEAT\_ZERO_{it}$	0.019	0.065	−3.548***	0	0	−3.525***
EM_OVERALL	0.220	0.484	−8.580***	0	0	−8.248***

Panel B: Determinants of R&D capitalization – probit regressions (d_cap_{it})

Dependent variable: d_cap_{it}	Predicted sign	Probit	Probit	Probit	Probit
$SIZE'_{it}$	(?)	0.096*	0.084*	0.093*	0.091*
		(1.84)	(1.72)	(1.93)	(1.84)
MB'_{it}	(?)	−0.325**	−0.339**	−0.351**	−0.314**
		(−2.29)	(−2.44)	(−2.48)	(−2.34)
RD_GROWTH_{it}	(?)	0.009***	0.010***	0.010***	0.009***
		(3.01)	(2.73)	(2.70)	(3.00)
$RDINT_{it}$	(?)	−0.003	0.014	0.021	0.001
		(−0.10)	(0.47)	(0.73)	(0.03)
$LAG\_CAP\_RATIO_{it}$	(+)	0.091***	0.090***	0.089***	0.091***
		(10.17)	(10.51)	(10.49)	(10.20)
LEV'_{it}	(+)	0.152***	0.146***	0.150***	0.151***
		(3.51)	(3.68)	(3.69)	(3.57)
ROA'_{it}	(?)	0.002	0.0004	0.004	0.003
		(0.08)	(0.02)	(0.17)	(0.13)
RD_VALUE_{it}	(+)	0.032	0.025	0.025	0.032
		(1.25)	(0.98)	(0.96)	(1.22)
CUT_RD_{it}	(−)	0.020	0.035	0.027	0.013
		(0.49)	(0.89)	(0.69)	(0.32)
$BEAT\_FORECAST_{it}$	(+)	0.127***			
		(7.13)			
$BEAT\_PAST\_E_{it}$	(+)		0.031**		
			(2.37)		
$BEAT\_ZERO_{it}$	(+)			0.009*	
				(1.93)	
$EM\_OVERALL_{it}$	(+)				0.150***
					(6.17)
Observations		776	776	776	776
Wald χ^2		259.15	260.53	276.46***	259.13***
Log pseudolikelihood		−309.737	−321.458	−322.306	−311.629
Industry dummies		Yes	Yes	Yes	Yes
Year dummies		Yes	Yes	Yes	Yes

(*Continued*)

Table 3. Continued

Panel C: Determinants of R&D capitalization – Tobit regressions ($RDCAP_{it}$)					
Dependent variable: $RDCAP_{it}$	Predicted sign	Tobit	Tobit	Tobit	Tobit
$SIZE'_{it}$	(?)	0.153	−0.290	0.085	0.136
		(0.13)	(−0.24)	(0.07)	(0.11)
MB'_{it}	(?)	−0.231***	−0.256***	−0.259***	−0.232***
		(−3.47)	(−3.85)	(−3.72)	(−3.64)
RD_GROWTH_{it}	(?)	0.021***	0.022***	0.023***	0.020***
		(6.96)	(7.09)	(7.51)	(6.70)
$RDINT_{it}$	(?)	0.010	−0.003	0.018	0.002
		(0.10)	(−0.03)	(0.20)	(0.02)
LAG_RDCAP_{it}	(+)	0.261***	0.263***	0.261***	0.261***
		(14.01)	(14.12)	(13.69)	(13.87)
LEV'_{it}	(+)	0.053*	0.061**	0.067**	0.054*
		(1.84)	(2.40)	(2.54)	(1.83)
ROA'_{it}	(?)	0.020	0.019	0.027	0.020
		(0.92)	(0.90)	(1.31)	(0.93)
RD_VALUE_{it}	(+)	0.051***	0.045**	0.043**	0.054***
		(2.90)	(2.49)	(2.38)	(3.09)
CUT_RD_{it}	(−)	−0.019	−0.003	−0.008	−0.029
		(−0.43)	(−0.06)	(−0.20)	(−0.64)
$BEAT\_FORECAST_{it}$	(+)	0.138***			
		(5.07)			
$BEAT\_PAST\_E_{it}$	(+)		0.084***		
			(4.88)		
$BEAT\_ZERO_{it}$	(+)			0.016**	
				(2.05)	
$EM\_OVERALL_{it}$	(+)				0.212***
					(6.72)
Observations		776	776	776	776
F-Statistic		38.76***	41.21***	41.05***	41.52***
Log pseudolikelihood		1213.153	1213.732	1206.490	1218.798
Industry dummies		Yes	Yes	Yes	Yes
Year dummies		Yes	Yes	Yes	Yes

Notes: This table shows regression results for our analyses on the determinants of R&D capitalization. Panel A reports univariate test results. Panel B reports the average marginal effects of the regressors of a probit regression with d_cap_{it} as the dependent variable (*z*-statistics in parentheses). Panel C reports the average marginal effects of the regressors of a Tobit regression with $RDCAP_{it}$ as the dependent variable (*z*-statistics in parentheses). One hundred and eleven observations are dropped due to perfect failure predictions in the probit regressions. All variables are defined as in the appendix.
***, **, * indicate significance at .01, .05 and .10 levels respectively, two-tailed.

opportunistically increase earnings in order to meet debt covenants; and, (3) firms with lower profitability are more likely to opportunistically increase earnings to present a better performance. Except for ROA'_{it} with an insignificant coefficient, our results are in line with these arguments: a lower MB-ratio increases the probability to capitalize by about 32% and higher leverage by about 15% across the different proxies for earnings management.

For the remaining fundamental firm characteristics, Table 3 Panel B shows that a proportionate increase in one of the variables firm size ($SIZE'_{it}$), R&D growth (RD_GROWTH_{it}), and the amount of R&D capitalization in the previous year ($LAG\_CAP\_RATIO_{it}$), increases the probability to capitalize R&D in the current year by about 9%, 1%, and 9%, respectively. The proxy for real earnings management (CUT_RD_{it}) is not significant in any of the specifications.

The marginal effects of the benchmark beating proxies are relatively large (3–15%) compared to most fundamental determinants except MB'_{it}, indicating a high importance for the decision to capitalize.

The results for the amount capitalized $RDCAP_{it}$ as the dependent variable in Table 3 Panel C are similar[13] except the following two variables: while firm size is not significant, R&D value is: a proportionate increase in the success of the R&D program increases R&D capitalization by about 5%. Prior year's R&D capitalization (LAG_RDCAP_{it}) has the largest impact on the probability to capitalize more R&D of around 26% across all Tobit regressions.

All benchmark beating proxies have a positive association with the amount capitalized, a proportionate increase in the overall measure for earnings management increases the amount capitalized by 21%, which is large compared to the marginal effects of most fundamental determinants, except MB_{it} and $LAG\_RDCAP_{it,}$ which take on similar values.

4.3. Market Pricing of R&D Capitalization and earnings management

Table 4 reports coefficient estimates for the association between R&D capitalization and market values three months after fiscal year-end ($MV_{it+3months}$). The models show high adjusted R^2 and most of our control variables are significant with expected sign.

The first column shows the results based on the total sample of 887 observations. The coefficient of $RDCAP_{it}$ is not significant, suggesting that the market does not price the capitalized amount (3.518, $p > .10$). Consistent with our expectations, coefficients for R&D expenses for both expensing firm-years ($RDEXP\_EXP_{it}$) and capitalizing firm-years ($RDEXP\_CAP_{it}$) are significantly negative. For an interpretation of the economic significance of the regression results, we compute elasticities (not tabulated). For the average expensing firm, a 1% increase in expensed R&D decreases market value by 0.08%, while market value decreases by 0.16% for a capitalizing firm.[14] Hence, expensed amounts are not considered investments but rather losses, particularly if the firm has capitalized a portion of total R&D.

We also investigate a possible pricing of the overall amount of R&D expenditure. Literature has found that the market prices R&D expenditures like investments (e.g. Stark & Thomas, 1998). This could also hold in our setting, implying that the market prices R&D independent of the accounting and values all expenditures instead of the capitalized amounts. However, our results show the opposite. In untabulated additional analyses we analyze various subsamples but keep observing a significant and negative coefficient for R&D expenditures and R&D expense. This suggests that even though some of the expensed R&D may contain future benefits, the market does not value them, possibly due to their highly uncertain nature. Instead, the market may wait until the R&D program has progressed further implying higher certainty and then revalues the firm. Overall, these findings indicate that R&D capitalization is not priced, which could be due to the market's perception of R&D capitalization as a means of earnings management.

In the following tests, we analyze the association of R&D capitalization and market values for the suspect and non-suspect group, based on our different proxies for benchmark beating. The second column of Table 4 analyzes the suspect group with analysts' forecasts as the benchmark ($BEAT\_FORECAST_{it} = 1$). Since the test on endogeneity is significant at the .05 level (robust score $\chi^2 = 4.456$), we report 2SLS regression results with model (2) as the first stage (excluding

[13]We restrict our Tobit regression in Table 3 Panel C to the number of observations from our probit regression in Table 3 Panel B for a more consistent comparison. Our results remain unchanged when running the Tobit regression for all 887 firm-years.

[14]For the economic interpretation of the results, we compute elasticities at mean. All calculations are based on mean values for the respective subsamples used in the regression.

BEAT_BENCH$_{it}$). The F-statistic for the joint significance of the instruments with 18.566 ($p <$ .01) is well above 10, the suggested threshold for reliable 2SLS estimates as often required (e.g. Stock, Wright, & Yogo, 2002). In addition, the partial R^2 of 0.46 is relatively high implying that we do not have a problem of weak instruments. Economically, lagged capitalization can be considered exogenous and hence is our main instrument (Larcker & Rusticus, 2010). Consistent with the notion that the market may see through opportunistic behavior, the association of the amount capitalized and market value is significantly negative (-23.81, $p < .05$). Economically,

Table 4. Market values and R&D capitalization for suspect and non-suspect group

Panel A: Beat analysts' forecasted earnings				
Dependent variable: $MV_{it+3months}$	Predicted sign	Total sample	Suspect group (BEAT_FORECAST = 1)	Non-suspect group (BEAT_FORECAST = 0)
		OLS	2SLS	OLS
E'_{it}	(+)	6.601***	7.972***	6.369***
		(9.03)	(5.79)	(7.44)
BV'_{it}	(+)	2.602***	3.022***	2.364***
		(8.35)	(7.02)	(6.17)
$RDCAP_{it}$	(?)	3.518		11.81
		(0.51)		(0.92)
$RDCAP\_instr_{it}$	(?)		−23.81**	
			(−2.53)	
$RDEXP\_EXP_{it}$	(−)	−5.661***	−9.290***	−4.126*
		(−3.00)	(−4.08)	(−1.71)
$RDEXP\_CAP_{it}$	(−)	−13.14***	−7.973***	−15.20***
		(−5.79)	(−2.89)	(−4.66)
$SIZE'_{it}$	(−)	−0.119***	−0.0519	−0.164***
		(−3.72)	(−1.05)	(−3.94)
LEV'_{it}	(+)	0.021*	0.024	0.020*
		(1.85)	(1.21)	(1.76)
$SALES\_GROWTH_{it}$	(+)	0.249	0.007	0.303
		(1.09)	(0.02)	(1.25)
RD_GROWTH_{it}	(+)	0.065	0.205	0.071
		(0.70)	(1.60)	(0.65)
$LOSS'_{it}$	(+)	0.367***	0.496***	0.348**
		(2.73)	(2.86)	(1.99)
$EVAR'_{it}$	(+)	2.558***	3.118**	2.103
		(2.60)	(2.29)	(1.62)
$BETA_{it}$	(+)	0.200*	0.203	0.210
		(1.88)	(1.27)	(1.60)
Constant		2.108***	0.940	2.777***
		(2.71)	(0.73)	(2.86)
Observations		887	248	639
F-Stat/Wald χ^2/F-Stat		18.03	761.33	13.85
Adj. R^2		0.64	0.74	0.60
Industry dummies		Yes	Yes	Yes
Year dummies		Yes	Yes	Yes
Highest VIF		2.86		3.27
Test on endogeneity:				
Robust score χ^2			4.456**	
Joint sign. of instruments			18.566***	
Partial R^2			0.46	

(*Continued*)

Table 4. Continued

Panel B: Beat past year's earnings			
Dependent variable: $MV_{it+3months}$	Predicted sign	Suspect group (BEAT_PAST_E = 1)	Non-suspect group (BEAT_PAST_E = 0)
		OLS	OLS
E'_{it}	(+)	9.136***	6.407***
		(3.40)	(8.45)
BV'_{it}	(+)	3.163***	2.513***
		(4.31)	(7.72)
$RDCAP_{it}$	(?)	−1.878	1.268
		(−0.22)	(0.14)
$RDEXP\_EXP_{it}$	(−)	−8.933**	−4.995**
		(−2.18)	(−2.13)
$RDEXP\_CAP_{it}$	(−)	−11.59***	−13.82***
		(−2.65)	(−5.07)
$SIZE'_{it}$	(−)	−0.074	−0.143***
		(−1.30)	(−3.82)
LEV'_{it}	(+)	0.219***	0.016
		(2.90)	(1.44)
$SALES\_GROWTH_{it}$	(+)	−0.202	0.331
		(−0.99)	(1.29)
RD_GROWTH_{it}	(+)	0.111	0.0626
		(0.47)	(0.60)
$LOSS'_{it}$	(+)	0.264	0.386**
		(0.99)	(2.52)
$EVAR'_{it}$	(+)	1.541	2.304**
		(0.83)	(2.21)
$BETA_{it}$	(+)	0.428*	0.157
		(1.83)	(1.34)
Constant		−0.140	2.538***
		(−0.11)	(2.85)
Observations		127	760
Adj. R^2		0.77	0.63
F-Statistic		9.36	16.35
Industry dummies		Yes	Yes
Year dummies		Yes	Yes
Highest VIF		8.31	3.14

(*Continued*)

a 1% increase in capitalized R&D decreases market value for the average suspect firm by 0.16%, while a 1% increase in expensed R&D decreases market values by 0.20% for capitalizers and 0.16% for expensers.

For the non-suspect group ($BEAT\_FORECAST_{it} = 0$), results are presented in the third column of Table 4 (Panel A). The coefficient of RD_CAP_{it} is positive but not significant at the conventional level (11.81, $p > .10$). For an average non-suspect firm, a 1% increase in capitalized R&D does not affect market value, while a 1% increase in expensed R&D decreases market values by 0.12% for capitalizers and 0.05% for expensers. Since the test on endogeneity is not significant, we report OLS regression results. The VIF take on a maximum value of 3.27 suggesting no major concern of multicollinearity.

Our results change only slightly when analyzing the benchmark past year's earnings (Table 4 Panel B). The sign of $RDCAP_{it}$ is still negative for suspect firm-years ($BEAT\_PAST\_E_{it} = 1$) but it is not significant (−1.878, $p > .10$). Hence, in the case of beating past year's earnings,

Table 4. Continued

Panel C: Combined earnings management proxies (forecast, past year's earnings, zero line)			
Dependent variable: $MV_{it+3months}$	Predicted sign	Suspect group (EM_OVERALL = 1)	Non-suspect group (EM_OVERALL = 0)
		2SLS	OLS
E'_{it}	(+)	8.144***	6.577***
		(6.41)	(7.52)
BV'_{it}	(+)	2.808***	2.374***
		(6.80)	(5.95)
$RDCAP_{it}$	(?)		22.06
			(1.18)
$RDCAP\_instr_{it}$	(?)	−17.76**	
		(−2.52)	
$RDEXP\_EXP_t$	(−)	−8.529***	−4.405*
		(−4.01)	(−1.67)
$RDEXP\_CAP_{it}$	(−)	−8.719***	−16.66***
		(−3.43)	(−4.62)
$SIZE'_{it}$	(−)	−0.035	−0.185***
		(−0.81)	(−4.08)
LEV'_{it}	(+)	0.030	0.014
		(1.38)	(1.32)
$SALES\_GROWTH_{it}$	(+)	−0.053	0.360
		(−0.27)	(1.29)
RD_GROWTH_{it}	(+)	0.298**	0.001
		(2.34)	(0.01)
$LOSS'_{it}$	(+)	0.405**	0.494**
		(2.39)	(2.56)
$EVAR'_{it}$	(+)	3.306**	1.530
		(2.48)	(1.19)
$BETA_{it}$	(+)	0.256*	0.174
		(1.77)	(1.25)
Constant		0.464	3.551***
		(0.41)	(3.34)
Observations		301	586
Wald χ^2/F-Statistic		545.85	12.84
Adj. R^2		0.70	0.60
Industry dummies		Yes	Yes
Year dummies		Yes	Yes
Highest VIF			3.93
Test on endogeneity:			
Robust score χ^2		4.224**	
Joint sign. of instruments		20.264***	
Partial R^2		0.48	

Notes: This table shows regression results for our analyses on the association of market values and R&D capitalization in relation to the following benchmarks: beat analysts' forecasts (Panel A), beat past year's earnings (Panel B), and an overall benchmark beating measure (Panel C). If the test on endogeneity is significant, we report 2SLS regression results and OLS regression results otherwise. In all panels, the suspect group refers to firm-years where earnings management is more likely (Group 'within') while the non-suspect group refers to firm-years where earnings management is less likely (combined groups 'below' and 'above'). All variables are defined as in the appendix.
***, **, * indicate significance at .01, .05 and .10 levels respectively, two-tailed.

market values are not as strongly discounted by market participants as they are in the case of beating analysts' forecasts. For the non-suspect group ($BEAT\_PAST\_E_{it} = 0$), the regression coefficient for $RDCAP_{it}$ is again positive but not significant (1.268, $p > .10$).

Table 4 Panel C presents the results for the combined earnings management measure ($EM\_OVERALL_{it}$) based on the three proxies (beat analysts' forecasts, prior year's earnings, and zero line). We find for the suspect group ($EM\_OVERALL_{it} = 1$) that the coefficient of $RDCAP_{it}$ is significantly negative (-17.76, $p < .05$). Economically, a 1% increase in capitalized R&D decreases market value for the average suspect firm by 0.12%, while a 1% increase in expensed R&D decreases market values by 0.21% for capitalizers and 0.15% for expensers.

For the non-suspect firm-years ($EM\_OVERALL_{it} = 0$), the coefficient of $RDCAP_{it}$ is positive but not significant, while R&D expenses for both capitalizing and expensing firm-years show significantly negative coefficients. For an average non-suspect firm, a 1% increase in capitalized R&D does not affect market value, while a 1% increase in expensed R&D decreases market values by 0.12% for capitalizers and 0.05% for expensers. The negative effect on market value for suspect firms suggests that R&D capitalization is penalized by the market.

Overall, the results indicate that R&D capitalization of benchmark beaters is negatively perceived by market participants and consequently their market values are discounted.

4.4. Market Pricing of R&D Capitalization and Signaling

Consistent with prior research using total R&D, we expect that some portion of R&D costs is related to future benefits and, consequently, should be valued positively by the market (Stark & Thomas, 1998). Our previous results indicate that R&D capitalization is perceived negatively by market participants when it is associated with earnings management. Consequently, R&D capitalization may be priced if it is informative and market participants perceive no association with earnings management. In untabulated analyses, we run our market value regression for the two subgroups within the non-suspect group separately: $FORECAST\_BELOW_{it} = 1$ and $FORECAST\_ABOVE_{it} = 1$. We expect a significantly positive coefficient for capitalized R&D particularly for firm-years where earnings exceed analysts' forecasts without capitalization ($FORECAST\_ABOVE_{it} = 1$). However, $RDCAP_{it}$ remains insignificant for both subgroups. The same is true for the two subgroups related to prior year's earnings as the benchmark, that is, $PAST\_E\_BELOW_{it} = 1$ and $PAST\_E\_ABOVE_{it} = 1$.

For non-suspect firm-years with good performance (i.e. positive earnings before R&D) where R&D capitalization can have no impact on beating a benchmark, R&D capitalization may potentially be priced because capitalization would not be associated with any benchmark beating activity. In the first column of Table 5, we include those 524 observations in our regression, which are (1) not suspect based on the beating analysts' forecasts proxy ($BEAT\_FORECAST_{it} = 0$) and (2) show positive earnings before R&D. The regression coefficient of $RDCAP_{it}$ now turns significantly positive (40.89, $p < .05$) suggesting that the market values R&D capitalization positively for that group. The same results hold for the overall measure of earnings management ($EM\_OVERALL_{it} = 0$): for non-suspect firm-years with positive earnings before R&D, the market prices R&D capitalization positively (46.67, $p < .05$). For the average well-performing non-suspect firm, a 1% increase in capitalized R&D increases market value by 0.06%. The observed positive effect on market value is only about half to one third the size of the market value discount observed for the suspect group of about 0.12% (based on $EM\_OVERALL_{it}$) and 0.16% (based on $BEAT\_FORECAST_{it}$). Hence, when the market perceives R&D capitalization to be a tool for earnings management, the negative repercussions are higher than potential signaling effects related to R&D capitalization.

These results indicate that for well-performing firm-years exceeding benchmarks without the help of R&D accounting, R&D capitalization is informative. The market seems to be able to rule out the suspect cases and hence, considers signals from R&D capitalization in the remaining

Table 5. Signaling of FEBs in the absence of earnings management

Dependent variable: $MV_{it+3months}$	Predicted sign	BEAT_FORECAST = 0 and $E' > 0$	BEAT_PAST_E = 0 and $E' > 0$	EM_OVERALL = 0 and $E' > 0$
		OLS	2SLS	OLS
E'_{it}	(+)	8.971***	8.600***	8.882***
		(6.63)	(6.09)	(6.59)
BV'_{it}	(+)	2.293***	2.568***	2.280***
		(4.85)	(6.70)	(4.72)
$RDCAP_{it}$	(?)	40.89**		46.67**
		(2.20)		(1.97)
$RDCAP\_instr_{it}$	(?)		−4.766	
			(−0.36)	
$RDEXP\_EXP_{it}$	(−)	−5.764*	−6.470*	−5.447*
		(−1.91)	(−1.78)	(−1.69)
$RDEXP\_CAP_{it}$	(−)	−19.71***	−15.49***	−20.72***
		(−5.47)	(−4.61)	(−5.37)
$SIZE'_{it}$	(−)	−0.160***	−0.118***	−0.175***
		(−3.87)	(−3.02)	(−3.81)
LEV'_{it}	(+)	0.029**	0.054**	0.027*
		(1.97)	(2.25)	(1.89)
$SALES\_GROWTH_{it}$	(+)	0.495	0.500**	0.601*
		(1.59)	(2.01)	(1.66)
RD_GROWTH_{it}	(+)	0.076	0.087	0.026
		(0.57)	(0.64)	(0.18)
$EVAR'_{it}$	(+)	−1.501	0.273	−1.716
		(−1.01)	(0.22)	(−1.22)
$BETA_{it}$	(+)	0.218	0.130	0.181
		(1.49)	(0.90)	(1.18)
Constant		2.759***	2.381**	3.168***
		(2.77)	(2.22)	(2.92)
Observations		524	494	485
F-Stat/Wald χ^2/F-Stat		14.60	729.96	13.77
Adj. R^2		0.64	0.67	0.64
Industry dummies		Yes	Yes	Yes
Year dummies		Yes	Yes	Yes
Highest VIF		3.18		3.16
Test on endogeneity:				
Robust score χ^2			6.473**	
Joint sign. of instr.			28.858***	
Partial R^2			0.62	

Notes: This table shows regression results for our analyses on the association of market values and R&D capitalization for well-performing non-suspect firm-years. If the test on endogeneity is significant, we report 2SLS regression results and OLS regression results otherwise. All variables are defined as in the appendix.
***, **, * indicate significance at .01, .05 and .10 levels respectively, two-tailed.

cases of well-performing non-suspect firm-years. The market's positive pricing of capitalized R&D is not prevalent for other specifications we tested.

4.5. Robustness Checks

Our findings are robust to a number of sensitivity checks. While we use lagged total assets (before R&D capitalization) as the scaling variable in our main analyses, we also use the following alternative deflators: lagged book value of equity (before R&D capitalization), lagged total assets without adjustments, and number of shares outstanding. Our results remain almost

unchanged. Our results are also robust to winsorizing the continuous variables at the 5th and 95th instead of the 1st and 99th percentile.

In their study on earnings targets and R&D investments, García Osma and Young (2009) analyze reductions in R&D spending in reaction to missing previous year's benchmarks as well as in association to contemporaneous benchmarks. Our results displayed in the tables are based on contemporaneous benchmarks. When defining our proxies for benchmark beating as lagged measures, our results remain unaffected.

As indicated in our main analyses, we report 2SLS regression results when the test on endogeneity regarding $RDCAP_{it}$ is significant. Otherwise, we report OLS regression results. In additional tests, we follow the procedure in Cazavan-Jeny et al. (2011) and include the inverse Mill's ratio (IMR_{it}) as suggested by Heckman (1979) based on regression model (1) (excluding $BEAT\_BENCH_{it}$). The model captures the fundamental factors driving the choice to select into the group of capitalizers. Based on the regression results, the inverse Mill's ratio is calculated as the probability density function divided by the cumulative distribution function of a standard normal distribution. The resulting IMR_{it} is included as an additional control variable in our model. Our results are robust to the inclusion of the inverse Mill's ratio: the coefficient of $RDCAP_{it}$ is negative (albeit not significant) for the suspect firm-years but positive and significant at least at the 0.10 level for well-performing non-suspect firms.

Finally, we restrict our sample to the period of mandatory IFRS application (2005–2012) to rule out effects of voluntary adoption. Our sample size reduces to 697 firm-years and all our results remain unaffected.

5. Conclusion

Previous studies under national GAAP have found that giving managers discretion when capitalizing R&D can result in more value relevant information (Ahmed & Falk, 2006) while others argue that it encourages earnings management leading to valuation-discounts (Cazavan-Jeny & Jeanjean, 2006; Markarian et al., 2008). The current paper investigates this trade-off between signaling and earnings management for R&D capitalization under IFRS.

We identify firm-years for which R&D capitalization is relevant for pushing their earnings above a specific threshold (the suspect group), using different earnings benchmarks (analysts' forecast for earnings, prior year's earnings, zero line of earnings, and the combination of all). We find that suspect firm-years capitalize significantly more R&D. We further analyze the determinants of the capitalization decision and find that capitalizing R&D is strongly associated with benchmark beating and other opportunistic determinants.

We analyze the association of market values with capitalized R&D and find that the market does not price the capitalized amounts. When analyzing the suspect group and the non-suspect group separately, we find that for suspect firm-years, market values are negatively associated with capitalized R&D, consistent with the notion that the market detects opportunistic behavior related to R&D accounting and discounts firm values accordingly.

We further analyze the subsample of non-suspect firm-years. Consistent with prior research, we expect that some portion of R&D is related to future benefits and, consequently, should be valued positively by the market (Stark & Thomas, 1998). The results indicate that for non-suspect firm-years with good performance (i.e. positive earnings before R&D) where R&D capitalization has no impact on beating a benchmark, R&D capitalization is priced positively.

Overall, the market seems to be able to rule out the cases in which benchmark beating is likely and hence, considers signals from R&D capitalization in the remaining cases of well-performing non-suspect firm-years. Our results are robust to controls for endogeneity, the use of different deflators, and various specifications of accounting earnings management.

Our study contributes to the ongoing discussion on internally generated intangible assets by showing that beating earnings benchmarks is an important driver for R&D capitalization under IAS 38, leading to valuation-discounts for suspect firm-years. On the other hand, for well-performing non-suspect firm-years, R&D capitalization is informative.

Second, our results contribute to the literature on the consequences of earnings management by providing a setting in which the market is able to detect earnings management and prices capitalized R&D accordingly. When R&D capitalization is perceived as a tool for earnings management, the market value discounts are higher than the positive signaling effects related to credible R&D capitalization. These findings also contribute to the literature on accounting choice and establish a need to control for the degree of earnings management when studying the informativeness of accounting choice.

We acknowledge several limitations of our study. First, the measurement of earnings management is subjective and, as such, difficult to apply. However, beating benchmarks has been used extensively and is largely confirmed by the literature as a proxy for earnings management. Second, our final sample size is relatively small which is largely due to the need to hand-collect the information. Nevertheless, we provide a clean setting where R&D plays a significant role in the economy, and where the recognition criteria set out in IAS 38 have been applied for more than a decade. Germany's history of immediate R&D expensing prior to the IFRS adoption gives our study a special tension and makes the results transferable to other settings like the USA where R&D capitalization is still prohibited.

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Appendix. List of variables

Variable	Definition
d_cap_{it}	=dummy variable equal to 1 if firm i capitalizes R&D in year t, and 0 otherwise
$RDCAP_{it}$	=R&D capitalization for firm i, year t
$RDCAP\_instr_{it}$	=instrumented $RDCAP_{it}$ based on Equation (2), excluding $BEAT\_BENCH_{it}$
$RDEXP\_EXP_{it}$	=R&D expenses for expensing firm i, year t
$RDEXP\_CAP_{it}$	=R&D expenses including amortization and write-offs for capitalizing firm i, year t
$RDINT_{it}$	=R&D intensity equaling R&D expenditures (expensed R&D + capitalized R&D) divided by total sales for firm i, year t
CAP_RATIO_{it}	=amount of capitalized R&D divided by total R&D expenditures for firm i, year t
BV'_{it}	=book value of equity before R&D capitalization equaling book value of equity − (accumulated capitalized R&D − accumulated amortized R&D) − net income for firm i, year t
E'_{it}	=earnings before R&D equaling net income + R&D expenses including R&D amortization and write-offs for firm i, year t
E_adjexp_{it}	=earnings assuming expensing of all R&D for firm i, year t (net income + R&D amortization and write-offs − capitalized R&D)
E_adjcap_{it}	=earnings assuming capitalization of all R&D for firm i, year t (E_adjexp_{it} + R&D expenditures)
$MV_{it+3months}$	=market value of equity for firm i as of fiscal year-end t + 3 months
CUT_RD_{it}	=dummy variable equal to 1 if reported R&D expenditures for firm i, year t < reported R&D expenditures for firm i, year t − 1, and 0 otherwise
$BEAT\_BENCH_{it}$	=proxy for $BEAT\_FORECAST_{it}$, $BEAT\_PAST\_E_{it}$, $BEAT\_ZERO_{it}$, or $EM\_OVERALL_{it}$
$BEAT\_FORECAST_{it}$	=dummy variable equal to 1 if consensus earnings forecast (mean) > IBES earnings assuming full expensing and consensus earnings forecast (mean) < IBES earnings assuming full capitalization for firm i, year t, and 0 otherwise
$FORECAST\_BELOW_{it}$	=dummy variable equal to 1 if $BEAT\_FORECAST_{it} = 0$ and consensus earnings forecast (mean) > IBES earnings assuming full capitalization for firm i, year t, and 0 otherwise
$FORECAST\_ABOVE_{it}$	=dummy variable equal to 1 if $BEAT\_FORECAST_{it} = 0$ and consensus earnings forecast (mean) ≤ IBES earnings assuming full expensing for firm i, year t, and 0 otherwise
$BEAT\_PAST\_E_{it}$	=dummy variable equal to 1 if prior year's earnings > earnings assuming full expensing and prior year's earnings < earnings assuming full capitalization for firm i, year t, and 0 otherwise
$PAST\_E\_BELOW_{it}$	=dummy variable equal to 1 if $BEAT\_PAST\_E_{it} = 0$ and prior year's earnings > earnings assuming full capitalization for firm i, year t, and 0 otherwise
$PAST\_E\_ABOVE_{it}$	=dummy variable equal to 1 if $BEAT\_PAST\_E_{it} = 0$ and prior year's earnings ≤ earnings assuming full expensing for firm i, year t, and 0 otherwise
$BEAT\_ZERO_{it}$	=dummy variable equal to 1 if 0 > earnings assuming full expensing and 0 < earnings assuming full capitalization for firm i, year t, and 0 otherwise
$ZERO\_BELOW_{it}$	=dummy variable equal to 1 if $BEAT\_ZERO_{it} = 0$ and 0 > earnings assuming full capitalization for firm i, year t, and 0 otherwise
$ZERO\_ABOVE_{it}$	=dummy variable equal to 1 if $BEAT\_ZERO_{it} = 0$ and 0 ≤ earnings assuming full expensing for firm i, year t, and 0 otherwise
$EM\_OVERALL_{it}$	=dummy variable equal to 1 if $BEAT\_FORECAST_{it} = 1$, or $BEAT\_PAST\_E_{it} = 1$, or $BEAT\_ZERO_{it} = 1$ for firm i, year t, and 0 otherwise
$SIZE'_{it}$	=natural logarithm of total assets adjusted for R&D capitalization equaling total assets − net accumulated R&D capitalization for firm i, year t

(*Continued*)

Appendix. Continued

Variable	Definition
MB'_{it}	=MB-ratio for firm i, year t with book value of equity adjusted for R&D capitalization equaling book value of equity − net accumulated R&D capitalization
RD_GROWTH_{it}	=(R&D expenditures$_{it}$ − R&D expenditures$_{it-1}$) divided by R&D expenditures$_{it-1}$ for firm i, year t
$LAG\_CAP\_RATIO_{it}$	=capitalized development expenditures for firm i, year t − 1 scaled by total R&D expenditures
LAG_RDCAP_{it}	=capitalized development expenditures for firm i, year t − 1 scaled by lagged total assets adjusted for R&D capitalization
LEV'_{it}	=(total assets − BV′) divided by BV′
ROA'_{it}	=net income adjusted for R&D capitalization (net income + R&D amortization) divided by total assets adjusted for R&D capitalization (total assets − net accumulated R&D capitalization) for firm i, year t
RD_VALUE_{it}	=success of R&D program for firm i, year t defined as: (market value of equity − book value of equity − net accumulated R&D capitalization)$_{it}$ divided by (R&D expenditures$_{it}$ + R&D expenditures$_{it-1}$)
$SALES\_GROWTH_{it}$	=(Sales$_{it}$ − Sales$_{it-1}$) divided by Sales$_{it-1}$ for firm i, year t
$LOSS'_{it}$	=a dummy variable equal to 1 if adjusted earnings (net income + R&D expenses including amortization and write-offs) are negative, and 0 otherwise
$EVAR'_{it}$	=the variance of adjusted earnings (net income + R&D expenses including R&D amortization and write-offs) over a four-year rolling window for firm i, year t
$BETA_{it}$	=a firm-year's one-year beta based on HDAX for firm i, year t
IMR_{it}	=Inverse Mill's ratio based on the probit regression (1) excluding $BEAT\_BENCH_{it}$