Research and development investments, development costs capitalization, and credit ratings: Exploratory evidence from UK R&D-active private firms

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Abstract

This exploratory study investigates research and development (R&D), specifically the relationship between development costs capitalization and the credit ratings of R&D-active private companies. Results indicate that uncertainty surrounding R&D investment is a leading factor in the credit risk assessment of R&D-active private companies. Hence, R&D intensity is seen as negatively impacting credit ratings. Although credit rating assessors are generally more concerned about downside risks, they seem to take into account different degrees of uncertainty. Consequently, our findings reveal that capitalized development projects that signal likely future economic benefits lead to better creditworthiness. Moreover, we infer from our additional analyses that credit rating assessors do consider the reasons of R&D-active private companies for capitalizing development costs. This conclusion is derived from evidence that discretionary capitalization ratios employed in opportunistic earnings management do have a significantly negative association with credit ratings. Conversely, non-discretionary counterparts have a significantly positive effect.

Keywords: private firms, accounting policy choice, R&D investment, development costs capitalization, credit rating

JEL Classifications: D82 · G24 · G32 · G33 · M40 · M41 · O3

1. Introduction

The growing value of intangible assets together with the capacity for innovation as a crucial competitive edge is increasingly important. Therefore, the purpose of this exploratory study is to examine the influence of R&D intensity and development costs capitalization on the credit ratings of R&D-active private companies. Prior research is concerned with determinants for as well as consequences of the capitalization of development costs (e.g. Dinh et al. 2016; Eierle & Wencki 2016; Mazzi et al. 2019a, b; Mazzi et al. 2022) and the effects of R&D expenditures (e.g. Shi 2003; Eberhart et al. 2008). This research, though, is mainly limited to investigations concerning listed companies and equity markets (e.g. Oswald 2008; Cazavan-Jeny et al. 2011; Dinh et al. 2016). However, Shi (2003) points out that debt markets may constitute a more appropriate environment for evaluating the economic consequences of R&D. The trade-off between related risks and benefits is more serious for debt providers suffering from an asymmetric pay-off structure. The same applies to credit rating agencies (CRAs), which leads to an asymmetric interest in firm-specific information (e.g. Griffin et al. 2018). Even though a few prior studies examine debt providers' valuation of R&D investment and internally generated intangible assets for public firms (e.g. Shi 2003; Eberhart et al. 2008; Ciftci & Darrough 2016; Kreß et al. 2019), to the best of our knowledge evidence for private companies is yet to be presented. This exploratory study provides initial insights regarding the effect of capitalized development costs on a company's credit risk assessment, as operationalized by credit ratings.

The new Financial Reporting Standard (FRS) 102 introduced in the United Kingdom (UK) in 2015 provides private companies with an accounting option to capitalize development costs when specific conditions are fulfilled. These concur with the criteria entailing mandatory capitalization according to International Financial Reporting Standards (IFRS). Accordingly, financial statement users not only receive information on a company's innovation strength from

R&D expenditures in the profit and loss account, but in the case of capitalization they are also provided with a signal of internal development projects' prospects of success.

In addition to banks as the primary source of financing for private companies (e.g. Berger & Udell 1998; Bruns & Fletcher 2008), CRAs are becoming more relevant as users of financial information across a variety of businesses, including non-public firms.[1] The increased availability of third-party credit ratings for private companies and the reduced costs of information transfer have resulted in a rising number of financial institutions using these CRA scores for lending approvals and risk pricing models (Cowan & Cowan 2006; Berger & Frame 2007; Liberti & Petersen 2019). Hence, external credit ratings either complement internal credit risk management systems to minimize information asymmetries (Doumpos & Pasiouras 2005; Berger & Udell 2006) or substitute for them in initial decisions to accept or deny credit applications (e.g. Cassar et al. 2015; Liberti & Petersen 2019). In addition, non-financial credit-granting firms with no specialized knowledge on credit risk assessment also rely heavily on external credit ratings in order to evaluate their clients' creditworthiness or take financial recovery measures in cases of financial distress (Doumpos & Pasiouras 2005).

Our exploratory study focuses on the private companies' sector for which there is a distinct lack of empirical evidence despite its crucial role as a major driving force within the UK economy.[2] Research into public firms reveals that R&D capitalization is value-relevant for debt markets in reducing debt costs. However, Kreß et al. (2019, p. 674) point out that it is "*questionable as to whether [their] results are transferable to smaller non-public firms with*

[1] For instance, in her study for the UK Department for Business, Enterprise and Regulatory Reform, Collis (2008) reports that private firms perceive CRAs to be important users of their published accounts. The Institute of Chartered Accountants in England and Wales (ICAEW 2009) also considers that CRAs are major financial decision-makers in the private company sector.

[2] Private firms form the European economy's backbone making up 99.8% of all enterprises, 67% of total employment, and 57.4% of value added in the 28 European Union countries (EU-28) non-financial business sector (Muller et al. 2017). The UK business sector is also well-known for being dominated by private firms (Department for Business, Energy & Industrial Strategy 2017). R&D investment from UK businesses amounted to £22.2 billion in 2016 (67 % of total R&D expenditures) (Office for National Statistics 2018), of which about £14 billion stem from private companies (derived with data from the FAME database).

more severe risk-benefit profiles". Indeed, findings from studies concerning public firms may not be unrestrictedly transferable to the context of private companies, as they are perceived to exhibit higher credit and operational risks (Andrikopoulos & Khorasgani 2018); moreover, their R&D activities suffer from higher uncertainty. More specifically, one can argue that when compared with smaller (private) companies, larger (public) firms can benefit from economies of scale and economies of scope. As a result, public firms make more efficient use of their innovation expenditure through a more wide-ranging and diversified investment strategy (e.g. Noteboom 1994; Vossen 1998; Ortega-Argilés et al. 2009). Second, due to their size public firms are able to invest in various R&D undertakings, thereby spreading any risk over more extensive R&D portfolios. This option is not available to private companies, for which future success usually depends on a single innovation or very few R&D projects (e.g. Noteboom 1994; Vossen 1998; Ortega-Argilés et al. 2009). Third, public firms are characterized by having greater market power than private companies, which in turn helps them to cope with failed R&D projects without losing market share (e.g. Vossen 1998; Ortega-Argilés et al. 2009). Last but not least, smaller (private) firms have only limited financial and human resources compared with their larger (public) counterparts, which leads to more occasional, unstructured, less systematic, and non-permanent R&D (Santarelli & Sterlacchini 1990; Ortega-Argilés et al. 2009). In sum, as also concluded by Noteboom (1994), private companies suffer from higher R&D risk than public firms.

Based on an initial sample of over 6,074 R&D-active private companies for the two years immediately following FRS 102's introduction, we manually analyzed annual accounts looking specifically at financial information concerning the accounting treatment and measurement of internal development projects. Subsequently, we were able to identify 660 firm year observations for our exploratory study. Findings reveal that R&D-active private companies' R&D intensity is negatively associated with their credit ratings, indicating the caution of credit rating assessors in light of the general uncertainty surrounding their R&D projects. Conversely, the capitalized elements of R&D investments are associated with better credit ratings. Thus, credit rating assessors seem to value capitalized development costs positively within their rating procedure, a signal of reduced risk from R&D investment. Additional analyses, though, show that discretionary capitalization in the sense of opportunistic earnings management is valued negatively. These results remain robust when subjected to several sensitivity tests, including different model specifications along with alternative measures for R&D and development costs capitalization.

As a result of our exploratory study, we make the following significant contributions to prior academic literature. We advance research dealing with (private) companies' credit risk assessment by analyzing the impact of R&D and its accounting treatment on credit ratings. Thereby, we also shed further light on the economic consequences of development costs capitalization, in particular for R&D-active private firms and from a debt market perspective. Beyond the academic contribution, we provide valuable information for both standard setters and regulators. In this context, current research by the European Federation of Accountants and Auditors for small and medium-sized enterprises (EFAA for SMEs) clearly emphasizes the scope for improving comparability of accounting information, particularly regarding internally generated intangible assets (Martin & Jarvis 2020). In light of this, our findings show that an accounting option to capitalize development costs restricted by the fulfillment of specific criteria may provide reliable, decision useful information and contribute to better credit ratings. More specifically, our results might overcome opponents' concerns about negative economic effects of inherent opportunistic earnings management by showing that CRAs may generally not be misled by discretionary capitalization of development costs. In summary, our study should not only be of particular interest in the context of ongoing research projects on intangible assets' reporting of the UK's Financial Reporting Council (FRC)[3] and the European Financial Advisory Group (EFRAG) [4], but also provide knowledge for future harmonization projects regarding the accounting treatment of intangible assets by private companies.

The remainder of this paper is organized as follows. Section 2 discusses relevant literature covering R&D accounting treatment in the UK and develops our hypotheses. Section 3 explains our research design by describing the empirical models employed and the sample selection process, while Section 4 presents our empirical findings as well as additional analysis. Several sensitivity tests are presented in Section 5. Concluding remarks are given in Section 6.

2. Background, literature review and hypotheses development

2.1 Accounting treatment of R&D in the UK

Effective January 1, 2015, the FRC revised the financial reporting system in the UK and the Republic of Ireland. In developing new accounting standards, the FRC's key objective was to provide users of financial reporting with high quality, readily understandable information. The accounting standard governing the accounting treatment of R&D is currently FRS 102, which applies to all entities not required by the IAS Regulation (European Union (EU) Regulation 1606/2002/EC) to prepare their consolidated financial statements in accordance with EU-adopted IFRS.[5] FRS 102 is primarily based on IFRS for SMEs, with some

[3] The scope of this project includes the accounting treatment of intangible assets as well as disclosures about intangibles in the narrative reports - see information about the research activity *Intangibles: How Can Business Reporting Do Better?* at https://www.frc.org.uk/accountants/accounting-and-reporting-policy/research/intangibles-how-can-business-reporting-do-better. In general, current research projects are available at the FRC's homepage: https://www.frc.org.uk/accountants/accounting-and-reporting-policy/research.

[4] Detailed information on the EFRAG research project on better information on intangible assets is available at: https://www.efrag.org/Activities/1809040410591417/EFRAG-research-project-on-better-information-on-intangible-assets?AspxAutoDetectCookieSupport=1#.

[5] A micro entity can choose to prepare its individual financial statements in accordance with the micro-entities regime as set out in The Small Companies (Micro-entities' Accounts) Regulations 2013 (SI 2013/3008), including the application of FRS 105. Large, medium-sized, and small private companies are required to prepare their consolidated and individual financial statements in accordance with FRS 102 and allowed to adopt voluntarily FRS 101 (in case of individual financial statements of qualifying entities) or EU-adopted IFRS (cf.

amendments to align with the respective EU Accounting Directive. When compared with the old UK Generally Accepted Accounting Principles (GAAP), FRS 102 has several changes in measurement, recognition, and disclosure requirements.

In line both with IFRS and the old provisions of Statement of Standard Accounting Practice for R&D No. 13 (SSAP 13), FRS 102 s. 18.8E prohibits the recognition of intangible assets arising from research. Thus, expenditure on research must be recognized as expense when incurred.

With regard to the accounting treatment of development costs, a conscious decision was made to deviate from the prohibition of capitalization anchored in the IFRS for SMEs. Instead, the accounting option already applicable under the old provisions of SSAP 13 was retained and further aligned with IFRS requirements with regard to additional recognition criteria that must be met. According to FRS 102 s. 18.8H, the conditions that must be fulfilled are more stringent than they were under SSAP 13. In addition, these new recognition criteria literally correspond to IAS 38.57. However, there is still one difference: IFRS prescribes the mandatory capitalization of development costs if the recognition criteria are met, while FRS 102 grants an explicit accounting option. Giving private companies an explicit accounting option provides the advantage that they are not unduly burdened by costs resulting from a mandatory capitalization, but able to capitalize development outlays if the benefits outweigh the related costs in a given case.[6]

FRS 100.4 - Basis of preparation of financial statements). For our study we investigate only private companies applying FRS 102 (see sample selection in chapter 3.2).

[6] In this context, the application of the accounting policy option is independent of any tax considerations. While the UK government supports companies that work on innovative projects in science and technology with the provision of an R&D tax relief, the eligibility of expenditures is not tied to their accounting treatment (CTA 2009/S1308). For a detailed commentary on the interplay between R&D tax relief and the accounting treatment of R&D expenditures in the UK, see Her Majesty's Revenue and Customs (HMRC) internal manual CRID81450, available at https://www.gov.uk/hmrc-internal-manuals/corporate-intangibles-research-and-development-manual/cird81450, and CRID81700, available at https://www.gov.uk/hmrc-internal-manuals/corporate-intangibles-research-and-development-manual/cird81700.

Summarizing, according to FRS 102 s. 18.8H a company may recognize an intangible asset arising from development (or from the development phase of an internal project) if, and only if, it can demonstrate all of the following: (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; and (f) its ability to measure reliably the expenditure attributable to the intangible asset during its development.

2.2 Literature review and hypotheses development

In light of the tension between R&D's uncertainty and its relevance as a driver of success, prior literature about equity investors' R&D valuation cites an expectation that future benefits from R&D investment will outweigh related risks (Lev & Sougiannis 1996). In this sense, literature reveals that the deployment of intangibles leads to abnormal profits and dominant competitive standings, enabling firms to achieve positions of temporary monopoly in the market (Lev 2001). Moreover, prior research reports that R&D-intensive firms not only record positive subsequent stock returns (Lev & Sougiannis 1996), but also exhibit high abnormally operating profitability (Eberhart et al. 2004) and annual earnings growth rates (Chan et al. 2001). However, the risk related to R&D is, in general, substantially higher than that for physical and even financial investment (Lev 2001). This reflects the innovation process, which is commonly afflicted with tedious search and discovery periods, ill-structured difficulties, and lags of unforeseen duration until output is available for internal use or commercialization (e.g. Dosi 1988; Hunter et al. 2012 with further references). Furthermore, R&D activities' inherent riskiness lies in their skewed nature (Lev 2001). While the success rate of innovation projects is often very low, future earnings and stock returns' variability of R&D-intensive firms is high (e.g. Chan et al. 2001; Kothari et al. 2002; Amir et al. 2007). Furthermore, liquidation value in the event of project failure is not substantial due to limited alternative usage possibilities (Kothari et al. 2002).

However, due to different payment structures, the trade-off between future benefits and risks from R&D activities is not transferable between equity and debt markets. As opposed to equity providers, debt holders exhibit only limited upside potential. Their returns are constrained by payment of interest and ultimately liability settlement. Debt providers are also subject to an unlimited downside risk in the event of loan default (Ciftci & Darrough 2016). Accordingly, Easton et al. (2009) suggest that equity investors' decisions are guided by their upside potentials, whereas lenders are more concerned about the downside risks. Similarly, CRAs have an asymmetrical interest in firm-specific information and may, therefore, focus on downside risk information (e.g. Griffin et al. 2018).

Indeed, literature that addresses the assessment of R&D investment from a debt market perspective documents mixed results in the context of public companies (e.g. Shi 2003; Czarnitzki & Kraft 2004; Del Bello 2007; Eberhart et al. 2008; Alp 2013; Zhang 2015; Cho & Choi 2019). Rather than concentrating on public debt typically issued by large and well-established firms, Ciftci & Darrough (2016) focused on bank loans in order to gain insights into lenders' perspectives on R&D for small, start-up companies. They provide evidence that companies' R&D intensity is positively related to bank loan spreads, confirming that R&D investments create information asymmetry and tend to be riskier (Seow et al. 2006).

As the risk aspect of R&D is even more critical for private firms due to their less diversified product and research portfolio, we expect a negative association between their R&D intensity and credit ratings. Thus, we test the following hypothesis:

H1: *R&D-active private firms' R&D intensity is negatively associated with their credit ratings.*

Within the credit rating process, a further issue to consider is how to deal with capitalized R&D. In accordance with the *demand hypothesis*, it may be argued that managers use the accounting option and inherent discretion to provide internal information about their firms' R&D activities to external parties (e.g. Ball & Shivakumar 2005; Hope et al. 2013), thereby signalizing related future benefits to the market in line with *signalling theory* (e.g. Oswald & Zarowin 2007; Tsoligkas & Tsalavoutas 2011). As a consequence of this *truthful* capitalization, existing information asymmetries between managers and their financial statements' users could be reduced (Eierle & Wencki 2016). Conversely, in line with the *opportunistic behavior hypothesis*, capitalizing development costs also raise concerns about managers' potential discretionary use in applying earnings management strategies, which can result in misrepresentation of R&D accounting information (Healy & Wahlen 1999). This view is corroborated by empirical literature, which provides evidence confirming the potential for opportunistic accounting discretion being used to obfuscate a company's true performance (e.g. Cahan et al. 2008; Hope et al. 2013; Dinh et al. 2016). With these considerations in mind, prior empirical literature on the voluntary capitalizing of development costs unsurprisingly found a broad variation of factors influencing public and private companies' accounting policy choices, which can often be linked to both honorable as well as opportunistic motivations.[7]

Evidence suggests that in the past banks tended to ignore capitalized intangible assets in their lending decisions or credit monitoring by deducting them from the balance sheet (e.g. Catasús & Gröjer 2003; Frankel et al. 2008; Zuelch & Burghardt 2010). However, with the rising importance of intangible value drivers, the literature also documents their growing

[7] Relevant studies are referred in section 3.1.2.

relevance in credit provisions and credit monitoring. For instance, research reports that intangible assets are increasingly used as loan collateral (Mann 2018). Additionally, Catasús & Gröjer (2003) conclude that intangible assets reported on the balance sheet are meaningful for lending decisions if they are reliable. Furthermore, the literature shows that information about intangible assets and intellectual capital improves the financial health evaluation by external parties (Sriram 2008) and may enhance rating reliability, thus, resulting in lower costs of debt (Alwert et al. 2009). Several studies indicate that information about intangible assets have a relevant impact on credit risk assessment and can even strengthen a company's creditworthiness (e.g. Catasús & Gröjer 2003; Bruns & Fletcher 2008; Vanini & van Liempd 2017; Cenciarelli et al. 2018). More specifically, Griffin et al. (2018) reveal that credit ratings improve in line with corporate innovation efficiency, calculated as the number of patents filed or cited by a firm scaled by its R&D expenses. They argue that higher levels of patents or citations represent successful and efficient innovations, hence, removing some of the uncertainty attached to R&D because they provide creditors with a clearer picture of future cash flows.

These thoughts are also transferable to the context of development costs capitalization. In the context of FRS 102, capitalization is allowed only for those internal projects that are in a sufficiently advanced stage of development as well as technically and commercially viable. Even if some potential for opportunistic earnings management remains in judging whether or not the additional recognition criteria have been fulfilled, they still ensure a certain degree of reliability in the capitalized development projects. Accordingly, internally generated intangible assets could signal highly likely future economic benefits and a strongly reduced risk potential to credit rating assessors.

Some research indicates that analysts tend to question higher capitalization ratios evoked by peer group analyses of their accounting behavior (Ding et al. 2013) and investors have in general concerns against the capitalization of development costs (e.g. Cazavan-Jeny et al. 2011). However, most evidence supports its overall positive effect (e.g. Oswald & Zarowin

2007; Tsoligkas & Tsalavoutas 2011; Dinh et al. 2016). In line with this, Shah et al. (2013) conclude from their value relevance study of listed UK companies that capitalized development costs are perceived to have followed successful R&D projects. Moreover, prior literature provides evidence on capitalization leading to higher future benefits (Mazzi et al. 2019b), lower risk in future earnings (Ahmed & Falk 2006) and, therefore, may increase a company's creditworthiness. This argumentation is confirmed by Kreß et al. (2019), who for a global sample of public companies report that an increasing amount of capitalized development costs produce a corresponding reduction in both public and private debt costs.

Hence, we test the following two hypotheses with regard both to the initial capitalization decision as well as the extent of development costs recognized as internally generated intangible assets in the balance sheet:

H2: *R&D-active private firms' capitalization of development costs has a positive association with their credit ratings.*

H3: *R&D-active private firms' development costs capitalization ratios are positively associated with their credit ratings.*

3. Research Design

3.1 Empirical models

3.1.1 R&D intensity, development costs capitalization, and private firms' credit ratings

In order to test the relationship between R&D intensity as well as development costs capitalization and private firms' credit ratings, we estimate the following empirical basic model:

$$\textit{Credit Rating} = \beta_0 + \beta_1 * \textit{R\&D-intensity} + \beta_2 * \textit{Capitalization of development costs} + \Sigma\beta_i \textit{ Firm-specific Controls} + \Sigma\beta_i \textit{ Year effects} + \Sigma\beta_i \textit{ Industry Controls} + \varepsilon \quad (1)$$

In this model, *Credit Rating* is operationalized by two different dependent variables. First, following prior research (e.g. Doumpos & Pasiouras 2005; Dedman & Kausar 2012; Zalata & Roberts 2017; Peel 2019), the dependent variable *CREDIT_RATING* is the QuiScore, which is an unsolicited rating developed by CRIF Decision Solutions Limited in conjunction with Jordans Limited and available at the BvD FAME database.[8] This credit rating score measures a company's likelihood of becoming bankrupt over the next 12 months and ranges between 0 and 100, where 0 represents the companies which are closest to the point of default. To determine this score, various pieces of information are applied including companies' accounts, different combinations of key financial items, such as shareholder funds, turnover, or liabilities, as well as directors' history, shareholders' data, holding/subsidiary structure, or County Court Judgements. Second, because the credit rating can be differentiated into five categories (Secure (81-100), Stable (61-80), Normal (41-60), Cautious (21-40), and High Risk (0-20)), we also take into account the different classification and, hence, incorporate a differentiation between secure and risky rating categories rather than the actual rating score (*CREDIT_RATING)*. The dependent variable *RATING_SECUREBAND* used for this purpose is an indicator variable, which equals 1 if the company's credit rating is secure or stable (> 60), and 0 otherwise.

To investigate how a private company's R&D intensity affects its credit rating, we included the variable *RD_INT*, measured as total (capitalized and expensed) R&D expenditures divided by sales (e.g. Czarnitzki & Kraft 2004; Zhang 2015; Kreß et al. 2019). Moreover, for the capitalization of development costs we included two different independent variables. The indicator (binary) variable *CAP* equals 1 if the company capitalizes development outlays. As a further variation within our analysis, we considered the capitalization ratio, which is the amount of capitalized development costs divided by a firm's total censored (expensed and capitalized)

[8] In line with prior literature (e.g. Dedman & Kausar 2012; Cho & Choi 2019; Griffin et al. 2018; Peel 2019), we employ the absolute rating value, which ranges from 0 and 100. Alternatively, we use the natural logarithm of a company's credit rating as alternate independent variable in our robustness tests, which are reported in section 5.4.

R&D expenditures (*CAP_RATIO*). Because the capitalization decision may be endogenously determined by a firm's properties other than those required under *FRS 102* and might bias our inferences on the credit rating score, we ran two-stage least squares (2SLS) estimations. Hence, *CAP* and *CAP_RATIO* in equation (1) are instrument variables.[9]

In line with prior literature, we controlled for other firm-specific factors that may affect private companies' credit ratings.[10] Thus, we included the variable firm size (*SIZE*), calculated as the natural logarithm of a firm's total sales. Furthermore, we included control variables for: a company's leverage (*LEVERAGE*), computed as long-term debt divided by total assets; reliance on tangible assets (*TANGIBLITY*), measured as the amount of tangible assets to balance sheet total; a firm's operating performance measured by return on assets (*ROA*), charged as earnings before interest and tax scaled by total assets; and its growth opportunities (*GROWTH*), calculated as growth in earnings before taxation. Moreover, the indicator variable *INCOME_NEG* is coded as 1 if a company reports negative earnings; additionally, indicator variable *BIG4* equals 1 if a company is audited by a BIG4 audit firm.

All variables referring to balance sheet positions or income statement items were, in line with prior literature (e.g. Oswald 2008; Dinh et al. 2016; Eierle & Wencki 2016), computed before capitalization of development costs and so-called 'as if expensed' figures. To deal with outliers, we winsorized all continuous variables at the 1st and 99th percentiles. Furthermore, we included industry and year-fixed effects in all equations. To control for heteroscedasticity, we employed Huber/White adjusted standard errors (Dinh et al. 2016). Variance Inflation Factors (VIF) are also reported to demonstrate that multicollinearity is not of major concern in our models. Definitions and measurements covering all variables are provided in Appendix I.

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9 For further details about the endogeneity tests and the first regression of the 2SLS approach, see Section 3.1.2.

10 Details on the rationale and theoretical justifications for the inclusion of the control variables can be found, for instance, in Ashbaugh-Skaife et al. (2006), Dedman & Kausar (2012), Alissa et al. (2013); Zhang (2015), Ciftci & Darrough (2016), Cornaggia et al. (2017), Vanini & van Liempd (2017), Kusano (2018), or Griffin et al. (2018).

3.1.2 Endogeneity of the capitalization of development costs – IV/2SLS approach

Appraisal of development costs' accounting treatment hinges on considerations with regard to the possible motives behind a capitalization decision. Prior research shows that decisions to capitalize development costs stem from various factors (e.g. Dinh et al. 2016; Eierle & Wencki 2016; Mazzi et al. 2019a, b; Brasch et al. 2022) and may be endogenous (Oswald 2008; Cazavan-Jeny et al. 2011). Hence, in line with prior studies (e.g. Dinh et al. 2015; Dinh et al. 2016; Kreß et al. 2019; Mazzi et al. 2019b), we use a 2SLS regression because tests[11] suggest that endogeneity exists. To analyze how the accounting treatment of development costs affects a private company's credit rating, we include instrument variable estimates, which are based on the determinants of companies' capitalization of development costs, by estimating the following regression model:

$$\textit{Capitalization of Development Costs} = \beta_0 + \Sigma\beta_i \textit{ Firm-specific Controls} + \Sigma\beta_i \textit{ Year effects} + \Sigma\beta_i \textit{ Industry Controls} + \varepsilon \quad (2)$$

In this model, *CAP* and *CAP_RATIO* are used as dependent variables to operationalize the *Capitalization of Development Costs* in the first stage Probit respectively zero (i.e., left-censored) Tobit model. Details on the rationale and theoretical justifications for including control variables can be found *inter alia* in Eierle & Wencki (2016), Dinh et al. (2016), Kreß et al. (2019), and Mazzi et al. (2019a, b), as well as Brasch et al. (2022) and in a variety of previous R&D studies.[12] Further information about the definitions and measurements of all variables are provided in Appendix I. Even though the results of equation (2) are not our main focus, we

[11] We check endogeneity by using Hausman-Wu test and instrument relevance by using Waldtest.

[12] We have consciously referred to the most recent relevant studies here; further references can be found in the studies cited.

report descriptive and multivariate findings for the sake of completeness in Appendices II and III.

3.2 Sample selection process[13]

Table 1 reports our sample selection process. The starting point is UK private firms that not only adopted FRS 102, but also invested in R&D during the financial years 2015 and 2016. We focused on these specific business years, as the new accounting standards became mandatorily effective for accounting periods beginning on or after January 1, 2015.[14] In addition, companies that prepared their financial statements in accordance with FRS 102 for the first time had the opportunity to change their policy from that applied under old UK GAAP. Hence, companies were able to switch from an expensing to a capitalizing accounting policy and vice versa without violating the principle of continuity.

[Insert Table 1 about here]

As the FAME database[15] does not allow searches for companies with internally generated intangible assets (R&D assets), we had to identify capitalizing firms by hand collection. In order to determine all Capitalizers, we would have had to look at every single company disclosing intangible assets in general, including goodwill and acquired intangible assets. That would have meant analyzing manually the annual accounts of more than 235,500 firms over a period in excess of one year. In reality, most firms that capitalize development costs are likely to have invested in R&D previously and exhibited related expenditures in their profit and loss accounts for the same or previous year due to investment cycles. Therefore, we decided to narrow the analyzed database sample down to companies with a known value of R&D expenditures in the

[13] A similar sample selection process was applied for the archival analysis in Brasch et al. (2022).

[14] The *FRS 102* amendments for small companies are effective for accounting periods beginning on or after January 1, 2016, but early application is permitted for accounting periods beginning on or after January 1, 2015 (*FRS 102.1.15*).

[15] FAME is a database provided by Bureau van Djik that includes financial data from over 11 million companies in the UK and Ireland.

income statement for 2015 or 2016. Then excluded all inactive firms, IFRS adopters for the last available year, and consolidated financial statements.

Subsequently, we collected available data from the FAME database and further necessary information not available in the database from the companies' annual financial reports manually. These hand-collected variables include mainly information about capitalization and the extent of capitalized development costs, as well as companies' adopted accounting standards. We gathered the credit ratings that were available for sample observations. Finally, we adjusted for observations with missing variables. A sample of 660 observations remained, from which 124 were Capitalizers and 536 were Expensers.[16]

4. Results

4.1 Descriptive statistics and regression results

Table 2 reports descriptive statistics from sample characteristics along with dependent and independent variables. Panel A shows results from the full sample, while Panel B provides differences between capitalizing and expensing companies. Statistics from the sample characteristic indicate that it is representative for the entire population of private companies, by featuring those which are new and well established as well as a wide range of small and large companies.

[Insert Table 2 about here]

Regarding R&D investment and its accounting treatment, descriptive statistics (see Table 2 Panel A) show that our sample companies invested about 6.4% of their total sales in R&D projects (*RD_INT*), of which about 11.6% are recognized as internally generated intangible assets (*CAP_RATIO*). If the capitalization ratio is viewed only from the perspective

[16] This rather small number of capitalising companies is line with pior empirical evidence of UK public firms applying *SSAP 13* prior to the mandatory adoption of *IFRS*; see Oswald & Zarowin (2007), Oswald (2008), and Dargenidou et al. (2021).

of capitalizing firms, on average it is 62% (see Table 2 Panel B). This is consistent with the ratio that Oswald (2008) documented for public companies under former UK GAAP which also provided an option to capitalise development costs. Furthermore, private companies have on average a credit rating score (*CREDIT_RATING*) of 88.7 (median is 92.0) and belong to the secure band, within which bankruptcy is very unusual and normally occurs only as a result of extraordinary changes within the company or its market (Bureau van Dijk 2020). The descriptive statistics further display that expensing companies have tendentially higher ratings (mean/median *CREDIT_RATING* = 89.373/93.000; mean *RATING_SECUREBAND* = 0.942) than capitalizing firms (mean/median *CREDIT_RATING* = 85.790/92.000; mean *RATING_SECUREBAND* = 0.895). Additionally, results from the T-test and Wilcoxon-Mann-Whitney-Test reveal that the capitalization of development costs seem linked with a lower tangibility of assets (mean *TANGIBILITY* = 0.145 for Capitalizers and 0.176 for Expensers) and lower operating performance (mean *ROA* = 0.010 for Capitalizers and 0.089 for Expensers). Results further suggest that capitalizing firms more often suffer from negative income numbers (mean *INCOME_NEG* = 0.266 for Capitalizers and 0.159 for Expensers), are less often audited by Big4 audit firms (mean *BIG4* = 0.444 for Capitalizers and 0.550 for Expensers) and smaller (mean *SIZE* = 9.890 for Capitalizers and 10.410 for Expensers). The Wilcoxon-Mann-Whitney-Test also displays significant differences between capitalizing and expensing firms regarding their economic growth (*GROWTH*) and leverage (*LEVERAGE*).

Table 3 provides the Spearman (Pearson) correlation coefficients for the main variables tested in our multivariate regression models above (below) the diagonal.[17] For both credit rating measures, we find significantly positive Spearman and Pearson correlations with *ROA*. However, the positive correlations with company size are weaker, but still significantly positive Pearson correlation between *CREDIT_RATING/RATING_SECUREBAND* and *SIZE* as well as

[17] To demonstrate that multicollinearity is not of major concern in our equations (1), we additionally report Variance Inflation Factors for our regression models, see also section 3.1.1.

a significantly positive Spearman correlation between *RATING_SECUREBAND* and *SIZE*. Tangible assets (*TANGIBILITY*) have significantly positive Spearman correlations, while their Pearson correlation coefficients are positive but not significant. Importantly, the variables *CAP_RATIO*, *RD_INT*, and *INCOME_NEG* have a negative and significant Pearson and Spearman correlation with both *CREDIT_RATING* and *RATING_SECUREBAND*. Pearson and Spearman correlations are negative and significant for *LEVERAGE* with *CREDIT_RATING*. Moreover, *LEVERAGE* has a negative correlation with *RATING_SECUREBAND* for both Pearson and Spearman, but it is only significant for Pearson. Correlation results between both credit rating measures and the variables *GROWTH* and *BIG4* are mainly not significant.

[Insert Table 3 about here]

Even though the descriptive and correlation results suggest that capitalization of development costs leads to a lower creditworthiness, these statistics do not consider determining factors for the capitalization decision. Furthermore, they do not control for firm-specific factors affecting a private company's credit risk assessment. For instance, we also find that a capitalizing firm has on average a higher R&D intensity, which is significantly negatively correlated with both credit rating measures (both Pearson and Spearman correlations with *CREDIT_RATING* and *RATING_SECUREBAND* are at the 1% significance level). Hence, in order to give a valid answer in regard to support for our hypotheses, these issues had to be further investigated with the use of a multivariate regression model.[18]

[18] Descriptive statistics and correlation results can deviate from the true associations as only the isolated effect is considered and endogeneity issues as well as other (firm or country) specific influences are not taken into account. See for example Florou & Kosi (2015), S. 1419 or Kreß et al. (2019), S. 649.

4.2 Multivariate analyses

4.2.1 Main analyses – the impact of R&D intensity and development costs capitalization on R&D-active private firms' credit ratings

Models 1 and 2 as well as 5 and 6 in Table 4 present our multivariate analysis testing the effects of R&D intensity and development costs capitalization on R&D-active private companies' credit rating. Models 1 and 5 consider the initial decision to capitalize or expense development costs (*CAP*), while models 2 and 6 reflect the impact of the capitalization ratio (*CAP_RATIO*). The dependent variable in models 1 and 2 is the actual credit rating score (*CREDIT_RATING*) and in models 5 and 6 it is the variable *RATING_SECUREBAND*, indicating a presence in the secure or stable rating category.

[Insert Table 4 about here]

These results support our H1: R&D-active private companies with greater R&D intensity are more likely to have poorer credit ratings (*CREDIT_RATING*) or scorings outside the secure and stable band (*RATING_SECUREBAND*). The coefficient of RD_INT is negative as expected and significant across all relevant model specifications (model 2 at the 5% level and all others at the 1% level). This implies that private firms' credit rating assessors weight the downside risks of uncertain R&D investment higher than potential underlying future economic benefits. This seems reinforced by the fact that a company's R&D intensity does not provide any information about the reliability of its R&D projects and, hence, credit rating assessors have no way of differentiating between R&D spending that will probably produce successful results and that is likely to be unsuccessful.

The multivariate analyses also support H2 and H3, given that the coefficients of *CAP* and *CAP_RATIO* are as hypothesized and statistically significantly positive in all model specifications (model 2 at the 10% level and all others at the 5% level). These findings indicate not only that private firms are able to send a signal when they capitalize, but also that credit rating assessors seem to trust in the highly likely future success of capitalized development projects. The latter case is probably supported by FRS 102's restriction of the explicit accounting option on the fulfillment of additional recognition criteria (*FRS 102 s. 18.8H*), and consequently only highly likely successful development projects are allowed to be capitalized. The *CAP_RATIO* not only reflects a company's capitalization decision (*CAP*), but also the amount of capitalized development costs in relation to total R&D investments. Therefore, our findings imply that R&D-active private companies with a greater proportion of highly likely successful development projects are assessed as more creditworthy. Put differently, R&D-active private firms with more extensive or a larger number of capitalized development projects (higher capitalization ratios) signal higher future economic benefits, growth opportunities, and competitive advantages; thus, in financial terms they are considered to be more stable.

Models 3 and 4 as well as 7 and 8 presented in Table 4 provides insights regarding the moderating role of development costs' capitalization on the risk assessment of R&D-active private companies within credit rating procedures. While models 3 and 4 show the effects on the actual credit rating score *CREDIT_RATING,* models 7 and 8 present findings on the impact on the indicator variable *RATING_SECUREBAND.* The capitalization of development costs variable in Models 3 and 7 is *CAP* while in models 4 and 8 is *CAP_RATIO*. The interaction effect between R&D intensity and development costs capitalization is significantly positive (in models 3 and 4 at the 10% level and in models 7 and 8 at the 1% level), thereby supporting H2 and H3. These findings imply that the capitalization of development costs are valued as a reliable signal for future prospects of success and, thus, moderates the risk assessment of rather uncertain R&D investments.

In summary, our findings support all three of our hypotheses. In addition, our control variables provide some interesting findings. *ROA* representing a company's profitability is positive at the 1% significance level in all model specifications. Negative reported earnings

(*INCOME_NEG*) is negative at the 1% significance level in all model specifications. Furthermore, in models 1 to 4 we find a negative association with the variable *LEVERAGE* at the 1% significance level as well as a positive relationship in models 5 and 6 to the variable *TANGIBILITY* at the 10% significance level. Finally, we find no significant evidence for the variables *SIZE, GROWTH*, and *BIG4*.

4.2.2 Additional analyses – Expected and discretionary development costs capitalization

Models 2 and 6 in Table 4 indicate that a private company's capitalization ratio is valued positively within the credit rating procedure. However, prior literature (e.g. Cahan et al. 2008; Markarian et al. 2008; Hope et al. 2013; Dinh et al. 2016; Eierle & Wencki 2016; Brasch et al. 2022) documents that both implicit and explicit accounting options covering the capitalization of development costs open up opportunities for managerial discretion and earnings management.[19] In addition, another strand of research deals with the impact of companies' earnings management efforts on their credit ratings (e.g. Graham et al. 2005; Ashbaugh-Skaife et al. 2006; Caton et al. 2011; Alissa et al. 2013; Zhao 2017; Liu et al. 2018; Zhang 2018; Hill et al. 2019).

In light of the general tendency of companies towards opportunistic behavior, we addressed the concern of whether private company's credit rating assessors differentiate between a discretionary and an expected 'normal' capitalization, which is unrelated to earnings management. Accordingly, we carried out additional analyses estimating the expected 'non-discretionary' as well as the unexpected 'discretionary' portion of a company's capitalization ratio (e.g. Jones 1991; Boynton et al. 1992; DeFond & Jiambalvo 1994; Francis et al. 2005). A

[19] For instance, Eierle & Wencki 2016 investigate the determinants of private firms' development costs capitalization under German GAAP, which provides an explicit accounting option without the fulfilment of restrictive conditions. Conversely, IFRS require mandatory capitalization if specific criteria are met. Since these restrictive conditions are afflicted with subjective management judgements, it is considered by prevailing opinion to be an implicit accounting option, see e.g. Markarian et al. (2008) or Dinh et al. (2016). Conversely, FRS 102 not only requires managerial discretion (recognition criteria) but also provides an explicit accounting choice to capitalize or expense these qualified development expenditures.

similar approach, also in relation to capitalized R&D, was recently applied by Cheng et al. (2016), Kuo & Lee (2018), Kreß et al. (2019), Mazzi et al. (2019a, b).

In order to disentangle these two effects, we used equation (2) to estimate the fitted values representing ratios at which point companies are expected to capitalize given their specific characteristics (*CAP_RATIO_Expected*) and residuals reflecting discretionary capitalization ratios (*CAP_RATIO_Unexpected*) (e.g. Cheng et al. 2016; Kuo & Lee 2018; Kreß et al. 2019; Mazzi et al. 2019a, b). Furthermore, we differentiated between positive residuals, those which are higher compared with expected capitalization ratios (*CAP_RATIO_Overcapitalized*), and negative residuals resulting from companies' undercapitalization (*CAP_RATIO_Undercapitalized*). For these four new variables, they are coded zero for Expensers because we are interested only in identifying expected and unexpected portions of *CAP_RATIO* for capitalizing companies (Kreß et al. 2019; Mazzi et al. 2019a, b).

Subsequently, we replicated our main analysis for H1 and H3 by introducing both *CAP_RATIO_Expected* and *CAP_RATIO_Unexpected* in models 9 and 11 in Table 5. In models 10 and 12 of Table 5, we further subdivided the *CAP_RATIO_Unexpected* into over-capitalized (*CAP_RATIO_Overcapitalized*) and under-capitalized (*CAP_RATIO_Undercapitalized*) portions of the capitalization ratio. The dependent variable in models 9 and 10 is *CREDIT_RATING*, the true score for a private company's credit rating, while models 11 and 12 show results with the indicator variable *RATING_SECUREBAND*.

[Insert Table 5 about here]

Models 9 and 11 in Table 5 suggest a significantly positive relationship between the ratio a company is expected to capitalize and its credit rating, as the coefficients for *CAP_RATIO_Expected* are positively significant at the 5% level. Conversely, findings indicate a significantly negative association between the capitalization ratio's discretionary portion and both credit rating measures, as the coefficients for *CAP_RATIO_Unexpected* are negatively significant at the 1% level. This implies that credit rating assessors value only expected capitalized development projects positively within their credit risk valuation, while discretionary capitalization associated with earnings management is viewed negatively.

These unexpected capitalization ratios can come about for various reasons (Kuo & Lee 2018; Kreß et al. 2019). First, companies capitalizing with lower development cost ratios may on the one hand not be able to meet expectations or on the other hand may be more prudent and decide to forego the accounting option, even though they would fulfil the restrictive conditions required under FRS 102. Second, over-capitalizing firms may be too optimistic in evaluating the future success of their R&D projects or use capitalization as a means of opportunistic earnings management. Models 10 and 12 in Table 5 indicates a significantly negative relationship between the over-capitalized ratio of development costs and a company's credit ratings (the coefficient of *CAP_RATIO_Overcapitalized* is negatively significant at the 1% level). Conversely, the findings demonstrate no significant association with the capitalization ratio's under-capitalized portion (*CAP_RATIO_Undercapitalized*). This is in line with prior evidence (Kuo & Lee 2018) and consistent with the idea that only upward earnings management leads to salient concerns for credit rating assessors.[20]

[20] Lev & Sougiannis (1996) point out that earnings are a direct measure of R&D related benefits, so researchers often use companies' future reported net income to analyze the future success of capitalized and expensed R&D projects (Aboody & Lev 1998; Kothari et al. 2002; Ahmed & Falk 2006; Amir et al. 2007; Cazavan-Jeny et al. 2011; Mazzi et al. 2019b; Kreß et al. 2019). Accordingly, to also validate the pre-discussed findings, we investigated the impact of discretionary capitalization ratios on private companies' future return on assets ($FUTURE\_ROA_{i,t+1}$). The results from this additional test show that both *CAP_RATIO_Expected* and *CAP_RATIO_Undercapitalized* contribute significantly positively to future, while *CAP_RATIO_Overcapitalized* have no significant effect on future benefits (the coefficient is negative, but not significant). These findings emphasize the reliability of both expected and non-discretionary portions of capitalized development costs as well as the underlying over-optimism or opportunistically motivated use of the over-capitalized counterparts. Hence, this additional analysis confirms our findings from models 10 and 12 and indicates that CRAs are able to assess properly different success prospects and risk levels of capitalized development projects. The robustness of these analyses has to be checked in a long-term perspective by future research.

5. Sensitivity analyses[21]

5.1 Elimination of potential first adopter effects

As the new UK accounting regulation under FRS 102 did not introduce the capitalization option per se, but merely modified the recognition criteria, it can be assumed that companies are familiar with the use of an accounting option for capitalizing development costs. However, the introduction of new accounting standards always triggers concerns regarding potential first adopter effects. To take this into account, we repeated our main analyses, but this time excluded observations from the year 2015. Results for the adjusted sample of 506 R&D-active private firm-year observations confirm the previous findings with regard to our main analyses and support H1, H2, and H3.

5.2 Robustness of interaction effects

As an alternative to investigating the moderator effect by an interaction variable, a multi-group analysis using a sample split is recommended. With this in mind, we divided our sample of 660 firm-year observation into one group with low (N= 549) and one with high (N= 111) capitalization ratios[22] and reran our main analyses.[23]

The findings reveal that R&D activities are assessed as negative in the event of development costs being expensed or are capitalized only to a limited extent, as the coefficient of RD_INT is significantly negative at the 1% level. In these cases, there are at most only comparatively few risk-compensating capitalized development projects that seem to be of minor importance from the perspective of credit rating assessors, which is reflected in the simultaneous non-significance of the independent variable *CAP_RATIO*. By contrast, we found

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[21] Tables reporting these results are available on request.

[22] Because the median of *CAP_RATIO* has the value 0, the mean value was used instead of the frequently used median-split method when dividing the sample.

[23] Due to the small sample size, we exclude the non-significant variables *GROWTH* and *BIG4* for these estimations.

significantly positive coefficients of *RD_INT* and *CAP_RATIO* in the group with above median capitalization ratios (both at the 5% level). This implies that a high proportion of successful development projects compensate for the risk component of overall R&D investments. In summary, R&D might indeed be considered positively within the credit rating procedure if a large part of it is linked to sufficiently probable and reliable prospects of success. This is in line with evidence from the interaction effect, presented in Table 4.

To investigate in further detail whether the positive moderating role of development costs' capitalization stems from expected or unexpected capitalization ratios, we also reran our additional analyses by including interaction variables. The results show a significantly positive interaction effect only between *RD_INT* and *CAP_RATIO_Expected*. This indicates that 'truthful' capitalized development projects moderate the risk assessment of R&D-active private companies within credit rating procedures, whereas the discretionary counterparts afflicted with earnings management represented by *CAP_RATIO_Unexpected* do not.

5.3 Alternative independent key variables – *RDCAP* and *RDEXP*

Based on existing research literature (e.g. Dinh et al. 2016; Kreß et al. 2019; Mazzi et al. 2019b), results from our main analysis as well as additional investigations regarding the differentiation of expected and discretionary development costs capitalization were tested for their robustness when using alternative independent key variables. Hence, we employ the actual amount of overall R&D outlays expensed (*RDEXP*) or capitalized (*RDCAP*) instead of the capitalization ratio (*CAP_RATIO*) and the R&D intensity (*RD_INT*). Additionally, similarly to the approach described in section 4.2.2, we estimate the expected and discretionary amount of development costs capitalization (*RDCAP_Expected* and *RDCAP_Unexptected*) and divide the latter into over- and undercapitalized sections (*RDCAP_Overcapitalized* and *RDCAP_Undercapitalized*). As the findings obtained are qualitatively similar to those presented earlier in the paper, our conclusions remain the same following these robustness tests.

5.4 Additional firm-specific controls and alternative variable measurements

Our multivariate results also remained robust when subjected to a number of sensitivity checks with regard to the use of additional firm-specific controls and alternative variable measurements. First, we looked at the effect of introducing an alternative variable measurement for firm size, the natural logarithm of total assets instead of total sales. Second, we included further controls in equations (1). In accordance with prior literature (e.g. Dedman & Kausar 2012; Zhang 2015; Ciftci & Darrough 2016; Griffin et al. 2018; Cho & Choi 2019), we controlled for the following firm-specific variables: 1) a company's age, where *AGE* is measured as the natural logarithm of incorporated years; 2) *IMPACT_INTANG*, which is the amount of a firm's acquired intangible assets versus total assets ; 3) Altman's Z-Score (*ZSCORE*) as calculated with the revised Z-Score model for privately held firms (Altman 1983, p. 120 f.[24]); 4) liquidity, where *CASH* is measured as a company's cash deposits scaled by total assets; 5) *CURRENT_RATIO* as the ratio of current assets divided by current liabilities; and 6) capital expenditures, where *CAPEX* is a companies' capital expenditures scaled by total assets. Following this further testing, results concerning our key variables *CAP*, *CAP_RATIO*, and *RD_INT* generally remain unchanged.

In order to test whether or not our findings are robust when subjected to an alternative business bankruptcy prediction model, we employed *ZSCORE* as dependent variable. In replicating equation (1) and (2) using a 2SLS approach, we find a statistically positive coefficients of *CAP* as well as *CAP_RATIO* and a statistically negative coefficient of *RD_INT* (all at the 1% significance level). Furthermore, the results are weaker when using the natural logarithm of a company's credit rating score as dependent variable. The coefficients of *CAP*

[24] An alternative to the Altman Z-score is the Taffler (1983) Z-score for UK companies. However, we used the Altman model as empirical analyses document that it is more effective than the Taffler model with regard to various application modes; see Giacosa et al. (2015).

and *CAP_RATIO* are positive but just misses the 10% significant mark, while the coefficient of *RD_INT* is significantly negative at the 10% level.[25]

Beyond these tests, we consider potential concerns that our results may not be robust when an alternative scaling factor is used in calculating R&D intensity. To alleviate these reservations, we repeated our main and additional analyses with the variable *RD_INT_TA*, which scales overall R&D expenditures with total assets instead of sales. In order to have consistent variable measurement, we also use the natural logarithm of total assets (*SIZE_TA*) as an alternative variable for company's size in these regression models. Despite the substitution of *RD_INT* by *RD_INT_TA*, the results from these tests illustrate that the main analyses and conclusions do not change.

5.5 Endogeneity, fixed effects, and clustered standard errors

The discretionary element of the restricted accounting option according to FRS 102 causes an endogeneity problem. This might bias the association between development costs capitalization and credit ratings, so we supplement our analyses with estimates from a 2SLS model (see section 3.1.2 for detailed specifications). Nevertheless, this instrument variable may not be purely exogenous and, thus, may lead to distorted results. In order to mitigate such concerns, we additionally incorporate year and industry fixed effects together with clustered standard errors when repeating our main analyses as well as our additional tests regarding the impact of expected and discretionary capitalization of development costs (e.g. Larcker & Rusticus 2010; Mazzi et al. 2018). Furthermore, following prior literature (e.g. Mazzi et al. 2019b) we estimate the fitted values and residuals respectively from equation (2) with year-fixed effects for each industry cluster. We then calculate *CAP_RATIO_Expected, CAP_RATIO_Unexpected, CAP_RATIO_Overcapitalized*, and *CAP_RATIO_Undercapitalized*

[25] The significances discussed refer to two-tailed tests.

as described earlier and repeat our additional analyses. In summary, our conclusions remain unchanged following these robustness tests controlling for cross-sectional and time series correlations.

6. Conclusion

This exploratory study addresses the effects of R&D-active private companies' R&D investment and development costs capitalization on their credit risk assessment. For a sample of 660 observations covering UK private firms investing in R&D, we provide evidence that credit rating assessors consider different risk levels for R&D projects in evaluating companies' credit ratings.

In line with the idea that debt providers and CRAs are more concerned about downside potentials, probably further reinforced through the increased riskiness of private companies' R&D, our multivariate findings demonstrate a significantly negative association between creditworthiness and R&D intensity. Conversely, results indicate a significantly positive impact from R&D-active private companies' development costs capitalization ratios and their credit ratings. Because FRS 102 prescribes an explicit accounting option to capitalize development expenditures under the premise that certain criteria are met, the legislation implies that only those projects at a sufficiently advanced stage of development as well as technically and commercially viable can be recognized as intangible assets. Consequently, financial statement users receive sensitive proprietary information on highly likely prospects of success in the event of capitalization, which they seem to perceive as a signal for reduced risk from R&D investments.

However, R&D accounting in accordance with FRS 102 opens up opportunities for managerial discretion. Prior research for listed firms and studies from other countries already document that the capitalization of development costs is commonly used opportunistically for earnings management purposes (e.g. Cahan et al. 2008; Markarian et al. 2008; Hope et al. 2013;

Dinh et al. 2016; Eierle & Wencki 2016; Brasch et al. 2022). Stemming from these considerations, we employed additional analyses concerning the valuation of expected as well as discretionary capitalization ratios. Our findings reveal that only the expected capitalization ratios are valued positively within a company's creditworthiness assessment, whereas the unexpected and in particular the over-capitalized portions related to earnings management are viewed as significantly negative.

To the best of our knowledge, our study is the first to shed light on the economic consequences of R&D-active private companies' development costs capitalization. As our analysis is of necessity subject to restrictions, it leaves scope for future research projects. First, our inferences are based only on use of the FAME credit rating scorings. Given this limitation, care must be taken when drawing general conclusions from the results of this study, particularly with regard to the internal credit risk assessments of banks and other financial institutions. Consequently, future research projects might consider conducting a wide-ranging survey on the valuation of companies' R&D and internally generated intangible assets between banks and CRAs. Second, our results are limited to a sample of R&D-active private companies for 2015 and 2016. Thus, our findings are only to a limited extent generalizable across the whole population of private companies. Follow-up studies could validate our explorative evidence by expanding the sample to cover private companies over several years. Third, we concentrated on how preparers of R&D-active private firms' credit ratings evaluate the risks and benefits of R&D spending and how they take into account their accounting treatment in credit risks assessment. Further research might examine to what extent private companies' R&D activities in general terms and capitalization specifically influence access to external financing as well as the cost of capital. Additionally, it would be worthwhile investigating how other stakeholders of private firms assess capitalized development costs. Overall, whether our results are transferable to other institutional settings could be examined by means of a cross-country study. We leave these issues to future research.

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Appendix I

List of variables	
Variable	***Definition***
Rating-specific variables:	
$CREDIT\_RATING_{i,t}$	BvD Credit Rating, Qui Score developed by CRIF Decision Solution Limited in collaboration with Jordans, that measures a company's likelihood of default within the next twelve month and ranges between 0 and 100. The credit rating is divided in the following five categories: 0-20 is high risk band; 21-40 is cautious band; 41-60 is normal band; 61-80 is stable band; 81-100 is secure band.
$RATING\_SECUREBAND_{i,t}$	Indicator variable coded 1 if a private company's credit rating belongs to the secure of stable band (>60), and 0 otherwise.
logCREDIT_RATING	The natural logarithm of a company's BvD credit rating score in year t.
Firm-specific variables:	
$AGE_{i,t}$	Natural logarithm of a company's age at the balance sheet date of year 2015.
$BEAT\_BENCH_{i,t}$	Indicator variable coded 1 if any of the individual proxies $BEAT\_PAST_{i,t}$ or $BEAT\_ZERO_{i,t}$ is 1, and 0 otherwise.
$BEAT\_PAST_{i,t}$	Indicator variable coded 1 if prior year's earnings are higher than earnings assuming full expensing and prior year's earnings are lower than earnings assuming full capitalization, and 0 otherwise.
$BEAT\_ZERO_{i,t}$	Indicator variable coded 1 if earnings assuming full expensing are negative and earnings assuming full capitalizing are positive, and 0 otherwise.
$BIG4_{i,t}$	Indicator variable coded 1 if a company is audited by Big4 auditors, and otherwise 0.
$CAP_{i,t}$	Indicator variable coded 1 if a company capitalizes development outlays, and 0 otherwise.
$CAP\_RATIO_{i,t}$	Capitalization ratio, calculated as development costs capitalized by a private company during year t divided by total (capitalized and expensed) R&D expenditures.
$CAP\_RATIO\_Expected_{i,t}$	The ratio of total R&D a capitalizing private company is expected to capitalize during year t given its specific characteristics, calculated as fitted values of the first stage regression model (2).
$CAP\_RATIO\_Unexpected_{i,t}$	The ratio of total R&D, which is associated with discretionary capitalization of capitalizing company during year t, calculated as difference between $CAP\_RATIO_{i,t}$ and $CAP\_RATIO\_Expected_{i,t}$

$CAP\_RATIO\_Overcapitalized_{i,t}$	The ratio of total R&D a capitalizing private company overcapitalized beyond the expected capitalization ratio ($>CAP\_RATIO\_Expected_{i,t}$) during year t.
$CAP\_RATIO\_Undercapitalized_{i,t}$	The ratio of total R&D a capitalizing private company undercapitalized beyond the expected capitalization ratio ($<CAP\_RATIO\_Expected_{i,t}$) during year t.
$CAPEX_{i,t}$	Company's capital expenditures scaled by total assets before R&D capitalization in year t.
$CASH_{i,t}$	Company's cash scaled by total assets before R&D capitalization in year t.
$CURRENT\_RATIO_{i,t}$	Company's current assets divided by its current liabilities in year t.
$CUT\_RD_{i,t}$	Indicator variable coded 1 if R&D expenditures for firm in year t < R&D expenditures for firm in year t-1, and 0 otherwise.
$FUTURE\_ROA_{i,t+1}$	Future return on assets (ROA) calculated as private company's net income in year t+1 scaled by lagged total assets before R&D capitalization.
$GROWTH_{i,t}$	One-year growth of company's earnings before taxes (EBT) before R&D capitalization.
$IMPACT\_INTANG_{i,t}$	Company's intangible assets without capitalized R&D scaled by total assets before R&D capitalization.
$IMPAIR\_RDASSET_{i,t}$	Indicator variable coded 1 if the company impaired R&D assets in the observation year, and 0 otherwise.
$INCOME\_NEG_{i,t}$	Indicator variable coded 1 if the company reported losses in year t, and 0 otherwise.
$INDEPEND_{i,t}$	Indicator for information asymmetry measured by BvD Independence Indicator A-D. Where A = 1 = independent companies; ≤ 25% of direct or total ownership; B = 2 = 25% < ownership percentage < 50.01%; C = 3 = total ownership > 50.01%; D = 4 = dependent ownership = direct ownership of a recorded shareholder > 50%.
$LAG\_RDCAP_{i,t}$	Capitalized development expenditures for firm in year t-1 scaled by adjusted total assets.
$LEVERAGE_{i,t}$	Long term debt divided by adjusted total assets for firm year t.
$RD\_GROWTH_{i,t}$	Change of the R&D expenditures from year t-1 to t, scaled by R&D expenditures in year t-1.
$RD\_INT_{i,t}$	R&D intensity for firm year t (R&D expenditures (expensed R&D + capitalized R&D) divided by sales).
$RD\_INT\_TA_{i,t}$	R&D intensity for firm, year t (R&D expenditures (expensed R&D + capitalized R&D) divided by total assets before R&D capitalization).
$RDCAP_{i,t}$	The amount of capitalized development costs for firm in year t divided by sales.
$RDCAP\_Expected_{i,t}$	The amount a capitalizing private company is expected to capitalize development costs during a year t given its specific

	characteristics, calculated as fitted values of the first stage regression model (2).
$RDCAP\_Unexpected_{i,t}$	The amount of capitalized development costs associated with discretionary capitalization of capitalizing company during year t, calculated as difference between $RDCAP_{i,t}$ and $RDCAP\_Expected_{i,t}$
$RDCAP\_Overcapitalized_{i,t}$	The amount a capitalizing private company overcapitalized beyond the expected capitalization ratio ($>RDCAP\_Expected_{i,t}$) during year t.
$RDCAP\_Undercapitalized_{i,t}$	The amount a capitalizing private company undercapitalized beyond the expected capitalization ratio ($<RDCAP\_Expected_{i,t}$) during year t.
$RDEXP_{i,t}$	The amount of expensed R&D for firm in year t divided by sales.
$ROA_{i,t}$	Company's return on assets (ROA) in year t.
$SIZE_{i,t}$	The natural logarithm of sales of company in year t.
$SIZE\_TA_{i,t}$	The natural logarithm of total assets before R&D capitalization of company in year t.
$TANGIBILITY_{i,t}$	the amount of company's tangible assets scaled by total assets before R&D capitalization in year t.
$ZSCORE_{i,t,}$	Altman's (1983) Z-Score for privately held firms computed as: $0.717 * X1 + 0.847 * X2 + 3.107 * X3 + 0.420 * X4 + 0.998 * X5$; Where $X1$ = working capital divided by total assets; $X2$ = retained earnings divided by total assets; $X3$ = EBIT divided by total assets; $X4$ = Book value of equity divided by total liabilities; $X5$ = Sales divided by total assets; The figures $X1$ - $X5$ are calculated 'as if expensed' measures for the use as independent variable.

Appendix II

Descriptive statistics of variables of equation (1) (N=660)					
	sd	**mean**	**min**	**median**	**max**
Capitalization decision variables:					
CAP	0.391	0.188	0.000	0.000	1.000
RDCAP	0.030	0.007	0.000	0.000	0.261
CAP_RATIO	0.285	0.116	0.000	0.000	1.000
Determinant variables:					
BEAT_BENCH	0.389	0.185	0.000	0.000	1.000
BEAT_PAST	0.362	0.155	0.000	0.000	1.000
BEAT_ZERO	0.236	0.059	0.000	0.000	1.000
ROA	0.244	0.074	-2.195	0.086	0.780
IMPAIR_RDASSET	0.078	0.006	0.000	0.000	1.000
CUT_RD	0.494	0.423	0.000	0.000	1.000
SIZE	1.423	10.312	5.993	10.135	15.401
LEVERAGE	0.340	0.162	0.000	0.040	2.371
GROWTH	4.134	0.258	-15.936	0.002	23.758
AGE	0.710	3.299	0.693	3.332	4.868
LAG_RDCAP	0.033	0.008	0.000	0.000	0.270
IMPACT_INTANG	0.093	0.045	0.000	0.006	0.556
RD_GROWTH	3.006	0.636	-0.974	0.055	28.054
RD_INT	0.141	0.064	0.000	0.018	1.286
INDEPEND	0.639	3.817	0.000	4.000	4.000
BIG4	0.500	0.530	0.000	1.000	1.000

Note: See Appendix I for variables' definitions.

Appendix III

Determinants of the capitalization decision (CAP) and the capitalization ratio (CAP_RATIO)

	VARIABLES	CAP Probit β	(z-value)	CAP_RATIO Tobit β	(t-value)
Variables for a companies' opportunistic motives	*Constant*	-0.439	(-0.580)	0.058	(0.089)
	BEAT_PAST	**0.313***	(1.716)	0.148	(0.882)
	BEAT_ZERO	0.436	(1.586)	**0.483****	(2.055)
	ROA [a]	**-0.614****	(-2.253)	**-0.771*****	(-2.866)
	IMPAIR_RDASSET	0.709	(0.834)	-0.226	(-0.074)
	CUT_RD	-0.153	(-1.125)	-0.116	(-0.946)
	SIZE	**-0.112***	(-1.887)	**-0.119****	(-2.265)
	LEVERAGE [a]	0.010	(0.054)	-0.143	(-0.636)
	GROWTH [a]	-0.007	(-0.463)	-0.005	(-0.334)
	AGE	0.038	(0.378)	0.040	(0.429)
	LAG_RDCAP [a]	**15.786*****	(3.486)	**13.435*****	(4.753)
	IMPACT_INTANG [a]	-0.297	(-0.396)	-0.325	(-0.474)
	RD_GROWTH [a]	0.0240	(1.289)	0.022	(1.425)
	RD_INT [a]	**-1.916****	(-2.095)	**-3.086*****	(-3.687)
	INDEPEND	0.059	(0.526)	0.004	(0.041)
	BIG4	-0.127	(-0.853)	0.018	(0.140)
	Industry Dummies	Included		Included	
	Year Dummy	Included		Included	
	N	660		660	
	McFadden R^2	0.2224			
	Cox&Snell R^2	0.1933			
	Nagelkerke R^2	0.3121			
	Wald-statistic			86.05***	
	Mean VIF	1.88		2.04	

Notes: *, **, *** denote significance at the 10%, 5%, and 1% level (two-sided), respectively. See Appendix I for variables' definitions. [a] Variables are winsorized at the top and bottom 1 percentiles.

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Table 1: Sample observations

Table 1
Sample selection process

	# Observations
We focus on private firms that invest in R&D during accounting periods 2015 and 2016. This is our beginning sample after excluding inactive firms, IFRS adopters for the last available year, and group accounts.	6,074
Less missing data when financial reports are not available, without R&D expenditures for either 2015 or 2016, prepared under IFRS, consolidated, or abbreviated.	-3,074
Initial Sample derived from the FAME database	***3,000***
Less firms/observations with specific missing variables	-1,552
Less missing credit rating data	-218
Less other account types as FRS 102 (for instance annual accounts prepared under old UK GAAP, FRS 101 or FRS 105)	-570
Final Sample	***660***
Total Capitalizers	124
Total Expensers	536

Note: At the time of the sample selection, the FAME database contained data from around 10 million private companies, whereof about 4 million were active firms.

Table 2: Descriptive statistics

Table 2
Descriptive statistics

Panel A: Descriptive statistics – Full Sample (N=660)

	standard deviation	**mean**	**min**	**median**	**max**
Sample characteristics:					
Firms' age (in years)	24	33	1	27	129
Firms' sales (in k £)	336,474	107,007	400	25,211	4,882,000
Firms' total assets (in k £)	337,845	116,807	350	20,047	4,648,000
Dependent variables:					
CREDIT_RATING	14.521	88.700	0.000	92.000	99.000
RATING_SECUREBAND	0.280	0.933	0.000	1.000	1.000
Independent variables:					
CAP_RATIO	0.285	0.116	0.000	0.000	1.000
RD_INT	0.141	0.064	0.000	0.018	1.286
SIZE	1.423	10.312	5.993	10.135	15.401
LEVERAGE	0.340	0.162	0.000	0.040	2.371
TANGIBILITY	0.166	0.170	0.000	0.118	0.710
ROA	0.244	0.074	-2.195	0.086	0.780
GROWTH	4.134	0.258	-15.935	0.002	23.758
INCOME_NEG	0.384	0.179	0.000	0.000	1.000
BIG4	0.500	0.530	0.000	1.000	1.000

Note: See Appendix I for variables' definitions.

Table 2 continues:

Panel B: Descriptive statistics across Capitalizers and Expensers

	Capitalizers (N=124)				*Expensers (N=536)*				*Comparison*	
	mean	*min*	*median*	*max*	*mean*	*min*	*median*	*max*	*T-test*	*Wilcoxon-Mann-Whitney Test*
Dependent variables:										
CREDIT_RATING	85.790	2.800	92.000	99.000	89.373	0.000	93.000	99.000	2.124**	2.261**
RATING_SECUREBAND	0.895	0.000	1.000	1.000	0.942	0.000	1.000	1.000	1.598	1.890*
Independent variables:										
CAP_RATIO	0.619	0.001	0.681	1.000						
RD_INT	0.079	0.000	0.035	0.931	0.060	0.000	0.015	1.286	-1.388	-5.060***
SIZE	9.890	7.651	9.742	14.323	10.410	5.993	10.206	15.401	4.194***	3.710***
LEVERAGE	0.217	0.000	0.049	2.371	0.150	0.000	0.040	2.371	-1.636	-1.961**
TANGIBILITY	0.145	0.000	0.098	0.701	0.176	0.000	0.124	0.710	2.003**	1.859**
ROA	0.010	-1.832	0.059	0.599	0.089	-2.195	0.093	0.780	2.751***	3.142***
GROWTH	0.133	-15.935	0.000	23.758	0.287	-15.935	0.037	23.758	0.325	2.916***
INCOME_NEG	0.266	0.000	0.000	1.000	0.159	0.000	0.000	1.000	-2.509**	-2.814***
BIG4	0.444	0.000	0.000	1.000	0.550	0.000	1.000	1.000	2.150**	2.146**

Note: *, **, *** denote significance at the 10%, 5%, and 1% level (two-sided), respectively. See Appendix I for variables' definitions. [a] Variables are winsorized at the top and bottom 1 percentiles.

Table 3: Correlation matrix

Table 3
Correlation matrix for the determinant variables – Spearman (Pearson) correlation above (below) the diagonal (N=660)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) *CREDIT_RATING*	1.000	0.436	-0.097	-0.113	0.008	-0.152	0.080	0.413	-0.019	-0.394	-0.080
		(0.000)	(0.013)	(0.004)	(0.831)	(0.000)	(0.041)	(0.000)	(0.632)	(0.000)	(0.039)
(2) *RATING_SECUREBAND*	0.866	1.000	-0.084	-0.113	0.116	-0.020	0.096	0.305	-0.021	-0.319	0.041
	(0.000)		(0.031)	(0.004)	(0.003)	(0.611)	(0.014)	(0.000)	(0.584)	(0.000)	(0.298)
(3) CAP_RATIO	-0.133	-0.110	1.000	0.187	-0.161	0.088	-0.080	-0.132	0.054	0.119	-0.100
	(0.001)	(0.005)		(0.000)	(0.000)	(0.024)	(0.041)	(0.001)	(0.163)	(0.002)	(0.010)
(4) *RD_INT*	-0.211	-0.220	0.036	1.000	-0.131	0.066	-0.166	-0.055	0.164	0.090	0.090
	(0.000)	(0.000)	(0.360)		(0.001)	(0.091)	(0.000)	(0.157)	(0.000)	(0.021)	(0.020)
(5) *SIZE*	0.093	0.132	-0.191	-0.177	1.000	0.035	0.074	0.134	0.002	-0.156	0.510
	(0.017)	(0.001)	(0.000)	(0.000)		(0.371)	(0.057)	(0.001)	(0.967)	(0.000)	(0.000)
(6) *LEVERAGE*	-0.233	-0.166	0.086	0.084	-0.090	1.000	0.238	-0.145	0.023	0.114	-0.022
	(0.000)	(0.000)	(0.028)	(0.030)	(0.020)		(0.000)	(0.000)	(0.557)	(0.003)	(0.573)
(7) *TANGIBILITY*	0.058	0.063	-0.085	-0.072	0.039	0.010	1.000	0.027	0.026	-0.117	-0.035
	(0.136)	(0.108)	(0.029)	(0.066)	(0.312)	(0.802)		(0.493)	(0.506)	(0.003)	(0.363)
(8) *ROA*	0.429	0.414	-0.168	-0.300	0.189	-0.239	-0.015	1.000	-0.072	-0.530	0.080
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.698)		(0.064)	(0.000)	(0.040)
(9) *GROWTH*	-0.009	0.017	0.073	-0.011	-0.030	0.027	-0.021	-0.085	1.000	0.027	-0.029
	(0.808)	(0.669)	(0.060)	(0.779)	(0.439)	(0.490)	(0.599)	(0.030)		(0.492)	(0.462)
(10) *INCOME_NEG*	-0.421	-0.319	0.134	0.101	-0.155	0.261	-0.053	-0.471	0.076	1.000	-0.092
	(0.000)	(0.000)	(0.001)	(0.010)	(0.000)	(0.000)	(0.173)	(0.000)	(0.050)		(0.018)
(11) *BIG4*	0.008	0.041	-0.143	0.002	0.487	-0.056	-0.055	0.085	-0.093	-0.092	1.000
	(0.847)	(0.298)	(0.000)	(0.952)	(0.000)	(0.152)	(0.158)	(0.029)	(0.017)	(0.018)	

Note: See Appendix I for variables' definitions.

Table 4
Regression results for the impact of R&D and its accounting treatment on private firms' credit ratings (H1-H3) and related interaction effects

	CREDIT_RATING				*RATING_SECUREBAND*			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
	β	β	β	β	β	β	β	β
VARIABLES	(t-Wert)	(t-Wert)	(t-Wert)	(t-Wert)	(t-Wert)	(t-Wert)	(t-Wert)	(t-Wert)
Constant	88.707***	88.728***	90.154***	90.097***	0.841***	0.837***	0.890***	0.889***
	(18.443)	(18.216)	(18.489)	(18.191)	(9.803)	(9.633)	(10.253)	(10.081)
CAP	6.178**		1.161		0.125**		-0.038	
	(1.989)		(0.272)		(2.250)		(-0.505)	
CAP_RATIO		6.701*		0.942		0.149**		-0.052
		(1.666)		(0.171)		(2.078)		(-0.535)
RD_INT [a]	-10.235***	-9.989**	-13.334***	-12.070***	-0.188***	-0.181***	-0.282***	-0.247***
	(-2.639)	(-2.553)	(-3.102)	(-2.931)	(-2.715)	(-2.590)	(-3.684)	(-3.371)
*CAP * RD_INT* [a]			18.888*				0.561***	
			(1.651)				(2.754)	
*CAP_RATIO * RD_INT* [a]				23.329*				0.685***
				(1.649)				(2.722)
SIZE	0.247	0.250	0.175	0.178	0.011	0.012	0.009	0.009
	(0.591)	(0.594)	(0.417)	(0.421)	(1.543)	(1.580)	(1.212)	(1.202)
LEVERAGE [a]	-4.117***	-4.035***	-4.185***	-4.108***	-0.035	-0.033	-0.036	-0.035
	(-2.737)	(-2.684)	(-2.785)	(-2.735)	(-1.288)	(-1.240)	(-1.349)	(-1.296)
TANGIBILITY [a]	4.423	4.488	4.003	4.085	0.100*	0.103*	0.086	0.088
	(1.459)	(1.473)	(1.318)	(1.337)	(1.851)	(1.894)	(1.594)	(1.611)
ROA [a]	15.855***	16.018***	16.082***	16.259***	0.309***	0.315***	0.314***	0.317***
	(6.461)	(6.416)	(6.549)	(6.511)	(7.062)	(7.066)	(7.183)	(7.126)
GROWTH [a]	0.012	0.012	0.007	0.007	-0.002	0.002	-0.002	-0.002
	(0.102)	(0.099)	(0.056)	(0.055)	(-0.763)	(-0.756)	(-0.854)	(-0.854)
INCOME_NEG	-10.302***	-10.266***	-10.151***	-10.094***	-0.105***	-0.104***	-0.100***	-0.099***
	(-6.982)	(-6.953)	(-6.876)	(-6.828)	(-3.974)	(-3.956)	(-3.798)	(-3.744)
BIG4	-1.186	-1.020	-1.209	-1.157	-0.007	-0.004	-0.008	-0.009
	(-1.045)	(-0.891)	(-1.067)	(-1.009)	(-0.367)	(-0.174)	(-0.412)	(-0.431)
Industry fixed effects	Included	Included	Included	Included	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included	Included	Included	Included	Included

N	660	660	660	660	660	660	660	660
Adjusted R^2	0.2671	0.2657	0.2688	0.2680	0.2101	0.2091	0.2163	0.2155
F-statistic	15.13***	15.03***	14.46***	14.40***	11.31***	11.25***	11.1***	11.06***
Mean VIF	1.94	1.93	2.06	2.03	1.94	1.93	2.06	2.03

Notes: *, **, *** denote significance at the 10%, 5%, and 1% level (two-sided), respectively. See Appendix I for variables' definitions. [a] Variables are winsorized at the top and bottom 1 percentiles.

Table 5
Regression results for expected and discretionary development costs capitalization

	CREDIT_RATING		*RATING_SECUREBAND*	
	Model 9	Model 10	Model 11	Model 12
	β	β	β	β
VARIABLES	(t-value)	(t-value)	(t-value)	(t-value)
Constant	91.535***	91.468***	0.890***	0.886***
	(19.549)	(19.519)	(10.627)	(10.600)
CAP_RATIO_Expected	**7.658****	**9.816***	**0.153****	**0.275*****
	(2.067)	**(1.886)**	**(2.310)**	**(2.961)**
CAP_RATIO_Unexpected	**-7.533*****		**-0.110*****	
	(-3.119)		**(-2.556)**	
CAP_RATIO_Overcapitalized		**-8.428*****		**-0.161*****
		(-2.955)		**(-3.163)**
CAP_RATIO_Undercapitalized		**1.870**		**0.421**
		(0.116)		**(1.465)**
RD_INT [a]	-13.237***	-13.084***	-0.239***	-0.230***
	(-3.403)	(-3.354)	(-3.436)	(-3.311)
SIZE	0.104	0.107	0.009	0.009
	(0.253)	(0.261)	(1.231)	(1.257)
LEVERAGE [a]	-4.404***	-4.217***	-0.039	-0.029
	(-2.929)	(-2.742)	(-1.463)	(-1.048)
TANGIBILITY [a]	3.826	3.834	0.090*	0.091*
	(1.273)	(1.275)	(1.676)	(1.687)
ROA [a]	15.041***	15.114***	0.296***	0.300***
	(6.213)	(6.232)	(6.830)	(6.929)
GROWTH [a]	0.006	0.005	-0.002	-0.002
	(0.055)	(0.045)	(-0.812)	(-0.843)
INCOME_NEG	-9.969***	-9.922***	-0.099***	-0.096***
	(-6.798)	(-6.753)	(-3.766)	(-3.668)
BIG4	-1.293	-1.310	-0.009	-0.010
	(-1.144)	(-1.158)	(-0.434)	(-0.480)
Industry fixed effects	Included	Included	Included	Included
Year fixed effects	Included	Included	Included	Included
N	660	660	660	660
Adjusted R^2	0.2745	0.2737	0.2143	0.2173
F-statistic	14.85***	14.07***	10.99***	10.63***
Mean VIF	1.86	1.96	1.86	1.95

Notes: *, **, *** denote significance at the 10%, 5%, and 1% level (two-sided), respectively. See Appendix I for variables' definitions.
[a] Variables are winsorized at the top and bottom 1 percentiles.

Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: