

R&D accounting choice and firm performance: disentangling signaling and opportunistic motives in capitalization

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Abstract

Purpose – This study aims to investigate whether the capitalization of development costs among Chinese listed firms reflects genuine research and development (R&D) progress or opportunistic earnings management by distinguishing between normal and opportunistic R&D capitalization. It further explores how different R&D accounting choices influence firm performance and shape investor perceptions.

Design/methodology/approach – We utilize detailed disclosures of capitalized and expensed R&D costs at the individual project level, as mandated by Chinese financial reporting standards, using data from the period 2007 to 2019.

Findings – Firms engaging in opportunistic capitalization exhibit significantly lower profitability compared to normal capitalizers. After excluding opportunistic capitalizers, we find that, compared with firms that expense all R&D costs, the normal capitalizers have more patent applications and grants, higher selling, general and administrative costs, lower operating revenue and lower accounting profitability. Moreover, cumulative abnormal stock returns are significantly higher for the capitalization firms than for expense-all firms, while no significant difference is observed between normal and opportunistic capitalizers. Value relevance tests further suggest that only normal capitalizers enhance the value relevance of earnings.

Originality/value – The findings reveal the importance of distinguishing the motives behind R&D capitalization and underscore the challenges investors face in discerning managerial intent. Moreover, this study contributes to the literature by offering new insights into the application and interpretation of R&D accounting choice in an emerging market setting.

Keywords Earnings management, Firm performance, Opportunistic capitalization, Research and development (R&D) accounting choice

Paper type Research article

1. Introduction

Firms spend a significant amount of resources on research and development (R&D) to maintain their competitiveness and explore new growth path. There exist two different approaches that firms may follow to report their R&D expenditures in financial statements. The expensing approach is stipulated by the United States Generally Accepted Accounting Principles (US GAAP) in which firms must report all R&D expenditures as expenses on the

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income statement (Aboody & Lev, 1998; Ciftci, 2010) [1]. The expensed R&D expenditure is deducted from the revenue and thus lowers the net income and earnings. The capitalization approach is allowed by the International Financial Reporting Standards (IFRS) in which firms may include part of R&D expenditure as intangible assets on the balance sheet. The IFRS specifies a set of conditions under which certain R&D expenditure can be capitalized – in essence, only development costs that firms spend at the development stage of successful R&D projects can be capitalized. Several studies suggest that capitalization of development costs provides outside investors with more information about the firm's R&D projects and increases the value relevance of accounting statements (Healy, Myers, & Howe, 2002; Lev & Sougiannis, 1996).

Under the IFRS, managers decide whether to expense or capitalize development costs. Several authors argue that managers may exploit the accounting choice of R&D expenditure to their advantage (Cazavan-Jeny, Jeanjean, & Joos, 2011; Dinh, Kang, & Schultze, 2016). When managers are under pressure to meet or beat earnings thresholds, they may prematurely capitalize some development costs to inflate earnings. Such opportunistic capitalization is likely to reduce the informativeness of the disclosed R&D expenditures in accounting statements to outside investors. The Chinese Accounting Standards (CAS) began to converge with the IFRS in 2007 and the R&D accounting rules are similar to the IFRS rules but also have some unique features. For instance, Chinese listed firms are mandated to disclose details about the development costs of each R&D project in their annual financial reports, which makes it possible to identify firms that have engaged in opportunistic capitalization. This study aims to distinguish between normal and opportunistic R&D capitalization and examine the effect of R&D accounting treatment on the performance of Chinese listed firms.

The amount of money that Chinese firms spend on R&D projects has increased dramatically in the past two decades. The percentage of Chinese listed firms reporting a positive amount of R&D expenditure in their annual financial statements increases from 15.9% in 2007 to 84.3% in 2019 [2]. The number of Chinese listed firms reporting a positive amount of capitalized development costs in their annual report increases from 41 in 2007 to 843 in 2019. The median amount of capitalized development costs increases from 6.3m Renminbi (RMB) in 2007 to 20.9m RMB in 2019. As R&D becomes a more important value driver of Chinese listed firms, it is important for investors and regulators to understand the implications of the reported R&D expenditures on firm performance.

While R&D capitalization may be the natural outcome of successful R&D progress, it could be incentivized by managers' motivation to reach earnings thresholds (Cazavan-Jeny & Jeanjean, 2006; Dinh *et al.*, 2016; Jones, 2011; Markarian, Pozza, & Prencipe, 2008). We use the detailed information about the capitalized and expensed costs of individual R&D projects that Chinese listed firms disclose in the footnote of their annual reports to identify opportunistic capitalization of development costs. Our empirical tests show that firms that report opportunistic capitalization have much lower profitability than firms with normal capitalization. It is worth noting that in order to identify opportunistic capitalization in year t , we use the capitalized and expensed costs of R&D projects that are reported in the years $t+1$, $t+2$ and $t+3$. This means that when firms report capitalization of development costs in year t , investors may not have sufficient information to separate opportunistic capitalization from normal capitalization. We calculate the cumulative abnormal return (CAR) in the short-term event window around the annual report release date and find no difference in the stock price reaction between normal capitalization and opportunistic capitalization. This suggests that outside equity investors cannot tell apart opportunistic capitalization from normal capitalization *ex ante* and thus cannot effectively deter firms from engaging in opportunistic capitalization. These findings highlight the practical limitation of our *ex post* identification strategy. To address concerns regarding the identification of opportunistic capitalizers, we further develop a predictive model to detect red flags of opportunistic capitalization at the time of capitalization and conduct additional empirical tests to validate our measure of opportunistic capitalizers.

To facilitate a cleaner test of the relation between capitalization of development costs and firm performance, we exclude firm-years of opportunistic capitalization and compare the performance of the normal capitalization firms with that of the expense-all firms. We find that the normal capitalization firms have a significantly larger number of patent applications and patent grants than the expense-all firms. This is consistent with the notion that capitalization of development costs is associated with the success of firms' R&D projects. In addition, we find that cumulative abnormal returns around the annual report release date are significantly higher for the normal capitalization firms than for the expense-all firms, which means that the market reacts more favorably to normal capitalization firms. However, we find that normal capitalization firms exhibit significantly lower profitability than expense-all firms, and this finding is robust to alternative profitability measures and to various methods used to address potential endogeneity concerns. Further analysis shows that the normal capitalization firms have larger selling, general and administrative (SG&A) expenses than the expense-all firms, which is likely due to the marketing, manufacturing and/or services costs that firms must incur in commercializing their innovations.

We also examine the value relevance of opportunistic and normal capitalizers. The results show that only normal capitalizers enhance the value relevance of earnings, whereas opportunistic capitalizers do not increase the value relevance of either earnings or book value. This finding suggests that investors do not view opportunistic capitalization as value-relevant information. Further analysis of the moderating effects of R&D intensity indicates that R&D intensity amplifies the positive short-window market response to normal capitalization and strengthens its negative association with future profitability, while having no significant impact on the relationship between opportunistic capitalization and either future profitability or CAR.

Overall, our findings suggest that R&D accounting of Chinese listed firms reveals valuable information to outside investors. Investors in general treat capitalization of development costs as a positive signal of the success of R&D projects. However, they cannot separate firms that opportunistically capitalize R&D costs from the normal capitalization firms. Firms that face the pressure to reach earnings targets are more likely to engage in opportunistic capitalization, which leads to lower profitability in the subsequent years.

This paper contributes to the literature in two ways. First, it provides new evidence from China on the relation between R&D accounting treatment and firm performance. By leveraging unique project-level R&D data disclosed by Chinese listed firms in the footnotes of their annual reports, we identify opportunistic R&D capitalization. This approach allows us to examine the genuine effects of normal R&D capitalization by ruling out the influence of opportunistic capitalization, thereby partially explaining the inconsistencies in the relationship between R&D accounting choices and firm performance observed in prior studies. Additionally, our analysis is based on the data in recent years when Chinese R&D accounting regulations are convergent to the IFRS. Existent studies on this issue rely on empirical evidence from earlier periods when countries such as French, Australia and Germany adhered to their domestic GAAP before adopting IFRS (e.g. [Ahmed & Falk, 2006](#); [Cazavan-Jeny et al., 2011](#); [Dinh et al., 2016](#); [Wang, Du, Koong, & Fan, 2017](#)). The findings in these studies are inconsistent and cannot be generalized to offer insights for answering our research question in China.

Second, one important question that prior studies do not answer is whether external monitoring by outside equity investors deters firms from engaging in opportunistic capitalization. Our analysis of the short-term stock price reaction around annual report release dates shows that Chinese equity investors view capitalization of development costs as positive news. However, the CAR is not significantly different between the normal capitalization and opportunistic capitalization firms, which means that outside equity investors cannot distinguish opportunistic capitalization from normal capitalization *ex ante*. Our results shed new light on the accounting practice of Chinese listed firms and how R&D accounting information is used in Chinese stock markets.

The rest of the paper is organized as follows. [Section 2](#) reviews the extant literature on the relation between R&D capitalization and firm performance. [Section 3](#) presents the sample, model specification and descriptive statistics. [Section 4](#) documents empirical results. [Section 5](#) shows the robustness of empirical findings. [Section 6](#) presents additional analysis. [Section 7](#) concludes with a summary and discussion.

2. Institutional background, literature review and hypothesis development

2.1 R&D accounting in China

Similar to the US GAAP, the CAS before 2007 mandated that all expenditures related to R&D must be expensed. As more and more countries adopted the IFRS, starting from January 2007, China adopted new accounting standards that are closely aligned with the IFRS. In particular, the *Chinese Accounting Standard for Business Enterprises No. 6* (CASBE6) provides detailed guidelines for R&D accounting, stipulating that R&D expenditures incurred during the research phase must be expensed, while those incurred during the development phase may be capitalized if certain conditions are met. The conditions for R&D capitalization include (1) the intangible asset is technically feasible to be completed or sold; (2) the firm has the intention to make use of the intangible asset or sell it; (3) there is a high probability that the intangible asset could create the economic benefit; (4) the firm has sufficient technological, financial and other resources that are required for completing the project and commercializing the intangible asset and (5) the costs incurred during the development phase can be measured reliably – in cases where a firm cannot reliably distinguish between the research and development phases of a project, the firm is obligated to expense all R&D costs for the project.

In addition, Chinese listed firms are required to disclose details about the financial costs of individual R&D projects in their annual financial reports. If a multi-year R&D project has reached the development phase but the firm has not been able to complete and commercialize the associated intangible assets in the current fiscal year, all costs incurred for the project in the year are counted as development costs and can be capitalized in the year's balance sheet. Moreover, the firm must report the amount of development cost for each ongoing project individually in a footnote of the annual report. However, if an R&D project no longer meets the above-mentioned capitalization conditions, all of the development costs that have been capitalized in the previous years must be expensed in the current fiscal year.

Several regulations regarding R&D disclosure requirements have been issued since 2007. In 2007, the Chinese Security Regulation Committee (CSRC) issued *Standards for the Contents and Formats of Information Disclosure by Companies Offering Securities to the Public No. 2—Contents and Formats of Annual Reports (2007 Revision)* (hereafter, “*Standards No. 2*”) and *Preparation Rules for Information Disclosure by Companies Offering Securities to the Public No. 15—General Provisions on Financial Reports (2007 Revision)* (hereafter, “*Preparation Rules No. 15*”). According to these two regulations, firms were required to disclose their R&D plans, the total R&D expenditures incurred for internal R&D projects and the expenditures incurred in the research phase and development phase, respectively.

Preparation Rules No. 15 was revised in 2010. Under the revised rules, there were no explicit requirements regarding R&D disclosure. However, the CSRC issued disclosure requirements on development costs. Specifically, firms were mandated to disclose the opening balance, the increase, the decrease and the closing balance of the development costs, but such disclosure was not required at the R&D project level. Additionally, firms were required to disclose the proportion of development costs to total R&D expenditure for the current period.

The subsequent revisions to these two regulations in May 2014 and December 2014 imposed disclosure requirements on both R&D information and development costs. Under *Standards No. 2 (2014 Revision)*, firms were required to disclose the progress and plans of their R&D projects in the Board Report Section of the annual report. Specifically, firms were expected to explain the rationale, progress, objectives and expected impact of R&D projects on future development. Besides, firms were required to disclose the amount of R&D expenditure

and its proportion to net assets and sales revenue. Moreover, under *Preparation Rules No. 15 (2014 Revision)*, firms were required to disclose project-level details of development costs, including the opening balance, the increase, the decrease and the closing balance for each R&D project in the footnotes section of the annual report. This was the first time that firms were mandated to disclose the detailed R&D project-level data. In our paper, we obtain the R&D project-level data from this disclosure section.

In addition, the *Law of the People's Republic of China on Enterprise Income Tax* became in force in January 2008, which allowed firms to deduct R&D expenses before income tax [3]. The income tax law incentivized companies to recognize more R&D expenses, leading to a sudden increase in reported R&D expenses in 2008. Another new policy that was issued in September 2012 by the Chinese Government aims at widely encouraging enterprises to innovate, which is expected to lead to a substantial increase in R&D investments by Chinese firms [4].

2.2 Literature review

2.2.1 Potential effects of R&D capitalization. R&D capitalization is prevalent and extensive in practice and could have a significant real impact on business operation (Canace, Jackson, Ma, & Zimbelman, 2022). Dinh, Sidhu, and Yu (2019) find that capitalizing R&D expenditures reduces the under-investment activities in the software development industry compared to expensing R&D. Firms that choose to capitalize R&D costs are less likely to cut R&D investments, even when faced with earnings pressure. Oswald, Simpson and Zarowin (2022) demonstrate that firms that switch from expensing to capitalizing R&D expenditures experience an increase in R&D investments because of lower information asymmetry and enhanced internal learning. Chen, Gaviious, and Lev (2017) suggest that R&D capitalization exerts influence on firms' disclosure decisions. They find that voluntary information disclosure about product development increases with the adoption of capitalizing R&D outlays. Wang *et al.* (2017) argue that in China, firms that choose to capitalize R&D investments are more likely to sustain long-term development, while firms expensing R&D investments focus more on short-term gains.

However, several studies caution that managers may misuse R&D capitalization to meet or beat earnings thresholds, ultimately damaging firm value and earnings quality. Ciftci (2010) finds that managerial discretions about the recognition of capitalized R&D assets are associated with greater earnings uncertainty. Cazavan-Jeny *et al.* (2011) analyze the French data from 1992 to 2001 to examine the determinants of R&D capitalization and its effect on firm performance. They find a negative relation between capitalized R&D expenditures and firm performance and that firms tend to capitalize R&D costs in order to meet or beat earnings expectations. Dinh *et al.* (2016) examine a sample of highly R&D-intensive firms in Germany from 1998 to 2012 and show that firms choose R&D capitalization to meet or beat earnings benchmarks, leading to a decrease in firm market value.

A sizable literature investigating the capital market consequences of R&D capitalization focuses on the value relevance and stock price informativeness of R&D capitalization. The debate surrounding whether R&D expenditures should be expensed or capitalized reflects the trade-off between accounting reliability and relevance (Lev & Sougiannis, 1996). Aboody and Lev (1998) study 163 software companies and find that capitalized software development costs are value relevant and provide useful information to investors. Healy *et al.* (2002) utilize the simulation model for the pharmaceutical industry and conclude that capitalization provides more value-relevant information than expensing R&D outlays. However, Oswald (2008) analyzes publicly listed firms in the United Kingdom (UK) from 1996 to 2004 and finds that irrespective of whether firms opt for capitalization or expensing, the value relevance of reported financial data is similar. Chan, Faff, Gharghori, and Ho (2007) find that Australian firms that choose to capitalize R&D expenditure exhibit a lower level of market return compared with firms expensing R&D outlays.

Several studies have investigated the informativeness of R&D capitalization decisions. [Oswald and Zarowin \(2007\)](#) analyze the UK data from 1990 to 1999 and find that R&D capitalization enhances the information content of stock prices, which is defined as the degree to which future earnings information is reflected in current period stock returns. A few recent studies show that R&D capitalization diminishes the accuracy of analyst forecasts and increases forecast dispersion, because capitalized R&D expenditure increases the difficulty for analysts in distilling value-relevant information from financial reports ([Dinh, Eierle, Schultze, & Steeger, 2015](#); [Kim, Cho, & Yang, 2021](#)). Moreover, the effect of R&D capitalization on stock price informativeness varies under accounting standards. For instance, [Oswald and Zarowin \(2007\)](#) find that under the UK GAAP, the stock returns of firms that capitalize development costs (i.e. the capitalization firms) embody more information about future earnings compared to firms that expense all R&D costs (i.e. the expense-all firms), whereas [Dargenidou, Jackson, Tsalavoutas, and Tsoligkas \(2021\)](#) find that under the IFRS, the capitalization firms and the expense-all firms have a roughly equal degree of market price informativeness. In a recent study, [Dinh and Schultze \(2022\)](#) distinguish discretionary R&D capitalization from non-discretionary capitalization and compare the informativeness of the two types of capitalization. They find that the non-discretionary capitalization is positively related to market value.

The above studies are representative of the extensive literature that examine the real effects and the capital market consequences of R&D capitalization. We read these studies in search for an answer to the question: Whether and how is R&D accounting choice related to future performance of Chinese listed firms? Although the R&D accounting standard in China is closely aligned with the IFRS, the Chinese institutional environment and the accounting standard have some unique features, which motivates us to work on a new study and report our findings in this paper.

2.2.2 China-related studies. Several studies examine the potential effects of the R&D accounting choice in China. In an early study, [Wang and Fan \(2014\)](#) hand-collected the amount of capitalized and expensed R&D expenditures from the financial statements of Chinese listed firms between 2007 and 2012 and applied the [Ohlson \(1995\)](#) residual income model to examine the relation between the R&D accounting choice and the end-of-year stock price or annual stock return. They find that firms that report a positive amount of capitalized R&D (i.e. the capitalization firms) tend to have higher end-of-year stock prices and annual stock returns than firms that expense all R&D costs (i.e. the expense-all firms). In a subsequent study, [Wang et al. \(2017\)](#) analyze hand-collected data on the capitalized and expensed R&D expenditures of Chinese listed firms between 2007 and 2014 and find that the capitalization firms have lower accounting profitability (measured by return on assets (ROA) and return on equity (ROE)) in the reporting year than the expense-all firms. More recently, [Kong and Su \(2021\)](#) investigate the effects of R&D capitalization on firm business performance and stock market reactions, focusing on Chinese firms listed on ChiNext between 2009 and 2016. Their results show that firm profitability (measured by ROE) in the reporting year is positively related to the proportion of capitalized development costs to the total annual operating revenue. [Bai, Koong, and Wang \(2023\)](#) investigate the value relevance of R&D accounting policy using the data of Chinese listed firms between 2007 and 2020. They apply the price and return regressions based on the [Ohlson \(1995\)](#) residual income model to examine the effects of capitalized and expensed R&D expenditures on contemporaneous and future annual stock returns. They find that capitalized development costs have a positive relation with contemporaneous stock returns but no relation with future stock returns, whereas expensed R&D costs have a positive relation with future stock returns but no relation with contemporaneous stock returns.

Our study differs from the above China-related studies in several aspects. First, we identify firms that capitalized development costs opportunistically and separate normal capitalization from opportunistic capitalization. We show that opportunistic capitalization is negatively associated with firm performance. By removing the opportunistic capitalization effect, we obtain cleaner evidence on the relation between normal capitalization and firm future

performance. Second, we examine the short-term market price reaction to the disclosure of R&D capitalization in annual financial reports. Our empirical results demonstrate the value of R&D capitalization to outside equity investors in China and their incapability of deterring opportunistic capitalization. Third, we apply the method in [Cazavan-Jeny et al. \(2011\)](#) in the calculation of the profitability measures to remove the potential confounding effect of the reported R&D costs. Fourth, we find significant differences in patent-related activities and operating performance between normal capitalization and expense-all firms, which shed new light on the relation between R&D accounting choice and firm performance in China. Fifth, the China-related studies in the literature differ in sample size because of the differences in the time period under study and the data sources. We collect data from the China Stock Market and Accounting Research (CSMAR) database, and our sample includes only Chinese A-share listed firms that have a positive amount of R&D expenditure in a fiscal year.

2.3 Hypothesis development

In China, firms are mandated to capitalize R&D expenditures once certain criteria are met. However, managers retain discretion in applying these criteria, particularly when assessing the technical feasibility and probable future economic benefits of R&D projects ([Ciftci, 2010](#); [Healy et al., 2002](#); [Yang, 2019](#)). Prior literature shows that some firms capitalize R&D expenditures to meet or beat earnings expectations, which reduces earnings quality, market value and stock performance ([Cazavan-Jeny & Jeanjean, 2006](#); [Dinh et al., 2016](#); [Jones, 2011](#); [Markarian et al., 2008](#)). When firms use R&D capitalization for opportunistic purposes, such as earnings management, they are more likely to recognize low-reliability R&D capitalization which includes subsequently impaired projects ([Yang, 2019](#)).

These findings imply that opportunistic R&D capitalization may convey information about the economic substance of the underlying projects. Accordingly, we propose that opportunistic R&D capitalization affects firms' future profitability from two perspectives. First, opportunistic capitalization reflects the low quality of underlying R&D projects. If firms capitalize R&D projects that do not genuinely satisfy the capitalization criteria, the recognized R&D assets are more likely to be associated with projects lacking technical feasibility or commercial prospects. As a result, these firms are expected to exhibit weaker future operating performance.

Second, opportunistic capitalization may indicate inefficient resource allocation. Compared with normal capitalizers, firms engaging in opportunistic capitalization are more likely to delay the recognition of economically unsuccessful R&D expenditures, obscure the true performance of innovation projects and continue allocating resources to projects with limited future benefits ([Yang, 2019](#)). Such distortions can reduce R&D investment efficiency, delay the timely termination of unsuccessful projects and ultimately impair subsequent operating performance.

- H1.* Compared with normal R&D capitalization, opportunistic R&D capitalization is associated with lower future profitability.

Next, we analyze how normal R&D capitalization affects firm profitability. On the one hand, normal R&D capitalization may convey favorable information about project quality and future growth prospects. It has been evidenced that capitalizing R&D expenditures could be regarded as a positive signal of an R&D project's success, as it leads to the recognition of an intangible asset on the balance sheet ([Ahmed & Falk, 2006](#); [Lev & Sougiannis, 1996](#)). This indicates that firms are more likely in the growth stage and are expected to experience improved performance in subsequent years. Previous literature also investigates whether R&D capitalization influences the firm investment activities, with findings generally supporting positive effects. Specifically, [Oswald et al. \(2022\)](#) suggest a positive association between R&D capitalization and the growth of R&D expenditures by using a difference-in-differences (DID) design based on the mandatory IFRS adoption in 2005, UK. [Dinh et al. \(2019\)](#) show that R&D capitalization mitigates under-investment in the US software development industry

compared with high-tech firms required to expense their R&D outlays. The increased R&D expenditure and reduced underinvestment are expected to enhance firms' long-term development, improve operating efficiency and further promotes firm performance.

On the other hand, normal R&D capitalization may be associated with weaker future profitability relative to expense-all firms. Although normal capitalized R&D projects are technologically feasible, they typically remain at a pre-commercial stage and therefore do not immediately generate revenue (Erickson & Jacobson, 1992). At this stage, firms need to allocate limited managerial and financial resources across multiple ongoing R&D projects. As some projects advance toward commercialization, firms are more likely to devote resources to those projects with greater commercial potential (Verma, Mishra, & Sinha, 2011). This resource allocation may temporarily constrain existing operations and place short-term pressure on current profitability. Meanwhile, normal capitalization may signal forthcoming commercialization to customers. Previous literature suggests that signals about products approaching commercialization may induce some customers to postpone purchases of existing products in anticipation of upgraded or new offerings (Rao & Turut, 2019), which leads to a decline in current sales revenue. Furthermore, with capitalized projects advancing from technical feasibility toward commercialization, firms must invest in marketing, administrative preparation, distribution channels, customer testing and other activities necessary for eventual product launch, leading to rising SG&A expenditures.

Consequently, although normal capitalization may signal promising growth opportunities, it may also be associated with lower future profitability due to the high cost and uncertainty inherent in innovation activities. Thus, we propose the following two competitive hypotheses.

- H2a.* Compared with expense-all firms, normal R&D capitalization is associated with higher future profitability.
- H2b.* Compared with expense-all firms, normal R&D capitalization is associated with lower future profitability.

3. Sample construction, model specification and descriptive statistics

3.1 Sample construction

We analyze Chinese firms that are listed on the Shanghai and Shenzhen Stock Exchanges between 2007 and 2019. We choose 2007 as the beginning year because the accounting standard *CASBE6* became effective starting from January 2007, which requires all Chinese listed firms to capitalize their development costs when the prescribed capitalization conditions are met. Since we focus on the accounting treatment of R&D expenditure, our sample includes only the firm years in which the firm reports a positive amount of total R&D expenditure.

Table 1 presents descriptive statistics of our initial sample. The initial sample consists of Chinese A-share firms listed in the Shanghai and Shenzhen Stock Exchanges in the non-financial industries and excludes the firm years that do not report positive total R&D expenditures in the firm's annual financial report. We divide the initial sample into two subsamples: the capitalization subsample consists of the firm years reporting positive capitalized development costs in the annual report, and the expense-all subsample consists of the firm years with positive total R&D expenditures but zero capitalized R&D costs. Column (1) shows that the number of firms in the initial sample varies across years, ranging from 111 in 2007 to 3,141 in 2019, and the total number of firm-years is 17,364. Columns (2) and (3) display the number of firms in the capitalization and expense-all subsamples, respectively. In total, there are 4,913 firm-years in the capitalization sample and 12,451 firm-years in the expense-all sample. The capitalization sample accounts for 28.29% of all firm-years in the initial sample.

Table 1. Annual statistics about the capitalized and expensed R&D expenditures

Year Column	Number of firms			Capitalization subsample		Mean of expensed R&D (in million RMB)	Median of expensed R&D (in million RMB)	Expense-all subsample	
	Whole sample (1)	Capitalization subsample (2)	Expense-all subsample (3)	Mean of capitalized R&D (in million RMB) (4)	Median of capitalized R&D (in million RMB) (5)			Mean of expensed R&D (in million RMB) (8)	Median of expensed R&D (in million RMB) (9)
2007	111	41	70	57.935	6.336	32.457	0.902	39.329	7.145
2008	217	80	137	22.156	5.441	74.999	6.521	65.073	16.311
2009	259	78	181	37.895	7.045	21.626	6.378	82.044	17.811
2010	626	79	547	40.366	5.900	28.455	12.984	62.370	16.593
2011	394	75	319	98.045	13.233	62.118	18.665	60.380	17.428
2012	603	221	382	49.849	10.566	194.580	31.874	152.314	36.392
2013	937	321	616	48.384	11.533	134.842	31.174	123.987	30.471
2014	1,038	341	697	52.144	12.212	161.475	36.919	147.899	33.062
2015	2,065	609	1,456	51.244	12.467	236.195	51.85	116.768	38.427
2016	2,344	677	1,667	61.217	13.33	249.227	62.045	115.562	41.956
2017	2,716	740	1,976	68.758	14.56	267.95	76.264	133.451	43.706
2018	2,913	808	2,105	96.393	19.031	349.297	91.466	152.687	48.255
2019	3,141	843	2,298	102.312	20.925	410.88	106.575	165.387	54.226
Total	17,364	4,913	12,451	71.166	13.99	263.939	59.224	132.147	40.965

Note(s): This table shows the annual statistics about the capitalized and expensed R&D expenditures of the Chinese listed firms in our initial sample. The initial sample consists of Chinese A-share firms listed in the Shanghai and Shenzhen Stock Exchanges in the non-financial industries and excludes the firm-years that do not report positive total R&D expenditures in the firm's annual financial report. We divide the initial sample into two subsamples: the capitalization subsample consists of the firm-years reporting positive capitalized development costs in the annual report, and the expense-all subsample consists of the firm-years with positive total R&D expenditures but zero capitalized R&D costs. Column (1) shows the number of firms in the initial sample while Columns (2) and (3) display the number of firms in the capitalization and expense-all subsamples. The mean and median of the capitalized and expensed R&D expenditures for firms in the capitalization subsample are reported in Columns (4)–(7). The mean and median of the expensed R&D expenditures for firms in the expense-all subsample are reported in Columns (8) and (9)

We observe a large increase in the total number of firms in both 2010 and 2015, and this increase is mainly driven by the rise in the number of expense-all firms. This pattern can be explained by two CSRC announcements issued in 2010 and 2015, respectively, which required firms to disclose both qualitative and quantitative information on R&D capitalization. Specifically, in 2010, under *Preparation Rules No. 15 (2010 Revision)*, firms were required to disclose the specific criteria for R&D capitalization and how they distinguished between the research phase and the development phase. Such qualitative disclosure requirements may affect firms' decisions on whether to capitalize or expense R&D outlays. For example, some firms may be more likely to expense R&D expenditures due to the strict disclosure requirements regarding specific criteria of capitalization and the potential proprietary costs associated with such disclosure. As a result, we observe a sharp increase in the number of expense-all firms in 2010. In 2015, under *Standards No. 2 (2015 Revision)*, firms were further mandated to disclose the amount of R&D capitalization and the ratio of R&D capitalization to total R&D expenditure. Accordingly, we observe the jump of both capitalizers and expense-all firms.

Columns (4) and (5) in Table 1 present the mean and median of capitalized development costs for the capitalization sample by year. Columns (6) and (7) show the mean and median of expensed R&D costs for the capitalization sample. The results indicate that the capitalization firms on average expensed a greater amount of R&D expenditure than that of capitalized development costs, which implies that only a relatively small portion of R&D expenditure can meet the capitalization criteria and be capitalized. Both capitalized development costs and expensed R&D costs have followed an increasing trend since 2009.

Firms in the expense-all subsample report positive expensed R&D costs but zero capitalized R&D expenditures. The mean and median of their expensed R&D costs are reported in Columns (8) and (9). The mean R&D expenditure spikes in the fiscal years 2008 and 2012, which is likely due to the income tax law promulgated in 2008 and the policy issued by the Chinese Government in 2012.

Several studies document that firms choose to capitalize development costs if they are under pressure to meet or beat earnings benchmarks (e.g. [Cazavan-Jeny et al., 2011](#); [Dinh et al., 2016](#)). Such opportunistic capitalization will be exposed in the subsequent years if the R&D project cannot generate an intangible asset of commercial value. Chinese accounting regulations require that if an R&D project turns out to be unsuccessful, the development costs that have been capitalized in previous fiscal years for the project must be expensed in the current fiscal year. Chinese listed firms are required to disclose the capitalized and expensed R&D expenditure of each major R&D project in the annual report ([Yang, 2019](#)). For any firm in a given fiscal year, we identify an impaired R&D project if the reported R&D costs for the project meet the following three conditions: (1) the opening balance of the development cost is positive, (2) the ending balance of the development cost is zero and (3) the expensed R&D costs of the project is equal to the decrease in the development cost in the current year, which means that the capitalized development costs in the previous fiscal years are expensed in the current year. We classify a firm as engaging in opportunistic capitalization in year t if it has at least one impaired R&D project in any of the subsequent three years, $t+1$, $t+2$, and $t+3$. We then divide the capitalization sample into two subsamples: the opportunistic capitalization sample consisting of firms engaging in opportunistic capitalization and the normal capitalization sample consisting of firms reporting normal capitalization.

Table 2 presents the breakdown of the firm-year observations in the normal capitalization sample, the opportunistic capitalization sample and the expense-all sample. Columns (1) and (2) show the number of firms with normal and opportunistic capitalizations by year, respectively. Column (4) reports the number of firms that expense all R&D expenditures. We find that 1,313 firm years in the opportunistic capitalization sample, accounting for about 27% of all firm years in the capitalization sample.

Table 2. Sample size by year and the type of capitalization

Year Column	Capitalization sample Opportunistic capitalization firms (1)	Normal capitalization firms (2)	Subtotal (3)	Expense-all sample (4)
2007	8	33	41	70
2008	14	66	80	137
2009	7	71	78	181
2010	8	71	79	547
2011	15	60	75	319
2012	35	186	221	382
2013	69	252	321	616
2014	100	241	341	697
2015	218	391	609	1,456
2016	260	417	677	1,667
2017	264	476	740	1,976
2018	196	612	808	2,105
2019	119	724	843	2,298
Total	1,313	3,600	4,913	12,451

Note(s): This table reports the number of firms among the normal capitalization, the opportunistic capitalization and the expense-all samples by year. Columns (1) and (2) show the number of opportunistic capitalization and normal capitalization firms, respectively. Column (4) shows the number of firms in the expense-all sample

3.2 Model specification

We first estimate the following regression model to examine the relation between R&D capitalization and firm performance by testing the difference in future firm profitability between the R&D capitalization firms and the expense-all firms.

$$ROA(ROE)_{i,t+k(k=1,2,3)} = \alpha_0 + \alpha_1 RDC_{i,t} + \alpha_2 ROA(ROE)_{i,t} + \alpha_3 Size_{i,t} + \alpha_4 Lev_{i,t} + \alpha_5 MB_{i,t} + \alpha_6 Growth_{i,t} + \alpha_7 RDint_{i,t} + \sum industry + \sum year + u_{i,t+k} \tag{1}$$

The dependent variable of Model (1) is the firm profitability measured by *ROA* or *ROE* in the years *t*+1, *t*+2 and *t*+3, respectively. The key independent variable *RDC_{i,t}* equals 1 if the firm year is in the capitalization sample and zero if the firm year is in the expense-all sample. The other independent variables include firm size (*Size_{i,t}*), leverage (*Lev_{i,t}*), market-to-book ratio (*MB_{i,t}*), asset growth (*Growth_{i,t}*) and R&D intensity (*RDint_{i,t}*). To avoid the potential confounding effect of R&D expenditures on the measurement of firm profitability, we follow prior studies (Cazavan-Jenny *et al.*, 2011; Dinh *et al.*, 2016) to exclude the amount of expensed R&D costs from net income in the calculation of *ROE* and exclude the amount of capitalized development costs from total assets in the calculation of *ROA_{i,t}*, *ROE_{i,t}*, *Size_{i,t}*, *Lev_{i,t}*, *MB_{i,t}*, *Growth_{i,t}*, and *RDint_{i,t}*. Appendix provides the definition of all the variables in details. In Model (1), we also control for industry- and year-fixed effects and use the clustered error estimates with firm-level clustering.

Next, we estimate the following regression model to test Hypotheses 1 and 2 by examining differences in future firm profitability among opportunistic capitalizers, normal capitalizers and expense-all firms.

$$ROA(ROE)_{i,t+k(k=1,2,3)} = \alpha_0 + \alpha_1 OTC_{i,t} + \alpha_2 RDC_{i,t} + \alpha_3 ROA(ROE)_{i,t} + \alpha_4 Size_{i,t} + \alpha_5 Lev_{i,t} + \alpha_6 MB_{i,t} + \alpha_7 Growth_{i,t} + \alpha_8 RDint_{i,t} + \sum industry + \sum year + u_{i,t+k} \quad (2)$$

The dependent variable of Model (2) is the firm profitability measured by *ROA* or *ROE* in the years $t+1$, $t+2$ and $t+3$, respectively. The key independent variables are $OTC_{i,t}$ and $RDC_{i,t}$. $OTC_{i,t}$ equals 1 if the firm year is classified as opportunistic capitalization and 0 otherwise (including both normal capitalizers and expense-all firms). $RDC_{i,t}$ equals 1 if the firm year belongs to the capitalization sample and 0 if it belongs to the expense-all sample. Control variables are the same as those in Model (1). Industry- and year-fixed effects are controlled, and standard errors are clustered at the firm level. In our model, the coefficient of $OTC_{i,t}$ represents the difference between opportunistic capitalizers and normal capitalizers, while the coefficient of $RDC_{i,t}$ captures the difference between normal capitalizers and expense-all firms.

3.3 Descriptive statistics and correlation analysis

We start with the initial sample described in Table 1 and remove the firm-year observations that have outliers and missing values. We apply the three-sigma (3σ) rule in Pukelsheim (1994) to identify and remove outliers for all continuous variables [5]. Our final sample includes 11,110 firm-years between 2008 and 2019 [6]. Table 3 shows the sample selection process. We collect the raw data for all the variables from the CSMAR databases.

Table 4 presents summary statistics of the variables in the regression Model (1). The mean of the indicator variable $RDC_{i,t}$ shows that about 30.3% of the firm years report positive capitalized development costs. The mean of R&D intensity ($RDint_{i,t}$) in our sample is equal to 2.2%, which is comparable to that in other countries (Hou & Xu, 2024). The mean of $ROA_{i,t}$, $ROE_{i,t}$, $Size_{i,t}$ and $Lev_{i,t}$ are 6.4%, 10.8%, 22.20 and 0.403, respectively, consistent with the figures in other China studies (Kong, Zhao, & Liu, 2021; Lin, Tan, Zhao, & Karim, 2015).

Table 5 shows the correlation matrix of our variables, where the upper and lower diagonal parts exhibit the Spearman and Pearson correlation coefficients, respectively. The coefficients show a negative correlation between firm profitability (measured by $ROA_{i,t} \sim t+3$ and $ROE_{i,t} \sim t+3$) and capitalization of development costs ($RDC_{i,t}$). There is a strong positive correlation between the current year profitability ($ROA_{i,t}$ and $ROE_{i,t}$) and the profitability in the future years $t+1$, $t+2$ and $t+3$ ($ROA_{i,t+1 \sim t+3}$ and $ROE_{i,t+1 \sim t+3}$). The correlation coefficients

Table 3. Selection of the final sample for regression analysis

	Number of observations
Observations in the initial sample in Table 1	17,364
less	
Observations with total liability greater than total asset	388
Observations with extreme values	2,319
Observations with missing values of any variable in the regression analysis	3,547
Final sample	11,110

Note(s): This table presents the process of selecting the final sample for regression analysis. The initial sample described in Table 1 includes Chinese A-share firms listed in the Shanghai and Shenzhen Stock Exchanges in the non-financial industries and excludes the firm years that do not report positive total R&D expenditures in the annual financial reports. We obtain the final sample by removing the observations with the total liabilities being greater than total assets, with extreme values and/or missing values

Table 4. Descriptive statistics of key variables

Variable	N	Mean	Median	Min	Max	Std. dev.
$RDC_{i,t}$	11,110	0.303	0.000	0.000	1.000	0.460
$ROA_{i,t}$	11,110	0.064	0.059	−0.166	0.300	0.051
$ROA_{i,t+1}$	11,110	0.0611	0.056	−0.172	0.300	0.054
$ROA_{i,t+2}$	8,224	0.058	0.055	−0.173	0.300	0.056
$ROA_{i,t+3}$	5,899	0.056	0.052	−0.178	0.302	0.056
$ROE_{i,t}$	11,110	0.108	0.102	−0.413	0.532	0.084
$ROE_{i,t+1}$	11,110	0.104	0.101	−0.437	0.532	0.091
$ROE_{i,t+2}$	8,194	0.102	0.010	−0.790	0.525	0.095
$ROE_{i,t+3}$	5,868	0.100	0.098	−0.790	0.522	0.098
$Size_{i,t}$	11,110	22.20	22.06	19.08	26.48	1.215
$Lev_{i,t}$	11,110	0.403	0.397	−0.036	0.951	0.188
$MB_{i,t}$	11,110	1.018	0.994	−0.890	3.567	0.652
$Growth_{i,t}$	11,110	0.126	0.091	−0.740	1.184	0.180
$RDint_{i,t}$	11,110	0.022	0.019	0.000	0.116	0.017

Note(s): This table shows descriptive statistics of the key variables in our empirical analysis. [Appendix](#) gives the definition of all variables

among all the independent variables are below 0.6, suggesting that there is no strong multicollinearity concern in our regression models.

4. Empirical results

4.1 Univariate comparisons among opportunistic capitalization, normal capitalization and expense-all firms

We first conduct univariate comparisons among the opportunistic capitalization sample, the normal capitalization sample and the expense-all sample. [Table 6](#) shows the number of observations and the mean value of each key variable for the three samples, as well as the results of the pairwise two-sample *t*-tests for differences in mean values. The results show that the opportunistic capitalization firms have significantly lower firm future profitability than the normal capitalization firms and the expense-all firms. We also find that the normal capitalization firms have significantly lower profitability than the expense-all firms. We examine the differences between the normal capitalization and expense-all firms more closely in [Section 4.2.2](#).

4.2 Capitalization of development costs and future profitability

4.2.1 Difference between the capitalization and expense-all samples. The regression results on the difference between the capitalizers and expense-all firms are reported in [Table 7](#). Columns (1) and (4) illustrate the results of our investigation into the relationship between R&D capitalization and firm profitability during the period $t+1$. Both the coefficients of $RDC_{i,t}$ in Columns (1) and (4) are significantly negative, which implies a reduction in firm profitability in the following year after capitalizing the R&D expenditure. Specifically, the negative coefficients of $RDC_{i,t}$ on $ROA_{i,t+1}$ (−0.008) and $ROE_{i,t+1}$ (−0.015) represent that the capitalization of R&D expenditure leads to a reduction of 0.8% (1.5%) in *ROA* (*ROE*) in year $t+1$ on average. Columns (2) and (5), as well as Columns (3) and (6), present the effects of R&D capitalization on firm profitability in years $t+2$ and $t+3$, respectively. The consistently significant negative coefficients of $RDC_{i,t}$ across all six columns corroborate the evidence that R&D capitalization is negatively related to the firm future profitability.

Table 5. Correlation matrix

	$RDC_{i,t}$	$ROA_{i,t}$	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$	$ROE_{i,t}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$	$Size_{i,t}$	$Lev_{i,t}$	$MB_{i,t}$	$Growth_{i,t}$	$RDint_{i,t}$
$RDC_{i,t}$	1	−0.080***	−0.081***	−0.078***	−0.065***	−0.054***	−0.059***	−0.060***	−0.059***	0.147***	0.078***	−0.002	0.038***	0.124***
$ROA_{i,t}$	−0.084***	1	0.690***	0.555***	0.455***					−0.166***	−0.402***	0.316***	0.269***	0.501***
$ROA_{i,t+1}$	−0.090***	0.779***	1	0.765***	0.618***					−0.153***	−0.347***	0.286***	0.208***	0.459***
$ROA_{i,t+2}$	−0.085***	0.640***	0.659***	1	0.750***					−0.157***	−0.323***	0.230***	0.114***	0.424***
$ROA_{i,t+3}$	−0.073***	0.540***	0.518***	0.626***	1					−0.138***	−0.281***	0.209***	0.050***	0.380***
$ROE_{i,t}$	−0.057***					1	0.611***	0.460***	0.368***	0.073***	0.015	0.238***	0.340***	0.445***
$ROE_{i,t+1}$	−0.065***					0.740***	1	0.727***	0.555***	0.062***	0.0245**	0.206***	0.273***	0.403***
$ROE_{i,t+2}$	−0.063***					0.577***	0.582***	1	0.720***	0.057***	0.030**	0.139***	0.171***	0.371***
$ROE_{i,t+3}$	−0.061***					0.477***	0.410***	0.563***	1	0.071***	0.050***	0.108***	0.097***	0.319***
$Size_{i,t}$	0.151***	−0.124***	−0.110***	−0.110***	−0.091***	0.091***	0.067***	0.063***	0.079***	1	0.545***	−0.521***	0.062***	−0.289***
$Lev_{i,t}$	0.075***	−0.369***	−0.299***	−0.271***	−0.231***	0.010	0.015	0.029**	0.051***	0.553***	1	−0.232***	0.110***	−0.213***
$MB_{i,t}$	0.002	0.300***	0.276***	0.206***	0.169***	0.223***	0.203***	0.128***	0.087***	−0.528***	−0.232***	1	0.203***	0.255***
$Growth_{i,t}$	0.040***	0.191***	0.145***	0.060***	−0.000	0.243***	0.182***	0.088***	0.018	0.037***	0.071***	0.195***	1	0.055***
$RDint_{i,t}$	0.158***	0.422***	0.381***	0.334***	0.292***	0.379***	0.339***	0.300***	0.248***	−0.247***	−0.194***	0.259***	0.014	1

Note(s): This table shows the correlation matrix for the key variables in regression analysis. The Spearman and Pearson correlation coefficients are entered in the upper and lower diagonal parts, respectively

Table 6. Univariate comparisons among the opportunistic capitalization, normal capitalization and expense-all samples

Variable	(1) Opportunistic capitalization sample		(2) Normal capitalization sample		(3) Expense-all sample		(2)-(1) Mean	(3)-(2) Mean	(3)-(1) Mean
	<i>N</i>	Mean	<i>N</i>	Mean	<i>N</i>	Mean			
$ROA_{i,t}$	735	0.054	2,636	0.059	7,739	0.067	0.005**	0.008***	0.012***
$ROA_{i,t+1}$	735	0.049	2,636	0.056	7,739	0.064	0.007***	0.008***	0.015***
$ROA_{i,t+2}$	625	0.046	1,941	0.054	5,658	0.061	0.007***	0.008**	0.015***
$ROA_{i,t+3}$	511	0.042	1,403	0.054	3,985	0.058	0.011***	0.005***	0.016***
$ROE_{i,t}$	735	0.090	2,636	0.104	7,739	0.110	0.014***	0.007***	0.021***
$ROE_{i,t+1}$	735	0.082	2,636	0.100	7,739	0.107	0.018***	0.008***	0.025***
$ROE_{i,t+2}$	624	0.079	1,929	0.098	5,641	0.106	0.019***	0.008***	0.027***
$ROE_{i,t+3}$	511	0.071	1,396	0.099	3,961	0.104	0.028***	0.005***	0.033***
$Size_{i,t}$	735	22.28	2,636	22.53	7,739	22.08	0.257***	-0.456***	-0.198***
$Lev_{i,t}$	735	0.396	2,636	0.432	7,739	0.394	0.036***	-0.038***	-0.002
$MB_{i,t}$	735	1.160	2,636	0.981	7,739	1.017	-0.179***	0.036**	-0.143***
$Growth_{i,t}$	735	0.168	2,636	0.129	7,739	0.122	-0.039***	-0.007*	-0.046***
$RDint_{i,t}$	735	0.026	2,636	0.026	7,739	0.020	-0.001	-0.006***	-0.006***

Note(s): This table presents univariate comparison among the opportunistic capitalization, normal capitalization and expense-all samples. All variables are defined in [Appendix](#)

Table 7. Difference in future profitability between capitalization and expense-all firms

	Return on assets			Return on equity		
	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$
$RDC_{i,t}$	-0.008*** (-8.60)	-0.009*** (-6.17)	-0.008*** (-4.11)	-0.015*** (-8.67)	-0.017*** (-6.75)	-0.016*** (-4.89)
$ROA_{i,t}$	0.565*** (34.42)	0.469*** (22.20)	0.405*** (14.93)			
$ROE_{i,t}$				0.503*** (32.39)	0.375*** (16.94)	0.325*** (12.30)
$Size_{i,t}$	0.006*** (11.36)	0.005*** (6.36)	0.005*** (4.04)	0.013*** (12.41)	0.013*** (7.96)	0.012*** (5.56)
$Lev_{i,t}$	-0.032*** (-11.09)	-0.032*** (-7.24)	-0.026*** (-4.40)	-0.008 (-1.52)	0.003 (0.37)	0.017 (1.64)
$MB_{i,t}$	0.012*** (11.44)	0.008*** (4.83)	0.005*** (2.18)	0.023*** (11.78)	0.018*** (5.87)	0.011*** (2.89)
$Growth_{i,t}$	0.007*** (3.44)	-0.006* (-1.95)	-0.018*** (-4.52)	0.020*** (5.06)	-0.003 (-0.45)	-0.027*** (-3.70)
$RDint_{i,t}$	0.491*** (13.07)	0.576*** (10.82)	0.619*** (8.51)	1.025*** (15.65)	1.297*** (9.96)	1.253*** (9.96)
Constant	-0.102*** (-7.09)	-0.053*** (-2.40)	-0.071*** (-2.55)	-0.241*** (-9.54)	-0.209*** (-5.87)	-0.217*** (-3.84)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	11,110	8,224	5,899	11,110	8,194	5,868
Adj. R^2	0.511	0.350	0.257	0.418	0.264	0.194

Note(s): All variables are defined in [Appendix](#). The robust t statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

4.2.2 Difference among the opportunistic capitalization, normal capitalization and expense-all firms. The results on differences in future profitability among opportunistic capitalization, normal capitalization and expense-all firms are reported in [Table 8](#). Columns (1)–(3) present the estimation results of Model (2) for ROA in years $t+1$, $t+2$ and $t+3$, respectively, while Columns (4)–(6) present the estimation results of Model (2) for ROE in years $t+1$, $t+2$ and $t+3$. The coefficient of $OTC_{i,t}$ reflects the difference between opportunistic capitalizers and normal capitalizers, while the coefficient of $RDC_{i,t}$ captures the difference between normal capitalizers and expense-all firms.

We find that $OTC_{i,t}$ is significantly negatively associated with both ROA and ROE over the subsequent three years, indicating that opportunistic capitalizers exhibit lower future profitability than normal capitalizers. Thus, [Hypothesis 1](#) is supported. These findings indicate that firms capitalizing R&D expenditures to meet or beat earnings expectations are more likely to experience poorer performance over the next three years. Moreover, the coefficients of $RDC_{i,t}$ are also negative and statistically significant across all columns, suggesting that expense-all firms exhibit significantly better future performance than firms with normal capitalization. Thus, [Hypothesis 2b](#) is supported. These regression results are consistent with the findings reported in [Table 6](#).

4.2.3 The reason why expense-all firms outperform normal capitalizers. To gain further insights into why the expense-all firms outperform firms with normal capitalizations, we conduct a comparative analysis of innovation levels, revenue and SG&A expenses between these two groups. The results are shown in [Tables 9](#) and [10](#). [Table 9](#) presents the regression results concerning the difference in patent applications and patent grants between normal

Table 8. Difference in future profitability among opportunistic capitalization, normal capitalization and expense-all firms

	Return on assets			Return on equity		
	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$
$OTC_{i,t}$	−0.005*** (−3.01)	−0.007** (−2.52)	−0.011*** (−3.47)	−0.010*** (−3.11)	−0.013*** (−2.86)	−0.024*** (−4.04)
$RDC_{i,t}$	−0.007*** (−6.82)	−0.007*** (−4.72)	−0.005** (−2.44)	−0.013*** (−6.94)	−0.014*** (−5.30)	−0.010*** (−2.93)
$ROA_{i,t}$	0.563*** (34.38)	0.468*** (22.24)	0.400*** (14.78)			
$ROE_{i,t}$				0.502*** (32.41)	0.373*** (16.90)	0.319*** (12.08)
$Size_{i,t}$	0.006*** (11.32)	0.005*** (6.35)	0.005*** (4.04)	0.013*** (12.38)	0.013*** (7.95)	0.012*** (5.56)
$Lev_{i,t}$	−0.032*** (−11.22)	−0.033*** (−7.40)	−0.026*** (−4.56)	−0.008 (−1.58)	0.002 (0.30)	0.016 (1.55)
$MB_{i,t}$	0.012*** (11.44)	0.008*** (4.86)	0.005** (2.26)	0.023*** (11.77)	0.018*** (5.90)	0.012*** (2.97)
$Growth_{i,t}$	0.008*** (3.57)	−0.006* (−1.82)	−0.018*** (−4.39)	0.021*** (5.19)	−0.002 (−0.30)	−0.026*** (−3.55)
$RDint_{i,t}$	0.492*** (13.11)	0.578*** (10.86)	0.627*** (8.59)	1.027*** (15.71)	1.300*** (13.85)	1.270*** (10.05)
Constant	−0.101*** (−7.09)	−0.053** (−2.40)	−0.072** (−2.56)	−0.241*** (−9.55)	−0.209*** (−5.89)	−0.218*** (−3.85)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	11,110	8,224	5,899	11,110	8,194	5,868
Adj. R^2	0.509	0.346	0.252	0.415	0.260	0.189

Note(s): All variables are defined in [Appendix](#). The robust t statistics shown in parentheses are based on the firm-clustered standard errors. *, **, and *** represent the statistical significance level of 10%, 5% and 1%, respectively

capitalization and expense-all firms. The key independent variable is $NMC_{i,t}$ which equals 1 if firm i has normal capitalization in year t and 0 if firm i expenses all R&D expenditures. $LnPatent_a1_{i,t+1}$ is calculated as the logarithm of 1 plus the total number of patent applications filed by firm i in year $t+1$. $LnPatent_a2_{i,t+1}$ is measured as the logarithm of 1 plus the number of patent applications that include only invention and utility patents for firm i in year $t+1$. $LnPatent_g1_{i,t+1}$ is the logarithm of 1 plus the total number of patent grants for firm i in year $t+1$. $LnPatent_g2_{i,t}$ is the logarithm of 1 plus the number of patent grants that only include invention and utility patents for firm i in year $t+1$. By following [Fang, Tian, and Tice \(2014\)](#), we incorporate a set of firm-level control variables, including $ROA_{i,t}$, $Size_{i,t}$, $Lev_{i,t}$, $MB_{i,t}$, $Growth_{i,t}$, $RDint_{i,t}$, $PPE_{i,t}$, $HHI_{i,t}$, $Capitalex_{i,t}$ and $Age_{i,t}$. $PPE_{i,t}$ is defined as the proportion of property, plant and equipment to total assets for firm i in year t . $HHI_{i,t}$ represents Herfindahl index of industry j to which firm i belongs in year t . $Capitalex_{i,t}$ is calculated as the capital expenditure scaled by total assets for firm i in year t . $Age_{i,t}$ is measured as the number of years firm i has listed on the A-share stock market. We also control the industry- and year-fixed effects. The results show that the coefficient of $NMC_{i,t}$ is significantly positive, suggesting that the normal capitalization firms are more likely to apply for more patents and obtain more patent grants, after controlling a series of firm-level characteristics.

Table 10 presents the results reflecting the differences in operating revenue and SG&A expenses between normal capitalization and expense-all firms in years t and $t+1$. $Revenue_{i,t}$ is calculated as the ratio of sales revenue to the total assets of firm i in year t , and $SG\&A_{i,t}$ is

Table 9. Differences in patent applications and patent grants between normal capitalization and expense-all firms

	Patent applications		Patent grants	
	<i>LnPatent_ a1_{i, t+1}</i>	<i>LnPatent_ a2_{i, t+1}</i>	<i>LnPatent_ g1_{i, t+1}</i>	<i>LnPatent_ g2_{i, t+1}</i>
<i>NMC_{i,t}</i>	0.128*** (2.74)	0.125*** (2.70)	0.103** (2.42)	0.101** (2.40)
<i>ROA_{i,t}</i>	0.063 (0.16)	−0.042 (−0.11)	−0.300 (−0.85)	−0.421 (−1.22)
<i>Size_{i,t}</i>	0.521*** (17.01)	0.517*** (17.03)	0.490*** (17.16)	0.482*** (17.15)
<i>Lev_{i,t}</i>	−0.330** (−2.33)	−0.314** (−2.25)	−0.345*** (−2.60)	−0.322** (−2.49)
<i>MB_{i,t}</i>	0.055 (1.31)	0.051 (1.23)	0.031 (0.78)	0.024 (0.63)
<i>Growth_{i,t}</i>	−0.092 (−1.17)	−0.103 (−1.34)	−0.116* (−1.69)	−0.123* (−1.86)
<i>RDint_{i,t}</i>	12.888*** (7.89)	12.693*** (7.83)	11.665*** (7.86)	11.330*** (7.76)
<i>PPE_{i,t}</i>	−0.277* (−1.71)	−0.271* (−1.68)	−0.288* (−1.91)	−0.283* (−1.89)
<i>HHI_{i,t}</i>	−0.178 (−0.83)	−0.161 (−0.75)	−0.161 (−0.80)	−0.168 (−0.85)
<i>Capitalex_{p,t}</i>	0.145 (0.33)	0.135 (0.31)	−0.001 (−0.00)	0.030 (0.08)
<i>Age_{i,t}</i>	0.009** (2.50)	0.008** (2.27)	0.009*** (2.68)	0.008** (2.42)
<i>Constant</i>	−10.398*** (−15.84)	−10.352*** (−15.90)	−10.248*** (−16.86)	−10.069*** (−16.84)
<i>Fixed Effects</i>				
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
# of Obs.	9,156	9,156	9,156	9,156
Adj. R ²	0.266	0.267	0.271	0.272

Note(s): All variables are defined in [Appendix](#). The robust *t* statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

calculated as SG&A expenses scaled by the total assets of firm *i* in year *t*. We also control for *Size_{i,t}*, *Lev_{i,t}*, *MB_{i,t}*, *Growth_{i,t}*, *HHI_{i,t}*, *Age_{i,t}* and *GDP_growth_{i,t}*. *GDP_growth_{i,t}* is GDP growth, which is measured as the difference between GDP in year *t* and GDP in year *t*−1 divided by the latter. Columns (1) and (3) present the results of the difference in sales revenue and SG&A expenses between normal capitalization and expense-all firms in year *t*, while Columns (2) and (4) present the results of the difference in sales revenue and SG&A expenses between normal capitalization and expense-all firms in year *t*+1. The significantly negative coefficients of *NMC_{i,t}* in Columns (1) and (2) show that the normal capitalization firms exhibit lower sales revenue than expense-all firms in both the current and the following years. The significantly positive coefficients of *NMC_{i,t}* in Columns (3) and (4) demonstrate that firms engaged in normal capitalization incur higher SG&A expenses compared with expense-all firms. Overall, the results in [Tables 9](#) and [10](#) suggest that, compared with the expense-all firms, the normal capitalization firms indeed achieve favorable outcomes in their R&D projects. However, they also incur substantial costs for marketing, administrative and other expenses necessary for the commercialization of their R&D success, providing an explanation for their lower accounting profitability.

Table 10. Differences in operating revenue and SG&A expenses between normal capitalization and expense-all firms

	Sales revenue <i>Revenue_{i,t}</i>	<i>Revenue_{i,t+1}</i>	SG&A expenses <i>SG&A_{i,t}</i>	<i>SG&A_{i,t+1}</i>
<i>NMC_{i,t}</i>	−0.027** (−2.44)	−0.020* (−1.66)	0.006*** (3.13)	0.006*** (3.45)
<i>Size_{i,t}</i>	0.016** (2.26)	0.008 (1.15)	−0.004*** (−3.37)	−0.004*** (−3.39)
<i>Lev_{i,t}</i>	0.244*** (7.01)	0.269*** (7.37)	−0.008 (−1.39)	−0.009 (−1.54)
<i>MB_{i,t}</i>	0.066*** (6.15)	0.045*** (4.06)	0.015*** (7.54)	0.011*** (5.75)
<i>Growth_{i,t}</i>	−0.085*** (−4.55)	−0.009 (−0.45)	−0.020*** (−6.62)	−0.010*** (−3.35)
<i>HHI_{i,t}</i>	−0.013 (−0.19)	−0.017 (−0.24)	−0.006 (−0.60)	−0.005 (−0.52)
<i>Age_{i,t}</i>	0.003*** (3.38)	0.003*** (3.49)	0.001*** (3.34)	0.001*** (3.69)
<i>GDP_growth_{i,t}</i>	0.870*** (2.76)	0.928*** (2.87)	0.031 (0.65)	0.076 (1.51)
<i>Constant</i>	0.214 (1.40)	0.330** (2.02)	0.192*** (7.06)	0.204*** (7.25)
<i>Fixed Effects</i>				
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
# of Obs.	8,945	9,015	8,902	8,892
Adj. <i>R</i> ²	0.234	0.231	0.343	0.341

Note(s): All variables are defined in [Appendix](#). The robust *t* statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

5. Robustness tests

5.1 Heckman two-stage treatment effect model

As firms are not randomly assigned to the opportunistic capitalization, normal capitalization and expense-all samples, our empirical findings may be subject to the sample selection bias. We employ a Heckman two-stage treatment effect model to address this concern ([Lennox, Francis, & Wang, 2012](#)). In the first stage of our treatment effect model, we estimate the determinants of the firm’s decision to capitalize development costs without opportunistic incentives in a probit model. The dependent variable is the binary variable *NMC_{i,t}*. The independent variable includes the firm characteristics such as *ROA_{i,t}*, *ROE_{i,t}*, *Size_{i,t}*, *Lev_{i,t}*, *MB_{i,t}*, *Growth_{i,t}* and *RDint_{i,t}*. In addition, we include an exogenous variable *Ratio_other_{i,t}* in the first stage of the Heckman two-stage treatment effect model as suggested by [Schopohl, Urquhart, and Zhang \(2021\)](#). It is defined as the ratio of the number of firms capitalizing development costs to the total number of firms in the same industry year, excluding firm *i*. This variable reflects the industry level of R&D capitalization, which can potentially have a significant effect on the firm’s decision to capitalize R&D. The results in Column (1) of Panels A and B in [Table 11](#) show that the coefficients of *Ratio_other_{i,t}* are significantly positive. Based on the probit model in the first stage, we calculate the Inverse Mills Ratio and add it to the second stage regression Model [7]. Columns (2), (3) and (4) in Panel A present the results on the relationship between normal capitalization and firm’s future ROA, the coefficients of *NMC_{i,t}* in these three columns remain negative and significant, which demonstrates the robustness of the negative relation between R&D normal capitalization in the current year and the firm’s future ROA. Similarly, the results in Panel B of [Table 11](#) show that the negative

Table 11. Heckman two-stage treatment effect model

Panel A: Return on assets

<i>Dependent variable</i>	First stage model	Second stage model		
	$NMC_{i,t}$	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$
$NMC_{i,t}$		−0.007*** (−7.22)	−0.007*** (−4.87)	−0.002 (−1.24)
$ROA_{i,t}$	−5.604*** (−10.38)	0.510*** (14.72)	0.451*** (9.09)	0.394*** (7.09)
$Size_{i,t}$	0.319*** (11.18)	0.010*** (5.43)	0.007** (2.56)	0.005* (1.70)
$Lev_{i,t}$	−0.333** (−1.99)	−0.036*** (−10.34)	−0.036*** (−6.94)	−0.027*** (−4.36)
$MB_{i,t}$	0.169*** (4.22)	0.014*** (10.12)	0.009*** (4.25)	0.005* (1.93)
$Growth_{i,t}$	0.231*** (2.59)	0.010*** (3.82)	−0.006 (−1.53)	−0.018*** (−4.27)
$RDint_{i,t}$	18.032*** (10.73)	0.674*** (6.58)	0.622*** (4.18)	−0.066 (−0.39)
$Ratio_other_{i,t}$	1.762*** (9.14)			
IMR		0.014* (1.87)	0.004 (0.34)	0.002 (0.15)
$Constant$	−8.301*** (−13.28)	−0.199*** (−3.88)	−0.086 (−1.13)	−0.081 (−0.95)
<i>Fixed Effects</i>				
Industry		YES	YES	YES
Year		YES	YES	YES
# of Obs.	10,372	10,372	7,596	5,586
Pseudo R^2	0.103			
Adj. R^2		0.519	0.354	0.202

Panel B: Return on equity

<i>Dependent variable</i>	First stage model	Second stage model		
	$NMC_{i,t}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$
$NMC_{i,t}$		−0.014*** (−7.43)	−0.011*** (−4.21)	−0.007** (−2.32)
$ROE_{i,t}$	−3.083*** (−10.43)	0.407*** (10.93)	0.283*** (6.03)	0.245*** (4.27)
$Size_{i,t}$	0.316*** (11.04)	0.023*** (6.65)	0.021*** (5.02)	0.017*** (3.21)
$Lev_{i,t}$	0.229 (1.45)	−0.001 (−0.17)	−0.047*** (−5.77)	−0.028*** (−2.79)
$MB_{i,t}$	0.161*** (4.00)	0.027*** (10.55)	0.023*** (6.23)	0.013*** (2.81)
$Growth_{i,t}$	0.243*** (2.73)	0.028*** (5.66)	−0.002 (−0.30)	−0.013* (−1.66)
$RDint_{i,t}$	18.047*** (10.82)	1.619*** (8.03)	0.415* (1.68)	0.370 (1.21)
$Ratio_other_{i,t}$	1.745*** (9.07)			

(continued)

Table 11. Continued

Panel B: Return on equity

Dependent variable	First stage model	Second stage model		
	$NMC_{i,t}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$
IMR		0.044*** (3.15)	0.034** (1.98)	0.025 (1.19)
Constant	−8.484*** (−13.40)	−0.552*** (−5.38)	−0.442*** (−3.54)	−0.362** (−2.30)
Fixed Effects				
Industry		YES	YES	YES
Year		YES	YES	YES
# of Obs.	10,372	10,372	7,756	5,553
Pseudo R^2	0.102			
Adj. R^2		0.425	0.186	0.127

Note(s): All variables are defined in [Appendix](#) and the robust *t* statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

relation between R&D normal capitalization in the current year and the firm’s future *ROE* is robust.

5.2 Propensity score matching

In this subsection, we apply the PSM method by following prior literature ([Rosenbaum & Rubin, 1983](#); [Shipman, Swanquist, & Whited, 2017](#)). We run a probit model to estimate the likelihood of firms choosing to capitalize development costs without opportunistic motivation. The dependent variable in the probit model is the binary variable $NMC_{i,t}$. The independent variables include firm characteristics such as $Size_{i,t}$, $Lev_{i,t}$, $MB_{i,t}$, $Growth_{i,t}$, $RDint_{i,t}$, $ROA_{i,t}$ and $ROE_{i,t}$. Based on the estimation results of the probit model, we calculate the propensity score for each firm-year observation and match firms that have normal R&D capitalization with those in the expense-all sample based on the closest propensity score within the same industry and year without replacement. We then re-estimate the impact of normal capitalization on future profitability based on the matched samples and present the results in Panel A of [Table 12](#). Consistent with the findings in [Table 8](#), the coefficients of $NMC_{i,t}$ across six columns in Panel A of [Table 12](#) remain significantly negative.

Panels B and C of [Table 12](#) show the balance test results for *ROA* and *ROE*, respectively. Before matching, all covariate variables exhibit significant differences between the treatment (firm years in the normal capitalization sample) and control groups (firm years in the expense-all sample). However, there is no significant difference in any covariate variable between the two groups after matching, which demonstrates the effectiveness of the PSM method in our study.

5.3 Alternative profitability measures

We change the measurements of the dependent variables to demonstrate the robustness of the results. We use $EBIT_{i,t+1\sim t+3}$ and $MROA_{i,t+1\sim t+3}$ as proxies for the alternative profitability measures. $EBIT_{i,t+1\sim t+3}$ is the ratio of earnings before interest and tax (*EBIT*) to total assets in the year *t*+1 to *t*+3, while $MROA_{i,t+1\sim t+3}$ is defined as the ratio of net profit after deducting non-recurring gains and losses to total assets in year *t*+1 to *t*+3. We use Model (3) to test the relation between normal capitalization and accounting profitability (measured by *EBIT* and *MROA*) in the future three years.

Table 12. Regression analysis of the PSM samples

Panel A: Regression analysis of the PSM samples						
	Return on assets			Return on equity		
	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$
$NMC_{i,t}$	-0.007*** (-5.96)	-0.008*** (-4.42)	-0.004* (-1.79)	-0.015*** (-6.33)	-0.017*** (-5.17)	-0.012*** (-3.02)
$ROA_{i,t}$	0.493*** (21.12)	0.406*** (13.14)	0.373*** (9.94)			
$ROE_{i,t}$				0.460*** (20.79)	0.356*** (10.86)	0.301*** (8.12)
$Size_{i,t}$	0.007*** (8.86)	0.006*** (5.46)	0.006*** (3.89)	0.013*** (9.18)	0.011*** (5.13)	0.013*** (4.83)
$Lev_{i,t}$	-0.036*** (-8.83)	-0.037*** (-5.82)	-0.038*** (-4.57)	-0.002 (-0.27)	0.012 (1.05)	0.016 (1.24)
$MB_{i,t}$	0.014*** (9.38)	0.010*** (4.59)	0.006*** (2.11)	0.022*** (8.37)	0.014*** (3.07)	0.011* (1.95)
$Growth_{i,t}$	0.004 (1.40)	-0.009** (-2.02)	-0.015*** (-3.09)	0.015** (2.36)	-0.002 (-0.24)	-0.012 (-1.30)
$RDint_{i,t}$	0.548*** (9.48)	0.622*** (7.68)	0.618*** (6.06)	1.129*** (11.22)	1.330*** (9.61)	1.206*** (7.25)
Constant	-0.098*** (-4.13)	-0.050 (-1.58)	-0.129*** (-2.61)	-0.233*** (-5.98)	-0.140** (-2.53)	-0.325*** (-3.07)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	4,928	3,665	2,678	4,926	3,617	2,643
Adj. R^2	0.500	0.335	0.264	0.413	0.269	0.209
Panel B: Balance test for the PSM samples: ROA						
Variable	Matching	Mean	Control group	Bias reduction	<i>T</i> test	
		Treatment group			<i>T</i>	$p> t $
$Size_{i,t}$	Before	22.538	22.079	93.50%	16.88	0.000
	After	22.477	22.507		-0.81	0.418
$ROA_{i,t}$	Before	0.059	0.067	84.00%	-6.82	0.000
	After	0.059	0.058		0.85	0.397
$Lev_{i,t}$	Before	0.433	0.394	97.70%	9.20	0.000
	After	0.429	0.430		-0.16	0.870
$MB_{i,t}$	Before	0.979	1.017	91.30%	-2.56	0.011
	After	0.976	0.979		-0.17	0.863
$Growth_{i,t}$	Before	0.129	0.122	42.50%	1.87	0.061
	After	0.130	0.126		0.81	0.416
$RDint_{i,t}$	Before	0.026	0.201	95.30%	15.06	0.000
	After	0.024	0.023		0.51	0.610
# of Obs	Before	2,628	7,733			
	After	2,464	2,464			
Panel C: Balance test for the PSM samples: ROE						
Variable	Matching	Mean	Control group	Bias reduction	<i>T</i> test	
		Treatment group			<i>T</i>	$p> t $
$Size_{i,t}$	Before	22.538	22.079	93.80%	16.880	0.000
	After	22.472	22.501		-0.790	0.431

(continued)

Table 12. Continued

Panel C: Balance test for the PSM samples: ROE

Variable	Matching	Mean	Control group	Bias reduction	T test	
		Treatment group			T	$p> t $
$ROE_{i,t}$	Before	0.104	0.110	94.10%	−3.480	0.001
	After	0.104	0.104		0.150	0.880
$Lev_{i,t}$	Before	0.433	0.394	82.40%	9.200	0.000
	After	0.429	0.436		−1.270	0.204
$MB_{i,t}$	Before	0.979	1.017	90.90%	−2.560	0.011
	After	0.979	0.982		−0.180	0.857
$Growth_{i,t}$	Before	0.129	0.122	12.70%	1.870	0.061
	After	0.131	0.125		1.260	0.206
$RDint_{i,t}$	Before	0.026	0.020	97.00%	15.060	0.000
	After	0.024	0.024		−0.320	0.747
# of Obs	Before	2,628	7,733			
	After	2,463	2,463			

Note(s): All variables are defined in [Appendix](#). The robust t statistics shown in parentheses are based on firm clustered standard errors. *, **, and *** represent the statistical significance level of 10%, 5% and 1%, respectively

$$EBIT(MROA)_{i,t+k(k=1,2,3)} = \alpha_0 + \alpha_1 NMC_{i,t} + \alpha_2 EBIT(MROA)_{i,t} + \alpha_3 Size_{i,t} + \alpha_4 Lev_{i,t} + \alpha_5 MB_{i,t} + \alpha_6 Growth_{i,t} + \alpha_7 RDint_{i,t} + \sum industry + \sum year + u_{i,t+k} \quad (3)$$

The estimation results reported in [Table 13](#) show that the coefficients of $NMC_{i,t}$ in all columns are negative and significant, indicating that normal capitalization is negatively related to firm future profitability. The evidence here is consistent with our findings in [Section 4](#).

5.4 Change the sample period

According to the institutional background, firms have been required to disclose the R&D project-level data since 2014. As a result, the classification of opportunistic and normal capitalizers based on R&D project-level data may suffer from self-selection bias. To address this concern, we re-estimate the main regression model by limiting the sample period from 2014 to 2019. The results are reported in [Table 14](#), where the coefficients of $OTC_{i,t}$ and $RDC_{i,t}$ are negative and statistically significant in all columns. This suggests that opportunistic capitalizers have lower future profitability than normal capitalizers, while normal capitalizers exhibit lower future profitability than expense-all firms. These findings are consistent with those from the main regression results, indicating the robustness of our conclusions.

6. Additional analysis

6.1 Capitalization of development costs and stock price reaction

In this part, we examine how the capital market perceives firms' R&D capitalization and whether investors can distinguish between the two different types of capitalization (normal vs opportunistic capitalization). Specifically, we establish Models (4) and (5) as follows to investigate the market consequences of R&D capitalization.

$$CAR_{i,t} = a_0 + a_1 RDC_{i,t} + a_2 UE_{i,t} + a_3 ROE_{i,t} + a_4 Size_{i,t} + a_5 Lev_{i,t} + a_6 MB_{i,t} + a_7 Growth_{i,t} + a_8 RDint_{i,t} + \sum industry + \sum year + u_{i,t} \quad (4)$$

Table 13. Difference in alternative measures of firm profitability between normal capitalization and expense-all firms

	Earnings before interest and tax			Modified ROA		
	$EBIT_{i,t+1}$	$EBIT_{i,t+2}$	$EBIT_{i,t+3}$	$MROA_{i,t+1}$	$MROA_{i,t+2}$	$MROA_{i,t+3}$
$NMC_{i,t}$	-0.006*** (-6.39)	-0.008*** (-4.70)	-0.005** (-2.29)	-0.005*** (-6.28)	-0.006*** (-4.24)	-0.004** (-2.04)
$EBIT_{i,t}$	0.593*** (42.35)	0.479*** (23.81)	0.422*** (15.69)			
$MROA_{i,t}$				0.670*** (52.11)	0.533*** (25.81)	0.473*** (17.53)
$Size_{i,t}$	0.006*** (10.52)	0.006*** (6.11)	0.004*** (3.59)	0.005*** (10.07)	0.005*** (5.50)	0.004*** (3.43)
$Lev_{i,t}$	-0.021*** (-7.35)	-0.026*** (-5.55)	-0.019*** (-3.00)	-0.023*** (-9.00)	-0.027*** (-6.10)	-0.020*** (-3.46)
$MB_{i,t}$	0.012*** (10.60)	0.008*** (4.55)	0.003 (1.23)	0.009*** (10.23)	0.006*** (4.10)	0.003 (1.55)
$Growth_{i,t}$	0.011*** (4.49)	-0.002 (-0.47)	-0.013*** (-3.13)	0.002 (1.14)	-0.010*** (-3.11)	-0.021*** (-5.10)
$RDint_{i,t}$	0.441*** (11.68)	0.536*** (9.38)	0.563*** (7.13)	0.348*** (10.80)	0.483*** (9.06)	0.493*** (6.70)
Constant	-0.095*** (-6.10)	-0.050** (-2.08)	-0.064** (-2.15)	-0.083*** (-7.28)	-0.061*** (-3.54)	-0.068*** (-2.70)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	10,335	7,574	5,367	10,349	7,608	5,393
Adj. R ²	0.505	0.334	0.242	0.594	0.382	0.277

Note(s): All variables are defined in [Appendix](#). The robust *t* statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

$$CAR_{i,t} = \beta_0 + \beta_1 OTC_{i,t} + \beta_2 RDC_{i,t} + \beta_3 UE_{i,t} + \beta_4 ROE_{i,t} + \beta_5 Size_{i,t} + \beta_6 Lev_{i,t} + \beta_7 MB_{i,t} + \beta_8 Growth_{i,t} + \beta_9 RDint_{i,t} + \sum industry + \sum year + \varepsilon_{i,t} \quad (5)$$

The independent variable, denoted as CAR, is computed by considering two different event windows around the annual report release date, $(-2, 2)$ and $(-1, 1)$, respectively. Abnormal return is calculated as the daily raw return minus the expected returns, which are calculated by employing the market model within a $(-210, -11)$ window. In our model, α_1 compares the differences in CAR between R&D capitalization and expense-all firms, while β_2 represents the differences in CAR between normal capitalizers and expense-all firms. β_1 compares the differences in CAR between opportunistic capitalizers and normal capitalizers. If capitalized R&D outlays have a favourable market reaction, we should expect a positive relationship between R&D capitalization and CAR. The coefficients of α_1 and β_2 should be positive. Similarly, if the market is capable of distinguishing opportunistic capitalization from normal capitalization, the coefficient of β_1 should be insignificant. $UE_{i,t}$ is the absolute value of the unexpected earnings, which is measured as the difference between the actual earnings per share (EPS) in the current period and the EPS in the previous year, adjusted by the EPS of the previous year. We also include $ROE_{i,t}$, $Size_{i,t}$, $Lev_{i,t}$, $MB_{i,t}$, $Growth_{i,t}$ and $RDint_{i,t}$ as control variables [8].

Table 14. Change the sample period (2014–2019)

	Return on assets			Return on equity		
	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$
$OTC_{i,t}$	−0.006*** (−3.15)	−0.006** (−2.36)	−0.011*** (−3.27)	−0.010*** (−3.19)	−0.013*** (−2.70)	−0.024*** (−3.78)
$RDC_{i,t}$	−0.007*** (−6.61)	−0.008*** (−4.76)	−0.005** (−2.12)	−0.013*** (−6.71)	−0.016*** (−5.59)	−0.011*** (−2.74)
$ROA_{i,t}$	0.559*** (32.20)	0.464*** (20.67)	0.408*** (13.90)			
$ROE_{i,t}$				0.495*** (29.59)	0.362*** (14.70)	0.320*** (11.05)
$Size_{i,t}$	0.006*** (10.78)	0.006*** (6.14)	0.005*** (4.07)	0.013*** (11.60)	0.013*** (7.47)	0.013*** (5.42)
$Lev_{i,t}$	−0.032*** (−10.41)	−0.035*** (−7.42)	−0.030*** (−4.61)	−0.005 (−0.96)	0.001 (0.11)	0.012 (1.03)
$MB_{i,t}$	0.012*** (10.89)	0.008*** (4.36)	0.005** (2.31)	0.023*** (11.07)	0.018*** (5.33)	0.014*** (3.11)
$Growth_{i,t}$	0.008*** (3.76)	−0.005 (−1.30)	−0.018*** (−4.27)	0.022*** (5.21)	0.000 (0.07)	−0.026*** (−3.40)
$RDint_{i,t}$	0.498*** (12.57)	0.598*** (10.71)	0.644*** (8.05)	1.043*** (15.08)	1.363*** (13.79)	1.334*** (9.76)
Constant	−0.132*** (−10.28)	−0.100*** (−4.98)	−0.085*** (−3.00)	−0.288*** (−11.79)	−0.274*** (−6.99)	−0.261*** (−4.86)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	10,115	7,370	5,076	10,115	7,350	5,058
Adj. R^2	0.498	0.337	0.247	0.405	0.252	0.187

Note(s): All variables are defined in [Appendix](#). The robust t statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

[Table 15](#) presents the results of market consequences of R&D capitalization, normal capitalization and opportunistic capitalization. The coefficients of $RDC_{i,t}$ are positively significant in all columns, suggesting that the capital market values the firms' R&D capitalization and interprets it as a positive signal of successful R&D projects. However, the coefficients of $OTC_{i,t}$ in Columns (3) and (4) are insignificant, which implies that investors fail to distinguish between opportunistic capitalization and normal capitalization.

6.2 The red flags of opportunistic capitalization

In this paper, we define opportunistic capitalizers based on ex-post impaired R&D projects. However, investors are generally unable to identify those projects that will ultimately fail at the time of capitalization. To help investors detect opportunistic capitalizers before the actual impairment occurs, we develop a predictive model to identify “red flags” in the year of capitalization.

Specifically, we first estimate a logit model. The dependent variable is $OTC1_{i,t}$, which equals 1 if a firm is classified as an opportunistic capitalizer and 0 if the firm is a normal capitalizer. The firm characteristics variables include earnings management incentives ($MBE_{i,t}$ and $MBE1_{i,t}$), firm size ($Size_{i,t}$), leverage ($Lev_{i,t}$), market-to-book ratio ($MB_{i,t}$), asset growth ($Growth_{i,t}$), the volatility of R&D intensity ($RDint_vol_{i,t}$), whether the firm's capitalization ratio exceeds the industry average ($RDC_ratio_dum_{i,t}$) and an indicator variable for whether the firm is audited by big4 auditor ($Big4_{i,t}$). $MBE_{i,t}$ is an indicator variable, which

Table 15. Difference in the CAR around annual report release date across samples

	(1) CAR (−2,2)	(2) CAR (−1,1)	(3) CAR (−2,2)	(4) CAR (−1,1)
$OTC_{i,t}$			0.000 (0.20)	−0.000 (−0.18)
$RDC_{i,t}$	0.002** (2.11)	0.002** (2.47)	0.002* (1.90)	0.002** (2.39)
$UE_{i,t}$	0.001* (1.92)	0.001*** (2.79)	0.001* (1.92)	0.001*** (2.79)
$ROE_{i,t}$	0.040*** (4.49)	0.020*** (2.77)	0.040*** (4.49)	0.020*** (2.76)
$Size_{i,t}$	0.004*** (5.84)	0.003*** (5.91)	0.004*** (5.84)	0.003*** (5.90)
$Lev_{i,t}$	−0.007** (−2.11)	−0.005 (−1.60)	−0.007** (−2.11)	−0.005 (−1.60)
$MB_{i,t}$	0.005*** (4.31)	0.005*** (4.68)	0.005*** (4.31)	0.005*** (4.67)
$Growth_{i,t}$	−0.000 (−0.04)	−0.001 (−0.42)	−0.000 (−0.04)	−0.001 (−0.42)
$RDint_{i,t}$	−0.080* (−1.92)	−0.055 (−1.55)	−0.080* (−1.92)	−0.055 (−1.55)
Constant	−0.107*** (−6.00)	−0.088*** (−6.08)	−0.107*** (−6.00)	−0.088*** (−6.08)
<i>Fixed Effects</i>				
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
# of Obs.	10,873	10,873	10,873	10,873
Adj. R ²	0.027	0.020	0.027	0.020

Note(s): All variables are defined in [Appendix](#). The robust *t* statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

equals 1 if the change in net income before R&D and extraordinary items is less than 0 and 0 otherwise. $MBE_{i,t}$ is a dummy variable, equals 1 if the net income before R&D and extraordinary items is less than 0 and 0 otherwise. Definitions of other variables are provided in [Appendix](#). Industry- and year-fixed effects are included in our model.

The results are presented in [Table 16](#). We find that firms with stronger incentives to meet prior-year earnings benchmarks or avoid losses, higher asset growth, a higher R&D capitalization ratio and lower audit quality are more likely to engage in opportunistic R&D capitalization. These findings provide practical “red flags” for market participants. In particular, the combination of earnings-driven incentives, rapid physical expansion, aggressive R&D accounting and weak external monitoring (i.e. non-big 4 auditors) may signal a managerial attempt to leverage R&D capitalization as a strategic tool to window-dress the balance sheet. This evidence provides an actionable framework for investors to scrutinize the reporting integrity of firms that are heavily investing in physical capacity or facing high pressure to meet earnings expectations.

6.3 The validity of our measurement of opportunistic capitalization

A potential concern about the measurement of opportunistic capitalization is that the current approach cannot disentangle intentional earnings management from genuine business failure, because an impaired R&D project may result from unpredictable risks or bad luck rather than

Table 16. The red flags of opportunistic capitalization

	(1) <i>OTC1_{i,t}</i>	(2) <i>OTC1_{i,t}</i>
<i>MBE_{i,t}</i>	0.233*** (2.59)	
<i>MBE1_{i,t}</i>		0.533*** (2.73)
<i>Size_{i,t}</i>	−0.058 (−0.69)	−0.055 (−0.66)
<i>Lev_{i,t}</i>	−0.475 (−1.05)	−0.541 (−1.19)
<i>MB_{i,t}</i>	−0.127 (−0.93)	−0.142 (−1.04)
<i>Growth_{i,t}</i>	0.457* (1.94)	0.444* (1.93)
<i>RDint_vol_{i,t}</i>	8.634 (0.71)	6.382 (0.52)
<i>RDC_ratio_dum_{i,t}</i>	0.334*** (2.73)	0.338*** (2.76)
<i>Big4_{i,t}</i>	−0.984*** (−2.71)	−0.975*** (−2.67)
Constant	−1.992 (−0.95)	−1.979 (−0.94)
#of Obs.	3,235	3,235
<i>Fixed effects</i>		
Industry	Yes	Yes
Year	Yes	Yes
Pseudo R ²	0.082	0.083

Note(s): All variables are defined in [Appendix](#). The robust z statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

earning management incentives. To address this concern, we conduct a cross-sectional analysis based on earnings pressure.

Specifically, we partition the sample into two groups based on *ex ante* earnings pressure. One group is firms that would experience a decline in earnings compared to the previous year, and another group is firms without such pressure. If these impairments were from unpredictable risks or bad luck, we should observe a similar decline in future profitability across these two groups.

Our results are reported in [Table 17](#). In Panel A, the dependent variables are $ROA_{i,t+1}$, $ROA_{i,t+2}$ and $ROA_{i,t+3}$, respectively. The key independent variable is $OTC1_{i,t}$, a dummy variable which equals 1 if a firm is classified as an opportunistic capitalizer and 0 if it is classified as a normal capitalizer. The control variables are the same as those used in Model (1). Columns (1), (3) and (5) report the results for firms facing earnings pressure, whereas Columns (2), (4) and (6) report the results for firms without earnings pressure. The results suggest that the negative relationship between $OTC1_{i,t}$ and future $ROA_{i,t}$ is only significant in Columns (1), (3) and (5), while insignificant in Columns (2), (4) and (6). In Panel B, the dependent variables are $ROE_{i,t+1}$, $ROE_{i,t+2}$ and $ROE_{i,t+3}$, respectively. The other variables are defined in the same way as those in Panel A. We also find that the negative relationship between $OTC1_{i,t}$ and future $ROE_{i,t}$ is only significant for firms with earnings pressure.

Overall, these results strongly suggest that the negative future performance is driven by intentional earnings management used to meet performance benchmarks rather than random project failure, indicating that our measure of opportunistic capitalization is more likely to

Table 17. The validity of the measurement of opportunistic capitalization

Panel A: The heterogeneous effect of earnings pressure on *OTC1* and *ROA*

	(1) $MBE_{i,t} = 1$ $ROA_{i,t+1}$	(2) $MBE_{i,t} = 0$ $ROA_{i,t+1}$	(3) $MBE_{i,t} = 1$ $ROA_{i,t+2}$	(4) $MBE_{i,t} = 0$ $ROA_{i,t+2}$	(5) $MBE_{i,t} = 1$ $ROA_{i,t+3}$	(6) $MBE_{i,t} = 0$ $ROA_{i,t+3}$
<i>OTC1</i> _{<i>i,t</i>}	−0.008*** (−2.94)	0.002 (0.28)	−0.008** (−2.10)	−0.003 (−0.38)	−0.011** (−2.41)	−0.010 (−1.06)
<i>ROA</i> _{<i>i,t</i>}	0.395*** (9.83)	0.032 (0.25)	0.464*** (9.12)	−0.185 (−1.33)	0.374*** (5.09)	−0.082 (−0.50)
<i>Size</i> _{<i>i,t</i>}	0.006*** (4.51)	0.011 (1.03)	0.003 (1.53)	−0.032** (−2.07)	0.003 (0.96)	−0.030 (−1.40)
<i>Lev</i> _{<i>i,t</i>}	−0.034*** (−4.73)	−0.039 (−0.99)	−0.016 (−1.38)	−0.020 (−0.46)	−0.025* (−1.69)	0.053 (0.90)
<i>MB</i> _{<i>i,t</i>}	0.015*** (5.31)	0.028*** (2.95)	0.005 (1.26)	0.002 (0.26)	0.005 (0.98)	0.005 (0.41)
<i>Growth</i> _{<i>i,t</i>}	0.003 (0.70)	0.021 (1.50)	−0.004 (−0.48)	0.026* (1.70)	−0.023** (−2.20)	0.017 (0.73)
<i>RDint</i> _{<i>i,t</i>}	0.524*** (6.40)	0.374 (1.22)	0.607*** (5.76)	0.295 (0.62)	0.607*** (3.71)	0.213 (0.38)
<i>Constant</i>	−0.098*** (−2.71)	−0.198 (−0.85)	0.009 (0.16)	0.778** (2.28)	−0.065 (−0.89)	0.658 (1.41)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	1,754	1,617	1,350	1,216	995	919
Adj. <i>R</i> ²	0.378	0.530	0.290	0.351	0.199	0.274

Panel B: The heterogeneous effect of earnings pressure on *OTC1* and *ROE*

	(1) $MBE_{i,t} = 1$ $ROE_{i,t+1}$	(2) $MBE_{i,t} = 0$ $ROE_{i,t+1}$	(3) $MBE_{i,t} = 1$ $ROE_{i,t+2}$	(4) $MBE_{i,t} = 0$ $ROE_{i,t+2}$	(5) $MBE_{i,t} = 1$ $ROE_{i,t+3}$	(6) $MBE_{i,t} = 0$ $ROE_{i,t+3}$
<i>OTC1</i> _{<i>i,t</i>}	−0.013** (−2.58)	0.005 (0.48)	−0.012* (−1.91)	−0.008 (−0.64)	−0.017** (−2.17)	−0.021 (−1.08)
<i>ROE</i> _{<i>i,t</i>}	0.362*** (9.08)	−0.039 (−0.30)	0.392*** (8.35)	−0.361*** (−2.70)	0.371*** (6.29)	−0.177 (−1.10)
<i>Size</i> _{<i>i,t</i>}	0.014*** (4.69)	0.019 (1.00)	0.009** (2.30)	−0.050* (−1.67)	0.006 (1.33)	−0.065 (−1.46)
<i>Lev</i> _{<i>i,t</i>}	0.012 (0.86)	0.037 (0.53)	0.043** (2.37)	0.018 (0.26)	0.037 (1.45)	0.127 (1.22)
<i>MB</i> _{<i>i,t</i>}	0.030*** (5.47)	0.055*** (3.03)	0.014* (1.79)	0.012 (0.67)	0.010 (1.05)	0.016 (0.68)
<i>Growth</i> _{<i>i,t</i>}	0.010 (1.09)	0.030 (1.16)	0.013 (1.04)	0.045 (1.62)	−0.031* (−1.71)	0.014 (0.31)
<i>RDint</i> _{<i>i,t</i>}	0.989*** (6.38)	0.765 (1.44)	1.297*** (7.09)	0.513 (0.89)	1.074*** (3.72)	0.764 (0.75)
<i>Constant</i>	−0.274*** (−3.93)	−0.411 (−0.93)	−0.108 (−1.19)	1.239* (1.83)	−0.201 (−1.39)	1.416 (1.46)
<i>Fixed Effects</i>						
Industry	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES
# of Obs.	1,754	1,617	1,342	1,211	988	919
Adj. <i>R</i> ²	0.305	0.451	0.264	0.270	0.193	0.211

Note(s): All variables are defined in [Appendix](#). The robust *t* statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

capture an opportunistic component when firms face strong earnings management incentives. While these results do not completely rule out the role of genuine business failure, they provide additional evidence consistent with the interpretation that earnings management incentives are an important channel underlying the documented effects.

6.4 The value relevance of opportunistic capitalization and normal capitalization

In this part, we examine the value relevance of opportunistic capitalization and normal capitalization. Following [Ohlson \(1995\)](#) and [Oswald \(2008\)](#), we construct the following empirical model:

$$P_{i,90}(P_{i,120}) = \beta_0 + \beta_1 EPS_{i,t} + \beta_1 BVPS_{i,t} + \beta_3 OTC_{i,t} + \beta_4 RDC_{i,t} + \beta_5 EPS_{i,t} \times OTC_{i,t} + \beta_6 EPS_{i,t} \times RDC_{i,t} + \beta_7 BVPS_{i,t} \times OTC_{i,t} + \beta_8 BVPS_{i,t} \times RDC_{i,t} + \sum industry + \sum year + \varepsilon_{i,t} \tag{6}$$

Where $P_{i,90}$ and $P_{i,120}$ represent the firm's closing share prices on the 90th and 120th trading days, respectively, after the release of the firm's annual report. $EPS_{i,t}$ is the EPS of firm i in year t . $BVPS_{i,t}$ is the book value of equity per share. $OTC_{i,t}$ equals 1 if the firm year belongs to the opportunistic capitalization sample and 0 otherwise. $RDC_{i,t}$ equals 1 if the firm year belongs to the capitalization sample and 0 if it belongs to the expense-all sample. We mainly focus on the coefficients of β_5 to β_8 .

The results are presented in [Table 18](#). We find that the coefficient on $EPS_{i,t} \times RDC_{i,t}$ is positive and significant, while the coefficients on β_5 , β_7 and β_8 are insignificant. The results indicate that, compared with expense-all firms, normal capitalizers enhance the value

Table 18. Value relevance of normal and opportunistic capitalization firms

	$P_{i,90}$	$P_{i,120}$
$EPS_{i,t}$	5.401*** (13.19)	5.331*** (12.50)
$BVPS_{i,t}$	0.208*** (4.44)	0.217*** (4.41)
$OTC_{i,t}$	-0.063 (-0.07)	-0.245 (-0.26)
$RDC_{i,t}$	-0.674 (-1.20)	-0.709 (-1.26)
$EPS_{i,t} \times OTC_{i,t}$	-2.225 (-1.41)	-2.151 (-1.26)
$EPS_{i,t} \times RDC_{i,t}$	1.953** (2.43)	2.074** (2.45)
$BVPS_{i,t} \times OTC_{i,t}$	0.084 (0.51)	0.097 (0.59)
$BVPS_{i,t} \times RDC_{i,t}$	-0.012 (-0.11)	-0.025 (-0.22)
Constant	9.620*** (6.64)	8.041*** (5.55)
Fixed Effects		
Industry	YES	YES
Year	YES	YES
# of Obs.	10,847	10,842
Adj. R^2	0.397	0.393
Note(s): All variables are defined in Appendix . The robust t statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively		

relevance of earnings but do not significantly affect the value relevance of equity value. However, the insignificant coefficients on the interaction terms associated with $OTC_{i,t}$ suggest that opportunistic capitalizers are not regarded as the value-added information by investors.

6.5 The moderating effect of R&D intensity

As R&D intensity plays an important role in both firm value and firms' choice between capitalizing and expensing R&D outlays, we examine whether R&D intensity moderates the effects of R&D capitalization on future firm profitability and CAR. Specifically, we incorporate the interaction terms $RDC_{i,t} \times RDint_{i,t}$ and $OTC_{i,t} \times RDint_{i,t}$ to investigate these moderating effects.

The results are reported in Table 19. Columns (1) to (6) report the regression results when the dependent variables are *ROA* and *ROE* over the subsequent three years. We find that the coefficients on the interaction term $RDC_{i,t} \times RDint_{i,t}$ across all columns are negative and significant, whereas the coefficients on $OTC_{i,t} \times RDint_{i,t}$ are insignificant. These results indicate that the negative association between normal R&D capitalization and subsequent profitability is more pronounced among firms with higher R&D intensity. One possible explanation is that firms with higher R&D intensity tend to have longer R&D cycles, require more sustained follow-up investments and face greater uncertainty in converting technically feasible projects into commercially successful products. As a result, even for normal capitalizers, the benefits of capitalization may take longer to be reflected in accounting profitability.

Columns (7) and (8) report the regression results when the dependent variable is CAR. We find that only the coefficient on $RDC_{i,t} \times RDint_{i,t}$ in Column 7 is positive and significant, while the coefficients on $OTC_{i,t} \times RDint_{i,t}$ in Columns 7 and 8 are insignificant. These results suggest that the positive market reaction to normal capitalizations is concentrated in firms with higher R&D intensity. One possible interpretation is that, when firms with high R&D intensity capitalize their R&D outlays, investors are more likely to interpret such capitalization as a signal of project progress, technological feasibility or stronger future growth opportunities.

Overall, these findings suggest that R&D intensity amplifies the positive short-window market response to normal capitalization while also strengthening its negative association with future profitability.

7. Summary and conclusion

This paper investigates the relation between R&D accounting choice and firm performance under the R&D accounting regulations in China. We use the project-level disclosures on capitalized and expensed costs in individual R&D projects, which Chinese listed firms are required to disclose in their annual financial reports, to identify firms that engage in opportunistic capitalization. We then split the sample of firms that report positive capitalized development costs into the opportunistic and normal capitalization subsamples. We find that, compared with firms that expensed all R&D expenditures, the normal capitalization firms have a greater number of patent applications and grants, incur higher SG&A expenses and exhibit lower accounting profitability. These findings are robust with the application of a Heckman two-stage treatment effect model and the PSM method to alleviate the potential endogeneity problems. We also obtain consistent results when using alternative profitability measures and changing the sample period. To address the potential concerns regarding the identification of opportunistic and normal capitalizers, we further develop a predictive model to detect red flags of opportunistic capitalization at the time of capitalization and conduct empirical tests to validate our measurement of opportunistic capitalizers.

In addition, we examine cumulative abnormal returns over an event window around annual report release dates and find that the normal capitalizers, on average, have significantly higher abnormal returns than the expense-all firms. The value relevance tests show that, compared

Table 19. The moderating effect of R&D intensity

	Return on assets			Return on equity			CAR CAR (−2,2)	CAR (−1,1)
	$ROA_{i,t+1}$	$ROA_{i,t+2}$	$ROA_{i,t+3}$	$ROE_{i,t+1}$	$ROE_{i,t+2}$	$ROE_{i,t+3}$		
$OTC_{i,t} \times RDint_{i,t}$	−0.031 (−0.33)	0.062 (0.48)	0.172 (1.02)	−0.158 (−1.00)	0.165 (0.76)	0.236 (0.83)	−0.081 (−0.73)	0.005 (0.05)
$RDC_{i,t} \times RDint_{i,t}$	−0.199*** (−3.96)	−0.151** (−1.98)	−0.164 (−1.52)	−0.366*** (−3.98)	−0.308** (−2.30)	−0.120 (−0.61)	0.154** (2.35)	0.082 (1.56)
$OTC_{i,t}$	−0.004* (−1.69)	−0.008* (−1.95)	−0.015*** (−2.82)	−0.006 (−1.12)	−0.017** (−2.18)	−0.030*** (−2.85)	0.003 (0.75)	−0.000 (−0.16)
$RDC_{i,t}$	−0.002 (−1.55)	−0.004* (−1.72)	−0.001 (−0.45)	−0.005* (−1.65)	−0.007* (−1.83)	−0.008 (−1.43)	−0.001 (−0.63)	0.001 (0.36)
$UE_{i,t}$							0.001*** (1.97)	0.001*** (2.83)
$ROA_{i,t}$	0.557*** (33.68)	0.464*** (21.85)	0.397*** (14.67)					
$ROE_{i,t}$				0.496*** (32.01)	0.370*** (16.68)	0.319*** (12.05)	0.042*** (4.70)	0.022*** (2.93)
$Size_{i,t}$	0.006*** (11.55)	0.006*** (6.49)	0.005*** (4.13)	0.013*** (12.63)	0.013*** (8.08)	0.012*** (5.58)	0.004*** (5.65)	0.003*** (5.75)
$Lev_{i,t}$	−0.033*** (−11.41)	−0.033*** (−7.50)	−0.027*** (−4.62)	−0.008 (−1.63)	0.002 (0.27)	0.016 (1.56)	−0.007** (−2.10)	−0.005 (−1.59)
$MB_{i,t}$	0.012*** (11.61)	0.008*** (4.97)	0.005*** (2.32)	0.023*** (12.00)	0.019*** (5.98)	0.012*** (2.98)	0.005*** (4.18)	0.005*** (4.57)
$Growth_{i,t}$	0.008*** (3.72)	−0.006* (−1.77)	−0.018*** (−4.38)	0.021*** (5.33)	−0.001 (−0.24)	−0.026*** (−3.54)	−0.000 (−0.11)	−0.001 (−0.46)
$RDint_{i,t}$	0.589*** (13.51)	0.642*** (10.15)	0.683*** (7.82)	1.212*** (15.93)	1.425*** (12.62)	1.295*** (8.46)	−0.145*** (−2.76)	−0.094** (−2.12)
<i>Constant</i>	−0.107*** (−7.44)	−0.057** (−2.56)	−0.075*** (−2.67)	−0.251*** (−9.93)	−0.216*** (−6.07)	−0.220*** (−3.87)	−0.103*** (−5.76)	−0.085*** (−5.88)
<i>Fixed Effects</i>								
Industry	YES	YES	YES	YES	YES	YES	YES	YES
Year	YES	YES	YES	YES	YES	YES	YES	YES
# of Obs.	11,110	8,224	5,899	11,110	8,194	5,868	10,873	10,873
Adj. R^2	0.510	0.346	0.252	0.416	0.260	0.189	0.027	0.020

Note(s): All variables are defined in [Appendix](#). The robust t statistics shown in parentheses are based on the firm-clustered standard errors. *, ** and *** represent the statistical significance level of 10%, 5% and 1%, respectively

with expense-all firms, normal capitalizers enhance the value relevance of earnings. These findings suggest that Chinese equity investors view the capitalization of development costs as a positive signal. However, we find no significant difference in cumulative abnormal returns between opportunistic capitalizers and normal capitalizers, and opportunistic capitalizers do not increase the value relevance of either earnings or book value. These findings suggest that outside investors are unable to distinguish opportunistic capitalizers from normal capitalizers *ex ante* and thus do not effectively deter firms from engaging in opportunistic capitalization.

Overall, this study enhances our understanding of the relation between capitalization of development costs and firm performance and makes a valuable contribution to the existing literature on the effects of R&D accounting choice. Moreover, our findings hold important implications for accounting standard setters and security regulators. One significant reason for expensing all R&D expenditures in the US GAAP is the regulators' concern about earnings management through R&D capitalization (Kothari, Laguerre, & Leone, 2002). Prior studies on the value relevance of R&D capitalization report mixed empirical evidence on the relation between R&D capitalization and firms' future earnings and market returns (Aboody & Lev, 1998; Cazavan-Jeny *et al.*, 2011; Wang *et al.*, 2017). Our research contributes to the literature by separating opportunistic capitalization from normal capitalization. This research design facilitates a cleaner assessment of the value relevance of R&D capitalization in China by eliminating the effect of earnings management motivation.

However, we acknowledge that there are some limitations in our study. For example, we could not completely resolve the endogeneity problem since some factors influencing firms' decision to capitalize R&D expenditures may be unobservable and hence cannot be measured and analyzed.

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Notes

1. The software development industry is one exception to this requirement (Aboody & Lev, 1998).
2. We calculate this ratio by using the data from the China Stock Market and Accounting Research (CSMAR) database.
3. https://www.gov.cn/gongbao/content/2009/content_1336380.htm
4. https://www.gov.cn/gongbao/content/2012/content_2238927.htm
5. Alternatively, we apply the winsorization method to all continuous variables at the 1st and 99th percentiles, and our findings remain the same.
6. The firm-year observations in 2007 are dropped from the final sample because we do not have the information on capitalized R&D costs in 2006 and cannot calculate the change of the adjusted total asset in 2007.
7. To address our concern about the potential multicollinearity problem in the second stage after the inclusion of the IMR variable, we follow Lennox *et al.* (2012) to calculate the variance inflation factor (VIF) for IMR and $RDC_{i,t}$ and find that the VIF value of both variables are below 5.
8. We replace $ROE_{i,t}$ with $ROA_{i,t}$, the magnitude and significance of the coefficients on $RDC_{i,t}$, $OTC_{i,t}$ and $NMC_{i,t}$ remain almost the same.

Supplementary material

The supplementary material for this article can be found online

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