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R&D Accounting Treatment and Firm Future Performance: Evidence from Greece

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Abstract

We examine whether the accounting treatment of R&D is a credible signal for the firm's future performance, both operating and financial. We examine Greek-listed firms that report under IFRS. IAS 38 imposes capitalization of R&D projects that are expected to be successful. We provide evidence that firms classified as capitalizers are larger, more leveraged and less profitable than those that expense R&D. We find that capitalizers capitalize when they want to beat last year's income benchmark. We show that capitalization is negatively or neutrally associated with future performance. In addition to that, we show that when firms capitalize and expense R&D at the same time, the expensed part of R&D costs is positively associated with future performance. Although we cannot explicitly prove that managers capitalize to manage earnings, the findings suggest that capitalization is not a credible signal for future superior firm performance. Our findings are in contrast with past literature supporting that R&D capitalization is an indication of better future performance.

Keywords

Accounting Treatment, R&D Costs, Capitalization, Greece

1. Introduction

Taking into consideration the fact that in some firms, intangible assets not only consist of an important percentage of the total assets but also, in many cases, they affect firm value more compared to tangibles, it is an important area to examine and research. In addition to that, evidence from the US market suggests that there is a failure to reflect intangibles in the financial statements (Lev & Gu, 2016). Even though their research is in the US setting, their results are expanded in firms that report under IFRS, where R&D capitalization is not only permitted but imposed

by IAS 38 when certain requirements are met (Zéghal & Maaloul, 2011).

So, there is a dichotomy on whether managers should be given the flexibility to choose the accounting treatment of R&D. This dichotomy is really important in the R&D literature, and it is our motivation for this paper. We can distinguish between the two schools of thinking regarding this issue in the literature. Those who are in favour of capitalization argue that this reporting choice acts as a signal and is used by the management to convey information about future performance (Lev & Zarowin, 1999). On the other hand, other researchers have shown that capitalization is used for earnings management or as an effort to conceal R&D investments, which are likely to fail in the future Prencipe et al. (2008).

The purpose of our study is twofold: First, we seek to answer whether capitalization of R&D is used by managers to manipulate their earnings, and second, whether capitalization conveys any information about the firm's future performance. We try to answer this question by using a sample of Greek-listed firms that report R&D activity in their financial statements (capitalization or expense). We choose Greek firms, because those research questions are unexplored in the Greek setting and because listed firms in Greece report R&D under IAS 38, under which R&D projects that are likely to be successful in the future must be capitalized.

To address these research questions, we perform two analyses. First, we seek to find the determinants of R&D capitalization, in other words, the firm characteristics that lead to capitalization. We classify firms as expensers when they expense all of their R&D costs (they report only expensed R&D in the subsequent year) and as capitalizers when they report capitalized R&D (some of the capitalizers report both expensed and capitalized R&D). In the second stage of our analysis, we examine the relationship between capitalization and future performance. We expect to find a positive relationship between them if management indeed capitalizes R&D under IAS 38. We follow the suggestion of Ronen (2001) and we use accounting ratios as proxies for firm performance.

The examined period ranges from 2005 to 2020. Our sample includes 650 firm-year observations (70 R&D active, listed firms). We notice that 70% of our sample has never capitalized R&D expenditures, while the remaining 30% has capitalized at least once during the examined period. We perform the capitalization determinants test by estimating a Probit regression. We find that firms that capitalize differ from firms that expense in terms of asset size, leverage and financial performance. Our findings support the theory that capitalization is used to manage earnings, as we provide evidence that capitalization occurs when there is poor performance and when management wishes to beat last year's income benchmark.

The second part of our analysis strengthens the earnings management indications we have obtained from the determinants model. We find a negative relationship between the decision to capitalize and future performance in one out of two models we have tested. Furthermore, we find a statistically significant relationship between the expensed R&D of capitalizers and not the capitalized proportion. We

also examine the issue of self-selection bias. Several researchers in the past have recognized this issue in their studies (Cazavan-Jeny & Jeanjean, 2006; Shehata, 1991). We follow their suggested solutions and we re-estimate our models. Correcting for self-selection bias has strengthened our results. Overall, our results indicate that either IAS 38 and its mandatory capitalization (under requirements) fail its main scope or that managers are unable to identify R&D projects that will be successful in the future and will bring future economic benefits to their firms.

The remainder of this paper is structured as follows. In Section 2, the hypotheses are developed. In Section 3, we describe the sample. In Section 4, the empirical analysis and results are presented, and finally, in Section 5, we present our final remarks.

2. R&D Accounting Treatment and Hypotheses

There are two possible accounting treatments for R&D costs. Either they are immediately expensed, or they are capitalized as an intangible asset in the balance sheet. Both major accounting principles US GAAP (SFAS 72) and IFRS (IAS 38) mandate that R&D costs must be expensed. Their main difference is that under IAS 38, R&D activity is distinguished into two distinctive phases, research phase and development phase. In the research phase, all occurred costs are expensed, like US GAAP. In the development phase, if the criteria for intangible asset recognition are met, then the costs must be capitalized. These criteria, in general, require the firm to prove that the asset will be completed and will generate future economic benefits to the firm. In contrast, before the introduction of IFRS, local GAAP in countries like the UK, France and Italy, allowed firm's management to decide whether development phase costs will be capitalized. The capitalization criteria were almost identical to current IAS 38 criteria for intangible assets recognition. The specific difference between IFRS and the local GAAP used before IFRS introduction in 2005, is the limitation of management's discretion in the latter.

Evidence suggests that stakeholders prefer the immediate expensing of R&D costs (Al-Horani et al., 2003). Published literature is focused mainly on the UK and countries that followed GAAP which were similar to those used in UK before IFRS. Analysts pointed out that firms were unable to predict future success of R&D investments and that is the reason why they were in favour of expensing (Entwistle, 1999). British accountants expressed the same concerns as analysts about the future uncertain benefits of R&D investments and the level of managerial judgement required to make the decision to capitalize (Stainer & Nixon, 1997). Evidence from the US is also supportive that R&D capitalization is not a trustworthy indication of successful or not R&D projects (see Boone & Raman, 2001; Chambers et al., 2003; Loudder & Behn, 1995).

From the auditors' point of view, they are concerned about the risks of over-capitalization, and they also expressed concerns about risks involved in R&D. Moreover, auditors must verify management's judgement and sometimes this is achieved by hiring external experts, which further increases the audit fee (Cheng

et al., 2016; Kreß et al., 2019). It seems that auditors are also in favor of expensing.

The Greek listed firms are an ideal sample for conducting a capitalization versus expensing analysis, as those firms report under IAS 38, which allows capitalization. The standard, specifically, mentions that development phase costs must be capitalized when:

- *the technical feasibility of completing the intangible asset (so that it will be available for use or sale)*
- *intention to complete and use or sell the asset*
- *ability to use or sell the asset*
- *existence of a market or, if to be used internally, the usefulness of the asset*
- *availability of adequate technical, financial, and other resources to complete the asset*
- *the cost of the asset can be measured reliably*

If any of the recognition criteria is met, then the expenditure must be charged to the income statement as incurred. Note that if the recognition criteria have been met, capitalization must take place.

Hypothesis Development

The stream of literature that supports the immediate R&D expensing argues that capitalization may lead to capitalized R&D projects which do not exhibit many chances of success in the future and that it can be used to manipulate earnings. Moreover, even under IAS 38 requirements, substantial managerial judgement is required to examine if these requirements are met or not (Stainer & Nixon, 1997). Apart from that, evidence shows that firms may decrease or increase their R&D expenditure to beat income benchmarks (Mande et al., 2000). Similarly, Cazavan-Jeny and Jeanjean (2006) and Cazavan-Jeny et al. (2011) find that capitalization of R&D is used for earnings management and has no positive effect on future profitability.

On the other hand, those that support capitalization, argue that it consists of a signal about future performance and that it is a way to convey information about successful R&D projects. There are several studies supporting that capitalized R&D is value relevant. Tsoligkas and Tsalavoutas (2011) provide evidence that capitalized R&D has a positive relationship with market value, both before and after the implementation of IAS 38. In the same spirit, Zhao (2002) supports that in both UK and France, capitalized R&D is value relevant with accounting earnings and book value. Evidence from other non-European countries is also supportive of the capitalization of R&D and their value relevance (see Ahmed & Falk, 2006; Landry & Callimaci, 2003).

Under IAS 38, the decision to capitalize is mandated by the standard. However, because there is managerial judgement on whether the requirements are met, management has the flexibility to avoid capitalization or overestimate its judgements and thus capitalize R&D. Whatever the counting treatment of R&D, it affects all the major financial statements, meaning the income statement and the

balance sheet along with the relevant ratios. This is a motive for the managers to manipulate earnings or performance ratios (Cazavan-Jeny et al., 2011).

The capitalization of R&D affects profitability ratios, especially ROE. Firms that capitalize will amortize R&D costs every year until the end of the useful life of the R&D asset (and they do not expense all of them as incurred if they choose to expense). This leads to a smoother ROE (Healy et al., 2002). Lev et al. (2005) highlighted that if we compare one capitalizer and one expenser after the end of an R&D project, they will have the same earnings but the capitalizer will have a new R&D asset at its balance sheet, thus lower ROA. In a similar vein, we expect expensers to exhibit worse leverage ratios. As they report fewer assets (and equity), ratios like debt-to-assets will tend to be larger than those of the capitalizers.

Taking into consideration the effects of capitalization or expensing, theoretically, we have a set of determinants that can potentially assess whether managers use the accounting treatment for R&D in order to manipulate earnings. The main hypothesis we make is that managers will choose to capitalize, when their performance is poor and when they are highly leveraged. Moreover, they will choose capitalization when they want to exhibit smooth earnings.

On the same page, when we examine the effect of capitalization on future performance, we expect the following. If managers indeed meet the requirements of IAS 38 and if they are not overestimating the potential future benefits of their R&D projects, we expect a positive relationship between capitalization and future performance. Furthermore, the capitalized R&D of the capitalizers should be more value relevant than their expensed R&D. If we fail to find such relationships, that means that managers have wrongfully capitalized R&D costs. This can happen either because they have manipulated earnings or because they have made wrong judgements about the R&D projects they have undertaken.

3. Sample and Descriptive Statistics

We use a sample of Greek-listed firms (active & inactive) which report R&D activity in their financial statements. We examine the period from 2005 to 2020, as in 2005, the IAS 38 Intangible Assets was implemented. The initial dataset consists of 180 firms. We exclude firms with no R&D activity, missing data and financial firms, as financials follow different accounting principles. The final sample is 70 R&D firms (650 firm-year observations). We have winsorized the sample at 1% level to avoid issues with possible outliers.

We split the firms into capitalizers and expensers, following the methodology of Cazavan-Jeny et al. (2011). A firm is classified as a capitalizer if it has capitalized R&D costs once during the 2005-2020 period, otherwise, it is classified as an expenser. The fact that firm is labelled as a capitalizer does not indicate that it has not expensed R&D costs at all; the majority of the capitalizers have capitalized and expensed R&D simultaneously. By observing the distribution of capitalizers in the industries in **Table 1**, we notice that their proportion differs across industries. In two industries (consumer products, travel and leisure) all firms are classified as

capitalizers, whereas there are industries (energy, media, retailers and utilities) where their firms have never capitalized any R&D costs.

Table 1. Industry classification.

Industry	#obs	%	#capitalizers	#expensers
Basic Resources	72	13.9	10	62
Construction & Mats	34	58.8	20	14
Consumer Prod & Serv.	4	100	4	0
Drug & Grocery Stores	38	71	27	11
Energy	16	0	0	16
Food, Bev. and Tobacco	85	11.8	10	75
Health Care	51	31.4	16	35
Ind. Goods & Services	120	27	32	88
Media	4	0	0	4
Retailers	16	0	0	16
Technology	116	30.2	35	81
Telecommunications	46	60.9	28	18
Travel & Leisure	16	100	16	0
Utilities	32	0	0	32
Total	650	30.5	198	452

Table 2 reports the characteristics of capitalizers and expensers. The main differences we notice are that expensers are smaller compared to capitalizers, in terms of average size, and that expensers are slightly but not significantly more profitable. Apart from being less profitable, capitalizers display more volatile profits. In terms of leverage, capitalizers are more leveraged while they exhibit higher capital expenditures. In future performance, there is not a significant difference between the two groups, however, expensers again are slightly more profitable. Last but not least, in terms of future sales growth, expensers exhibit higher growth.

4. Main Results

In the first stage of our analysis, we examine whether Greek managers use R&D capitalization for earnings management. To do so, we run two determinant tests of R&D capitalization. In the second stage, we examine how R&D reporting affects future firm performance.

4.1. R&D Capitalization Determinants tests

In order to examine whether management uses R&D capitalization to manage earnings, we ran two tests. First, we investigate the determinants of a firm in order to be classified as a capitalizer or an expenser. We estimate the following

Table 2. Sample characteristics.

Capitalizers Statistic	Expensers			
	N	Mean	N	Mean
SIZE	198	12.127	452	11.506
ROA	198	0.056	452	0.058
CF_RD	198	0.016	452	0.024
DEBTCAP	198	0.443	452	0.325
CAPEX	198	0.064	452	0.052
CV_ROA	198	2.865	452	1.822
CV_CFRD	198	2.072	452	0.743
S_GROWTH1	181	5.601	412	5.722
S_GROWTH3	148	5.613	335	5.756
RD_CAPXCF_RD	198	0.014	452	0.000
CF_RDEXP_CAP	198	0.011	452	0.024
CF_RDCAP_CAP	198	0.003	452	0.000
PTB	196	1.428	435	1.065
FUTROA1	181	0.053	412	0.055
FUTROA3	148	0.048	335	0.052

two equations using a Probit regression to explain the decision for a firm to be classified as a capitalizer or an expenser.

$$\begin{aligned} RDCAP_t = {} & \alpha_0 + \alpha_1 SIZE_t + \alpha_2 ROA_t + \alpha_3 CF\_RD_t + \alpha_4 DEBTCAP_t \\ & + \alpha_5 CAPEX_t + \alpha_6 CV\_ROA_t + \alpha_7 CV\_CFRD_t \\ & + \alpha_{10} \sum INDUSTRY_k + \alpha_{11} \sum YEAR_k + \epsilon_t \end{aligned} \quad (1)$$

$$\begin{aligned} RDCAP_t = {} & \alpha_0 + \alpha_1 SIZE_t + \alpha_2 ROA_t + \alpha_3 CF\_RD_t + \alpha_4 DEBTCAP_t \\ & + \alpha_5 CAPEX_t + \alpha_6 CV\_ROA_t + \alpha_7 CV\_CFRD_t + \alpha_8 ZBENCH_t \\ & + \alpha_9 LYBENCH_t + \alpha_{10} \sum INDUSTRY_k + \alpha_{11} \sum YEAR_k + \epsilon_t \end{aligned} \quad (2)$$

where $RDCAP_t$ is the decision of the firm to capitalize or not in the subsequent year *t*. We include industry and time indicator variables, as in each industry the capitalization rate is different.

We notice that capitalizers, in terms of total assets are larger than expensers. Thus capitalizers exhibit a lower ROA. Even though net income may be similar for the two groups, the R&D assets reported by capitalizers, will cause bias in the calculation of ROA [14]. For this reason, all variables, apart from CF_RD and CV_CFRD, are calculated before R&D activities. We exclude R&D amortization and expensed R&D from the calculation of net income and total assets. In this way, we derive adjusted ROA and SIZE, so differences in R&D reporting do not affect our metrics.

According to [31], we expect capitalization to improve profitability and leverage

ratios, and smooth earnings. We expect the following signs on the coefficients in the variables of Equation (1) if managers use R&D capitalization to manipulate earnings. We expect a negative coefficient between size and R&D capitalization, as larger firms typically expense a larger proportion of their R&D outlays (Aboody & Lev, 1998). Moreover, Aboody and Lev support the idea that profitable companies should avoid capitalization in order not to harm the quality of their earnings. Similarly, Cazavan-Jeny and Jeanjean (2006) have indicated that capitalization of R&D is the preferred accounting choice when performance is poor. Thus, we expect a negative coefficient on ROA.

It is well established in the literature that management prefers smooth earnings (Degeorge et al., 1999). R&D capitalization can be used to achieve this goal, so we expect a negative relationship between capitalization and the volatility variables (CV CFRD, CV ROA) (Healy et al., 2002). Finally, we use leverage (*DEBTCAP*) as a proxy for the restrictiveness of loan covenants. Firms may use R&D capitalization to affect their leverage ratio and avoid restrictions imposed by loan covenants (Aboody & Lev, 1998).

In Model 2, we introduce two additional variables, *ZBENCH* and *LYBENCH*, as proxies for the management's incentives to beat performance benchmarks by capitalizing R&D. Burgstahler and Dichev (1997) stated that firms seek to avoid reporting losses or decreases in earnings. Since capitalized R&D does not affect the income statement, we expect management to use capitalization in order to beat income benchmarks. Thus, we expect a positive coefficient for these two variables.

Table 3 reports our findings for Equation (1) and Equation (2). Model 1 suggests that larger firms, with high R&D intensity which are highly-leveraged, prefer capitalization over expensing. The positive and statistically significant coefficient of *DEBTCAP*, is an indication that management attempts to use capitalization to manipulate their gearing ratio, possibly because they face restrictions from debt covenants. As expected, we see a negative coefficient in *ROA*, consistent with the hypothesis that management prefers capitalization when performance is poor. Interestingly, we find no evidence that variables related to variation of *ROA* and *CF_RD*, affect the decision to capitalize or expense. In Model 2, as per the benchmark beating hypothesis, we find a positive coefficient in *ZBENCH*. This suggests that management uses capitalization to meet the last year's income benchmark, thus, it is a sign of earnings management.

Overall, from the Probit regression, we concur that indeed management uses capitalization to manage earnings in several ways. They use it, so they can mask poor performance, meet income thresholds and manipulate their gearing ratio.

4.2. Future Performance Prediction

In this section, we explore whether the accounting treatment of R&D costs can predict future performance. We hypothesize that managers follow the rules of IAS 38 in order to capitalize their R&D, and if so, we expect that capitalization is

Table 3. Determinants test.

	Dependent Variable	
	RDCAP	
	(1)	(2)
SIZE	0.432***	0.455***
	(0.087)	(0.089)
ROA	−2.744**	−4.550***
	(1.389)	(1.736)
CF_RD	17.496***	18.486***
	(3.622)	(3.738)
DEBTCAP	1.411***	1.590***
	(0.498)	(0.517)
CAPEX	6.156***	6.275***
	(2.100)	(2.140)
CV_ROA	−0.085	−0.072
	(0.067)	(0.063)
CV_CFRD	0.187	0.159
	(0.140)	(0.122)
LYBENCH		0.072
		(0.215)
ZBENCH		0.706**
		(0.346)
Constant	−15.084	−15.920
	(344.219)	(324.672)
Observations	650	650
Log Likelihood	−117.474	−115.250
Akaike Inf. Crit.	306.949	306.499

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

associated with superior future performance because capitalized R&D under IAS 38 are projects which are technically feasible and are expected to bring future commercial success to the firm. On the other hand, if management uses capitalization for earnings management, we expect the opposite. To test our hypothesis, we follow Cazavan-Jeny et al. (2011) and we use future performance and sales growth as measures of firm performance. The model is estimated using a pooled OLS regression.

4.2.1. Sales Growth Model

We use the following equation to model sales growth:

$$\begin{aligned} S\_GROWTH_k = {} & \alpha_0 + \alpha_1 CF\_RDEXP_t + \alpha_2 CF\_RDEXP\_CAP_t \\ & + \alpha_3 CF\_RDCAP\_CAP_t + \alpha_4 S\_GROWTH_t \\ & + \alpha_5 PTB_t + \alpha_6 SIZE_t + \alpha_7 CAPEX_t \\ & + \alpha_8 \sum INDUSTRY_k + \alpha_9 \sum YEAR_k + \epsilon_t \end{aligned} \tag{3}$$

where S_GROWTH is the natural logarithm for sales in year $t+k$/sales in year t, $k=1$ or $k=3$; all other variables are defined in Appendix A. Industry and time indicator variables have been included. We use a three-year horizon for our predictions because three years are required on average for an R&D asset to be amortized. We include industry and time indicator variables, as in each industry the capitalization rate is different. Standard errors are robust to firm clustering.

We follow Cazavan-Jeny et al. (2011) and we include $SIZE$ and $CAPEX$ as control variables. Larger firms tend to face difficulties in achieving sales growth. Larger capital expenditure is associated with larger sales growth. We expect a positive association between PTB and sales growth, as according to Chan et al. (2003), high growth is associated with firms that exhibit low book-to-market ratios. We want to examine whether the decision to capitalize is a signal for future superior performance. Therefore, we split CF_RD into three new components: CF_RDEXP (R&D cash flow of expensers), CF_RDEXP_CAP (expensed R&D cash flow of capitalizers) and CF_RDCAP_CAP (capitalized R&D cash flow of capitalizers). If the signaling hypothesis stands, we expect positive coefficients in the R&D capitalization proxies.

Columns (1) and (2) in **Table 4** are the estimated sales growth models for the two forecast horizons. We cannot find evidence that capitalization of R&D is related to future sales growth, as coefficients in the relative variables are not statistically significant in both forecasting horizons. Thus, there is no difference in terms of sales growth between capitalizers and expensers. IAS 38 requires that capitalized R&D is associated with projects that are likely to exhibit future commercial success. Our results cannot support this hypothesis and are consistent with managers either using capitalization for earnings management or they are overconfident regarding their estimations for future sales.

4.2.2. Future Income Model

As Cazavan-Jeny et al. (2011), we use an income model to further explore how capitalization affects future performance. The model is estimated using a pooled OLS regression. The model has the following specification:

$$\begin{aligned} FUTROA_k = {} & \alpha_0 + \alpha_1 CF\_RDEXP_t + \alpha_2 CF\_RDEXP\_CAP_t \\ & + \alpha_3 CF\_RDCAP\_CAP_t + \alpha_4 ROA_t + \alpha_5 PTB_t + \alpha_6 SIZE_t \\ & + \alpha_7 CAPEX_t + \alpha_8 \sum INDUSTRY_k + \alpha_9 \sum YEAR_k + \epsilon_t \end{aligned} \tag{4}$$

where $FUTROA_k$ is measured as $\sum ROA_{t,t+k} / (k+1)$, $k=1$ or $k=3$. All other variables are defined in Appendix A. We include industry and time indicator variables, as in each industry the capitalization rate is different. Standard errors are robust to firm clustering.

The regression results are reported in **Table 4**, in Columns (3) and (4). In this

Table 4. Performance forecast.

	Dependent Variable			
	SGR1 (1)	SGR3 (2)	FUTROA1 (3)	FUTROA3 (4)
CF_RDEXP	−0.043	−0.722	−1.645***	−2.956**
	(0.034)	(0.511)	(0.620)	(1.465)
CF_RDEXP_CAP	−0.023	0.652	1.866***	3.332**
	(0.041)	(0.492)	(0.613)	(1.483)
CF_RDCAP_CAP	0.115	0.802	1.338*	2.265
	(0.117)	(0.554)	(0.712)	(1.519)
log10(NETSAL)	0.095***	0.091***		
	(0.004)	(0.005)		
ROA			0.796***	0.556***
			(0.021)	(0.049)
PTB	−0.001	−0.001	0.002	0.003
	(0.001)	(0.001)	(0.002)	(0.003)
SIZE	−0.003*	−0.0002	0.0004	−0.002
	(0.002)	(0.002)	(0.001)	(0.003)
CAPEX	0.006	0.010	−0.047*	−0.044
	(0.007)	(0.011)	(0.028)	(0.060)
Constant	0.255***	0.256***	−0.021	0.003
	(0.009)	(0.010)	(0.015)	(0.035)
Observations	540	433	540	433
Adj. R-Squared	0.87	0.89	0.88	0.68

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

model, the expensed R&D of the expensers have a significant and negative relationship with future income over both forecasting horizons, as is expected from the theoretical hypothesis. Interestingly, the expensed R&D of capitalizers exhibit a positive and significant relationship with future income, over both forecasting horizons. On the other hand, the capitalized R&D of the capitalizers, do not exhibit a positive and significant relationship with future income. The absence of statistical significance is an indication of earnings management. These results are quite similar to those of Cazavan-Jeny et al. (2011) and Cazavan-Jeny and Jeanjean (2006). Our findings are in line with the hypothesis that managers use capitalization of R&D for earnings management or they overestimate the future performance of their capitalized projects.

4.3. The Self-Selection Bias Issue

A well-known issue in social science research is the sample selection bias. The

issue of selection bias occurs when a non-randomly selected sample is used. In economics, the issue and possible solutions have been heavily researched by James Heckman. Self-selection is a reason that leads to selection bias. Self-selection occurs by sample decisions made by the analysts or by the decisions made by the individuals that are being studied (Heckman, 1979).

In the accounting treatment of R&D literature, this issue is not widely recognized. However, both Aboody and Lev (1998) and Cazavan-Jeny and Jeanjean (2006) tried an approach to treat self-selection. At first glance, under IAS 38, a firm does not have a choice on when to capitalize R&D costs; if the requirements of the standard are met, then capitalization is obligatory. However, if the requirements are met or not, meaning if the R&D project is going to be economically successful or not in the future, it is a judgement made by the management. That means that management may have motives not to capitalize R&D, such as earnings management, and choose not to capitalize. In other words, future performance of firms may be affected by other firm characteristics, where capitalizers and expensers differ, rather than the R&D accounting treatment per se.

To address the issue, we follow a similar approach to Cazavan-Jeny and Jeanjean (2006). We extract the fitted values of *RDCAP* (the capitalization variable) from the determinants model, and we add the fitted values (*fitRDCAP*) as an additional independent variable in our future performance models. We report our results in **Table 5** and **Table 6**. For each model we have estimated, we compare it with the corresponding one which includes the *fitRDCAP*, e.g., for the two sales growth models in Columns (1) and (2), we make a comparison with Columns (3) and (4), which are the same models augmented with *fitRDCAP*.

Table 5. Future sales growth predictions with self-selection controls.

	Dependent Variable			
	SGR1 (1)	SGR1B (2)	SGR3 (3)	SGR3B (4)
fitRDCAP			−0.021***	−0.018***
			(0.004)	(0.005)
CF_RDEXP	−0.043	−0.722	−0.038	−0.677
	(0.034)	(0.511)	(0.034)	(0.444)
CF_RDEXP_CAP	−0.023	0.652	−0.006	0.628
	(0.041)	(0.492)	(0.040)	(0.428)
CF_RDCAP_CAP	0.115	0.802	0.382**	0.996*
	(0.117)	(0.554)	(0.156)	(0.530)
log10 (NETSAL)/ROA	0.095***	0.091***	0.096***	0.091***
	(0.004)	(0.005)	(0.004)	(0.005)
PTB	−0.001	−0.001	−0.001*	−0.001*
	(0.001)	(0.001)	(0.001)	(0.001)

Continued

SIZE	−0.003*	−0.0002	−0.002	0.001
	(0.002)	(0.002)	(0.001)	(0.002)
CAPEX	0.006	0.010	0.015**	0.018
	(0.007)	(0.011)	(0.007)	(0.011)
Constant	0.255***	0.256***	0.238***	0.240***
	(0.009)	(0.010)	(0.010)	(0.011)

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

Table 6. Regressions with self-selection controls.

	Dependent Variable			
	FUTROA1 (5)	FUTROA1B (6)	FUTROA3 (7)	FUTROA3B (8)
fitRDCAP			−0.009	0.007
			(0.013)	(0.019)
CF_RDEXP	−1.645***	−2.956**	−1.640***	−2.984**
	(0.620)	(1.465)	(0.617)	(1.483)
CF_RDEXP_CAP	1.866***	3.332**	1.874***	3.349**
	(0.613)	(1.483)	(0.613)	(1.501)
CF_RDCAP_CAP	1.338*	2.265	1.457*	2.195
	(0.712)	(1.519)	(0.765)	(1.547)
log10(NETSAL)/ROA	0.796***	0.556***	0.792***	0.559***
	(0.021)	(0.049)	(0.021)	(0.048)
PTB	0.002	0.003	0.002	0.003
	(0.002)	(0.003)	(0.002)	(0.003)
SIZE	0.0004	−0.002	0.001	−0.003
	(0.001)	(0.003)	(0.002)	(0.003)
CAPEX	−0.047*	−0.044	−0.042	−0.048
	(0.028)	(0.060)	(0.030)	(0.061)
Constant	−0.021	0.003	−0.029	0.009
	(0.015)	(0.035)	(0.022)	(0.042)

Note: *p < 0.1; **p < 0.05; ***p < 0.01.

In the sales growth model, we notice that the decision to capitalize has a significant and negative relationship with future sales growth. This means that ceteris paribus, the decision to capitalize is associated with lower sales growth in the future. The capitalized proportion of R&D outlays of the capitalizers became significant and is associated positively with sales growth only in the short-term horizon.

This denotes that maybe self-selection has driven our results in the initial model. In all other variables, we noticed no difference in statistical importance or coefficients, apart from *CAPEX*, which became significant in the short-term sales growth model. Interestingly, in both future income models, *fitRDCAP* is not significant and all other variables are the same at both significance and coefficients, so we cannot state that there is self-selection in this model.

5. Conclusion

In this research, we examine a sample of Greek-listed firms which report R&D activity in their financial statements. We seek to answer two main research questions: what are the criteria that make management capitalize R&D costs and whether this reporting choice is a credible signal about the future performance of the firm? In Greece, since 2005, IFRS has been used to report financial statements, so capitalization of R&D is imposed if the requirements set by IAS 38 are met. R&D projects must be capitalized if management is able to prove that these projects are likely to succeed and bring future economic benefits to the firm.

First, we examine the determinants of R&D capitalization to find out what makes firms capitalize R&D and second, we estimated two future performance models. The R&D capitalization determinants tests revealed that capitalizing firms are larger, more leveraged and less profitable than expensing firms. Furthermore, we find that firms capitalize when they have a benchmark to beat, in our case, the last year's income. This is consistent with the theory that capitalization is used to beat thresholds (Dinh et al., 2016).

In the second part of our empirical research, examining the relationship of capitalization with future performance, we hypothesize that because firms capitalize R&D under IAS 38, they have demonstrated that the capitalized R&D project will bring future economic benefits to the firm. Thus, we expect to find a positive relationship between capitalized R&D and future performance (and a negative relationship with expensed R&D). However, we cannot support this hypothesis, as our results indicate that the decision to capitalize versus expense has a negative or, at best, no effect at all on future firm performance. Moreover, we have evidence that when capitalizers expense a part of their R&D costs, only the expensed proportion of R&D is associated with better future performance and not the capitalized one.

These findings oppose the past R&D literature (see Healy et al., 2002; Lev & Sougiannis, 1996; Oswald & Zarowin, 2007) but are in line with a stream of literature that questions the use of R&D capitalization as a signal for future performance (see Cazavan-Jeny & Jeanjean, 2006; Cazavan-Jeny et al., 2011; Markarian et al., 2008). Our study's results can be compared with the results of Dimitropoulos (2020), who, for a Greek setting, found that before the financial crisis of Greece, R&D expenses had a negative impact on profitability, but during the crisis (2011-2016), this relationship changed, and R&D expenses became value-relevant. Kalantonis et al. (2020) found a negative relationship between R&D expenses and

market value in the Greek setting.

In conclusion, our results indicate that the scope of IAS 38, at least in the Greek setting, fails. Although we have indications of earnings management attempts by the firms, there are maybe more reasons for this failure. It is possible that management either overestimates the future success of R&D projects or just fails to engage in successful R&D projects. Maybe there is a general issue about Greek firms failing to truly innovate and provide novel products or services that will bring them future economic benefits and make them distinguish from their competitors abroad.

Contribution and Limitations

Our results contribute to the literature in several ways. This study is one of the few attempts to shed light on the R&D accounting treatment and its implications in Greece. Apart from that, we join a stream of literature about the continuous debate of the capitalization versus expensing of R&D. Most of the studies have examined the issue before the IFRS adoption, and by examining a period and a country that IFRS is mandatory, we make a contribution to the literature. Our results can also be expanded to the debate about R&D treatment by IFRS versus US GAAP, and whether managers should be given the flexibility to choose their accounting policies or follow strict rules (principles versus rules accounting).

One limitation of our study is that we were not able to obtain adequate R&D data prior to 2005 and make a comparison of R&D capitalization prior and after the implementation of IAS 38. For future research, we suggest exploring the field by using machine learning algorithms and out-of-sample predictions of R&D choice and future profitability.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix A: Variable Definitions

Table A1. Variable definitions.

Variable	Measurement
RDCAP	1 if change in gross development costs is positive, 0 otherwise
TAFR	Total assets-gross development costs+development costs amortization
RDS	Expensed R&D/sales
CF_RD	(RDS*sales*+DGross development costs)/AvgTAFR
CV_CFRD	SD(CF_RD)/|Avg.CF_RD|
CF_RDEXP	CF_RD if the firm expenses R&D
CF_RDEXP_CAP	RDS*sales/Avg.TAFR
CF_RDCAP_CAP	(DGross development costs)/Avg.TAFR
SIZE	Ln(TAFR)
ROA	(Income before extraordinary items, taxes and dividents+net financial expenditure+amortized R&D+expensed R&D)/Avg.TAFR
CV_ROA	SD(ROA)/|Avg.ROA|
PTB	
CAPEX	CAPEX/Avg.TAFR
DEBTCAP	Total debt/Avg.TAFR
ZBENCH	1 if income before R&D, extraordinary items and taxes is lower than R&D outlays, 0 otherwise
LYBENCH	1 if CF_RD>DROA, 0 otherwise

Appendix B: Descriptive Statistics

Table B1. Descriptive statistics.

Statistic	N	Mean	St. Dev.	Min	Max
SIZE	650	11.695	1.722	7.507	15.925
ROA	650	0.058	0.102	−0.266	0.399
CF_RD	650	0.021	0.043	−0.0002	0.232
DEBTCAP	650	0.361	0.254	0.000	1.354
CAPEX	650	0.056	0.056	0.0003	0.284
CV_ROA	650	2.140	3.607	0.160	24.541
CV_CFRD	650	1.148	1.966	0.221	13.557
S_GROWTH1	593	4.866	0.774	2.713	7.054
S_GROWTH3	483	4.880	0.778	2.757	7.070
RD_CAPXCF_RD	650	0.004	0.011	−0.0002	0.063
CF_RDEXP_CAP	650	0.020	0.041	0.000	0.226

Continued

CF_RDCAP_CAP	650	0.001	0.005	−0.001	0.038
PTB	631	1.178	1.338	−1.763	7.124
FUTROA1	593	0.055	0.091	−0.182	0.355
FUTROA3	483	0.051	0.079	−0.139	0.314