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CAPITALIZING VS EXPENSING R&D AND STOCK PRICE INFORMATIVENESS

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“CAPITALIZING VS EXPENSING R&D AND STOCK PRICE INFORMATIVENESS”

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ABSTRACT

This project is a study of R&D treatment in UK companies before and after the adaptation of IFRS. It is held in the thesis for the Master's Division of Banking and Financial Management at the University of Piraeus. We use very recent data from UK companies that engage R&D activities and two different periods and respond to these calls for research. We find that the capitalised portion of R&D is not related to market values, suggesting that the market perceives these items as unsuccessful projects without future economic benefits. R&D expenses are significantly and negatively related to market values both under UK GAAP and IFRS, supporting the proposition that they reflect no future economic benefits and thus they should be expensed. Based on these findings, we disagree that transition to IFRS does have implications on the valuation of R&D expenditure in the UK.

ΠΕΡΙΛΗΨΗ

Η παρούσα εργασία αποτελεί μια μελέτη που αφορά την διαχείριση των δαπανών έρευνας και ανάπτυξης στις εταιρίες του Ηνωμένου Βασιλείου πριν και μετά την υιοθέτηση των ΔΛΠ. Πραγματοποιήθηκε στα πλαίσια διπλωματικής εργασίας για το μεταπτυχιακό του τμήματος Χρηματοοικονομικής και Τραπεζικής Διοικητικής του Πανεπιστημίου Πειραιά. Χρησιμοποιούμε πολύ πρόσφατα δεδομένα από εταιρίες του Ηνωμένου Βασιλείου που πραγματοποιούν δαπάνες Έρευνας και Ανάπτυξης και εξετάζουμε δύο διαφορετικές χρονικές περιόδους. Βρίσκουμε ότι το κεφαλαιοποιημένο ποσοστό των δαπανών Ε&Α δεν σχετίζεται με τις χρηματιστηριακές τιμές συμπεραίνοντας ότι η αγορά τα εκλαμβάνει ως ανεπιτυχή σχέδια που δεν έχουν μελλοντικά οικονομικά οφέλη. Το εξοδοποιημένο ποσοστό των δαπανών Ε&Α το βρίσκουμε στατιστικά σημαντικό αλλά επηρεάζει αρνητικά τις χρηματιστηριακές τιμές τόσο πριν όσο και μετά την εφαρμογή των ΔΛΠ. Βασιζόμενοι λοιπόν σε αυτά τα συμπεράσματα διαφωνούμε πως η μετάβαση στα ΔΛΠ βελτίωσε την ερμηνεία των χρηματιστηριακών τιμών ανάλογα με την διαχείριση των δαπανών Ε&Α στο Ηνωμένο Βασίλειο.

CHAPTER 1

INTRODUCTION

Depending on the accounting standards, Research and Development (R&D) expenditures can either be expensed as incurred as a whole or partly capitalized and partly expensed. The R&D accounting choice is an important issue to study, because there has been much debate about the pros and cons of capitalization. Moreover for firms that engage R&D activities, R&D expenditures are likely to have a material impact on their earnings and stock returns. So if there are stock price effects associated with the capitalization of R&D costs, these effects may be statistical detectable.

UK General Accounting Principles (GAAP) permitted the capitalization of certain R&D expenditures. More specifically, the Statement of Standard Accounting Practice (SSAP) 13, provides discretion with regard to capitalization of certain R&D expenditure when some criteria were met. Since 2005, all European Union publicly traded firms are required to prepare consolidated accounts under International Financial Reporting Standards (IFRS) and as a consequence the requirements of IAS 38 Intangible Assets should be followed. The requirements of IAS 38 for the capitalization of R&D expenditure are generally similar to those of the UK GAAP with one but important difference. The capitalization of certain R&D expenditure is a result of the standard's requirements and not management's matter of choice i.e. managerial discretion to capitalize R&D expenditure is not permitted. In contrast if a series of specific criteria are met, a company should capitalize the R&D expenditure as an asset.

The main objective of this study is to examine whether the R&D reported assets and expenses are value relevant before and after the adoption of IFRS i.e. if stock prices become more informative after the adoption of IFRS. In order to pursue this objective we used recent data of 74 UK firms that engage R&D activities as this indicated in the 2003 to 2009 Top UK R&D Scoreboards by focusing on two different periods, from 2000 to 2004 and from 2005 to 2009.

Considering the above, this research contributes to the existing literature by giving empirical evidence for the value relevance of R&D assets and expenses before and after the mandatory transition from UK GAAP to IFRS and permits a comparison between them.

The remainder of this study is organized as follows. Chapter 2 provides the background to the study by explaining the accounting treatment of R&D expenditure in the UK and by reviewing prior literature. Chapter 3 describes the research design and the data employed in the prior researches. Chapter 4 describes our research design and reports the empirical findings with reference to the research hypothesis.

CHAPTER 2

PREVIOUS RESEARCH AND BACKGROUND

Businesses spend billions of dollars trying to develop new and better products. These outlays are referred to as research and development (R & D) costs. Accounting rule makers have struggled with how best to classify such expenditures. Should they be treated as expenses or assets? The classification of an outlay as an expense or an asset depends upon how long the firm will benefit from the outlay. If the benefit will be for more than one accounting period, it is classified as an asset. If the outlay provides economic benefit for less than a year it is generally classified as an expense.

Accounting for research and development (R & D) activities is an area of divergence between U.S. Generally Accepted Accounting Standards (U.S. GAAP) and International Financial Reporting Standards (IFRS). According to FASB 2, issued in 1974, all R & D costs shall be charged to expense when incurred. These costs include: (i) costs of materials, equipment and facilities that have no alternative future uses (ii) salaries, wages and other related costs of personnel engaged in R & D activities (iii) purchased intangibles that have no alternative future uses (iv) contract services and (v) a reasonable allocation of indirect costs, except for general and administrative costs, which must be clearly related to be included and expensed. The total R & D costs charged to expense should be disclosed in the financial statements in each period for which an income statement is prepared.

The FASB dismissed the alternative R & D accounting and reporting practices, including capitalization, which had been followed by business practice before 1974. In concluding that all R & D costs should be charged to expense, the Board considered such factors as uncertainty of future benefits of individual R & D projects and lack of causal relationship between expenditures and benefits. The Board considered an accounting method of selective capitalization, which is to capitalize R & D costs when incurred only if specific conditions are fulfilled and to charge to expense all other R & D costs. This method, requiring establishment of conditions that must be fulfilled before R & D costs are capitalized, has been practiced in many countries. For example, capitalization of selected R & D costs has been allowed under certain conditions in Japan and France, while capitalization of development costs has been practiced in the United Kingdom.

The selective capitalization method requires prerequisite conditions that are based on such factors as technological feasibility, marketability and usefulness. FASB members argued that considerable judgment is required to identify the point in the R & D process at which a new or improved product is defined and determined to be technologically feasible, marketable or useful. The FASB decided to reject this method because, in practice, no set of conditions that might be established for capitalization of costs could achieve comparability among enterprises.

The requirement that all R & D costs incurred internally be expensed immediately is a conservative, practical solution, which insures consistency in practice and comparability among companies. Defendants of this accounting method argue that from an income statement point of view, the long-run application of this standard frequently makes little difference.

Critics of the practice of immediate expensing of all R & D costs emphasize that writing off as an expense of the present period expenditures made with the expectation of benefiting future periods, is an example of revenue/expense mismatching and cannot be justified on the grounds of sound accounting principles. Furthermore, precluding capitalization of all R & D costs removes from the balance sheet what may be a company's most valuable asset.

In 1978, the International Accounting Standards Committee (IASC) issued IAS No. 9, Accounting for Research and Development Activities. It is in disagreement with the FASB's standard on accounting for R & D costs. The IASC identified certain circumstances that justify the capitalization and deferral of development costs. This standard was superseded by IAS 38, issued in September 1998, but the IASC's approach to the accounting for R & D costs did not change.

In 2001 the IASC was reconstituted into the International Accounting Standards Board (IASB), a highly professional organization supported by industry and governments throughout the world. The IASB was modeled after the FASB and created with a mandate to produce a single set of high-quality, understandable and enforceable international financial reporting standards. The revised IAS 38 issued in March 2004. The revised IAS 38 is applied to the accounting for intangible assets acquired in business combinations after March 31, 2004, and to all other intangible assets for annual periods beginning on or after March 31, 2004.

In accordance with the revised IAS 38, expenditure on research is recognized as an expense. There is no recognition of an intangible asset arising from research or from the research phase of an internal project.

An intangible asset arising from development or from the development phase of an internal project is recognized only if an enterprise can demonstrate all of the following: (1) The technical feasibility of completing the intangible asset, so that it will be available for use or sale (ii) Its intention to complete the intangible asset and use or sell it (iii) Its ability to use or sell the intangible asset (iv) How the intangible asset will generate probable future economic benefits among other things, the enterprise should demonstrate the existence of a market for the intangible asset or for the output of the intangible asset, or the internal usefulness of the intangible asset (v) The availability of adequate technical, financial and other resources to complete the development and to use or sell the intangible asset and (vi) Its ability to reliably measure the expenditure attributable to the intangible asset during its development.

The core conceptual difference between IFRS and U.S. GAAP with respect to accounting for R & D activities is the fact that IAS 38 assumes that in some instances the enterprise is able to identify expenditures during the development phase of the project that fulfill the requirements to be recognized as an intangible asset. Such intangible assets should not be accounted differently than those acquired externally, as long as the recognition criteria for intangible assets are met.

If an intangible asset does not meet the criteria for recognition as an asset, the expenditure is recognized as an expense when incurred. Also, an expenditure that was initially recognized as an expense should not be later included in the cost of an intangible asset.

Differences in how R & D activities are accounted for will also impact the reported cash flows of an entity. Capitalization and subsequent amortization of development costs means that development expenditures will not be reported as operating cash flows, but will be classified as cash flows from investing activities, whereas companies expensing development costs will reflect those expenditures as operating cash outflows in the year incurred.

On the other hand UK General Accounting Accepted Principles (GAAP) permits the capitalization of certain R&D expenditure. More specifically, the Statement of Standard Accounting Practice (SSAP) 13, Accounting for Research and Development, provides discretion with regard to capitalization of certain R&D expenditure when the recognition criteria are met. It is noted though that, since 2005, all European Union (EU) publicly traded firms are required to prepare consolidated accounts under International Financial Reporting Standards (IFRS)1 and as a consequence the requirements of IAS 38 Intangibles Assets should be followed instead.

The requirements of IAS 38 for the capitalization of R&D expenditure are generally similar with those of the UK GAAP with only one subtle but important difference. The capitalization of certain R&D expenditure is a result of the standard's requirements and not management's matter of choice. More specifically, the exercise of discretion to capitalize certain R&D expenditure is not permitted. In contrast, if a series of specific criteria are met, a company should capitalize the R&D expenditure as an asset.

SSAP 13 was originally issued in 1977. It was the outcome of two exposure drafts: ED 14 (1975) and ED 17 (1976) (Hope and Gray, 1982). ED 14, similar to the corresponding practice in the US, suggested the immediate expense of all R&D expenditure with the requirement for disclosing the amount written off separately. In contrast, ED 17 stated that a company should capitalize the portion of R&D expenditure which meet certain criteria. However, some companies where concerned with the mandatory capitalization arguing for the optional capitalization when the criteria are met (Stark, 2008).

It is important to note that prior to ED 14 there was no standard stating the accounting treatment of R&D (Elliot and Elliot, 2006, p. 450). ED 14 was effectively reflecting on to the collapse of Rolls-Royce in 1971. Among the reasons of the collapse was the fact that resources were not sufficient in order to complete the development of aero engines and thus they would be developed at a loss while their technical feasibility was questioned i.e. the aero engines were unreliable and of insufficient power (Elliot and Elliot, 2006). As a result, although SSAP 13 (1977) introduced the option to capitalize certain R&D expenditure most of the criteria that would indicate the capitalization of R&D derive from the collapse of the Rolls-Royce.

SSAP 13 (1977) was revised in 1989, with no major changes, and continues to provide an option to capitalize certain R&D expenditure when the recognition criteria are met. It must be noted that all the expenditure incurred at the research stage should be expensed as incurred, and only the development expenditure meeting the capitalization criteria could be capitalized. The criteria for R&D capitalization are the following: the project is clearly defined with the related expenditure being separately identifiable; the project is technically viable and commercial viable; adequate resources exist to complete the project; and lastly, all related expenditures are more than covered from the related revenues (paragraphs 10 - 12). It is interesting that, despite the provision of the optional capitalization, R&D expenditures were mainly expensed as incurred (Green et al., 1996) and it was rather rare for companies to capitalize any portion of R&D (Stark and Thomas, 1998; Oswald, 2008).

However, since 2005 all EU publicly traded firms reporting consolidated financial statements adopted, compulsory, IFRS with IAS 38 Intangible Assets governing the accounting treatment of intangibles. IAS 38 requires the capitalization of certain R&D expenditures which meet the following criteria.

In order to capitalize the development costs an enterprise should assess: the technical feasibility of the intangible asset; the intention to complete the asset with the ability to sell (or use) it; the availability of resources, technical or financial, to complete it; the ability to reliably measure the expenditure and the ability to justify that the asset will generate future economic benefits. Similar with SSAP 13 (1986), research expenditure should be expensed as incurred.

At a first glance, it appears that the treatment of R&D expenditure is very similar under UK GAAP and IFRS. However, there is a subtle but important difference: IFRS requires the capitalization of the R&D expenditure meeting the specified criteria, contrary to the UK GAAP which provides an option to capitalize the R&D expenditure which meets the criteria. This means that following the transition to IFRS, management's discretion would be removed and as a result several companies would have to capitalize certain R&D expenditure previously expensed as incurred (cf. Green et al., 1996; Stark and Thomas, 1998; Oswald, 2008).

In the past many researches tried to compare the accounting choice between capitalizing and expensing of R&D costs and has been much debate about the pros and cons of capitalization. This subject is major for the investors, analysts and financial statement preparers and for that reason academics tried to emphasize in many important issues such as managerial discretion on R&D expenditures , R&D manipulation and benchmark beating, and the relation between capitalizing and expensing of R&D with stock returns. We will study the earlier survey conducted in chronological order:

Ben-Zion (1978) provides evidence that differences between firms' market values and book values of equity are positively related to R&D outlays. Similarly, Hirschey and Weygandt (1985) provide evidence that the ratio of market value of assets to their replacement cost (Tobin's Q) is related to R&D

intensity (ratio of R&D outlays to sales). Sougiannis (1994) presents some evidence that current and past R&D expenditures are positively associated with both current earnings before R&D expense and current share price. In addition to these valuation studies, Bublitz and Ettredge (1989) provide evidence of a positive association between innovations in R&D expenditures from one year to the next and changes in equity values. Also, a number of studies provide evidence that the stock market reacts positively at the time that a new R&D program is announced (Woolridge 1988, Chan et al. 1990) and at the time that success is announced for an existing R&D program (Austin 1993).

These studies leave little doubt that investors view R&D expenditures "on average" as investments that are expected to produce future benefits, and that capitalizing and amortizing R&D costs has the potential to make accounting earnings and book values more useful as indicators of share values. Several recent studies provide more direct evidence on this issue. Loudder and Behn (1995) provide evidence that prior to adoption of SFAS 2, the correspondence between earnings and stock returns was greater for firms that elected to capitalize and amortize R&D costs than for firms that elected to expense R&D costs each period. Lev and Sougiannis (1996) provide evidence that both the incremental R&D expense and the incremental R&D asset that result from capitalizing and amortizing R&D costs capture information that is relevant for valuation beyond that contained in reported earnings.

According to these studies, Dennis Chambers, Ross Jennings and Robert B. Thompson II (1998) found that summary accounting measures explain a significantly greater fraction of the distribution of share prices when adjusted to reflect capitalization and amortization of R&D costs. However, the economic benefit from "no-discretion" capitalization and amortization appears to be small, and for a substantial minority of firms, this alternative accounting policy appears to reduce the usefulness of summary accounting measures for valuation. They found that a policy of selective capitalization and amortization, which permits firms to expense some R&D costs and to capitalize and amortize others, result in earnings and book value measures that explain substantially more of the cross-section of prices than those produced by either requiring all firms to expense all R&D costs or requiring them to uniformly capitalize and amortize these costs. Finally they concluded that substantial managerial discretion over the choice of costs to be capitalized and the rate at which such costs are expensed is likely to be a necessary for any alternative R&D accounting scheme that is capable of producing economically significant financial reporting benefits.

S.P Kothari, Ted E. Laguerre and Andrew J. Leone(1998) examined the reliability of future benefits of R&D expenditures relative to other investments such as capital expenditures. They compared the relative contributions of current investments in R&D and PP&E to future earnings variability and concluded that R&D investments generate more uncertain future benefits than investments in PP&E. They also controlled other determinants of earnings variability, firm-size and leverage and they found that the coefficient on current R&D expenditures is three times that of the coefficient of current PP&E expenditures. Hence they provide accounting standard setters with a relative measure of the reliability component of the relevance-reliability trade-off.

Louis K. C. Chan, Josef Lakonishok and Theodore Sougiannis (1999) questioned whether stock prices fully incorporate the value of intangible assets, with a focus on the market valuation of R&D capital. They found that the stock price fully incorporates any net benefits from R&D. While the bulk of their analysis looks at the relation between R&D and stock returns, they also provide an exploratory analysis of the relation between advertising expenditures and returns. Notably, they found that the general patterns uncovered in their analysis of R&D hold up when they examined the effect of advertising. Finally they provide evidence that R&D intensity is associated with return volatility, after controlling for firm size, age and industry effects.

Aswath Damodaran in his paper "Implications for Profitability Measurement and Valuation of R&D expenses" (1999) examined the consequences of capitalizing R&D expenses to assets and capital, operating and net income, profitability, cash flows growth and earnings multiples. They argued that R&D

expenses are in fact capital expenditures and should not be shown as part of operating expenses. They also argued that R&D expenses create a research asset that has to be amortized over time. Finally they concluded that In firms where R&D expenses have been increasing rapidly over time, reclassifying R&D can push up operating income significantly and can make return on capital a much higher number. In mature firms, where R&D expenses have been stable over time, the return on capital may decrease when R&D is reclassified.

Loudder and Behn (1995), Aboody and Lev (1998) and Oswald (2000) provide evidence within limited contexts that managers on balance have used their discretion to improve financial reporting. However, Oswald (2000) suggests that the improvement from capitalizing and amortizing development costs in the U.K. is very small, and the simulation results provided by Healy et al. (1999) suggest that realizing a substantial benefit from capitalizing and amortizing R&D costs depends on permitting managers to exercise substantial discretion. Based on the evidence that a less conservative policy that permits R&D costs to be recognized as assets rather than expensed when incurred has the potential to make summary accounting measures more useful for valuation, Dennis Chambers, Ross Jennings and Robert B. Thompson II (2001) investigated the potential magnitude of this improvement, and the extent to which the improvement depends on increasing the level of discretion permitted to financial statement preparers.

They suggest that increases in explanatory power are relatively small for alternative policies that limit discretion, but are much larger for alternatives that simulate considerable discretion. Second, price projections based on the alternatives that permit more discretion are closer to observed prices than those based on as-reported numbers for most firms in the sample, and these pricing error reductions appear to be economically significant. Third, these findings are not limited to one specification of the relation between share price and accounting values. Fourth, these findings are robust to simple forms of earnings management. As a result, these benefits will depend on the extent to which managers have incentives to use this discretion opportunistically, and the ability of corporate governance mechanisms and the audit process to place reasonable bounds on such behaviour.

Ronald Zhao in his research "Relative Value Relevance of R&D Reporting: An International Comparison" (2002), attempted to empirically test the effect of R&D accounting standard in an international context. Germany and the USA (except for the software industry) require the full and immediate expensing of R&D costs, whereas selective capitalization of R&D costs is allowed in France and UK. His results suggest that (1) the reporting of total R&D costs increases the association of equity price with accounting earnings and book value in countries with complete R&D expensing standard, (2) the allocation of R&D costs between capitalization and expense provides incremental information content over that of total R&D costs in countries permitting conditional capitalization of R&D costs.

Anne Cazavan-Jeny and Thomas Jeanjean in their paper "VALUE RELEVANCE OF R&D REPORTING: A SIGNALLING INTERPRETATION" (2003) examined the value relevance of R&D accounting treatment (expensing versus capitalization) on a sample of French listed companies because in France both accounting treatments of R&D costs (expensing and capitalization) are allowed. On the other hand, R&D expensed-related variables (RD_ES and RD_EPS) are negatively or not associated with stock prices and returns. We conclude that R&D capitalization summarizes relevant information for investors and reflects the profitability of R&D projects. The negative sign of the association of the R&D costs incurred by expensers and market values (price and returns) could reflect investors' reaction to the absence of compulsory disclosure of information about R&D in France in the financial reports.

Loudder and Behn compare the earnings usefulness of US firms that capitalized vs. expensed R&D before SFAS #2, and the change in earnings usefulness for firms that were forced to switch from capitalization to expensing. They define usefulness by the contemporaneous price–earnings relation. Aboody and Lev compare US firms that capitalize vs. expense software R&D outlays under SFAS #86. They find that the balance sheet (book) value of capitalized software R&D predicts future earnings.

According to these studies, Dennis R. Oswald and Paul Zarowin in their study " Capitalization of R&D and the Informativeness of Stock Prices" (2007) examined whether capitalization of R&D expenditures is associated with more informative stock prices, relative to expensing R&D. They found that capitalization is associated with greater stock price informativeness (higher FERC). They contributed both a new approach to studying the effects of accounting choice and a unique sample to test the effects of accounting choice in the R&D context.

Research indicates that management employ a range of manipulation techniques to achieve earnings targets, including aggressive cash flow recognition (Burgstahler and Dichev, 1997), discretionary accruals (Bartov et al., 2002 Gore et al., 2007), reclassification of core expenses as special items (McVay, 2006) and share repurchases (Bens et al., 2003; Hribar et al., 2004). Conversely, prior research reveals a positive association between unexpected changes in R&D expenditure and shareholder wealth (Chan et al.,1990). These findings imply market participants generally view R&D investment as helping to create and maintain firms' competitive advantage, and that shaving R&D spending purely to achieve an earnings benchmark is likely to be value-destroying.

According to these surveys Beatriz Garcia Osma and Steven Young in their paper "R&D Expenditure and Earnings Targets" (2009) examined whether UK firms cut R&D spending in response to short-term earnings pressures and how capital market participants interpret such behaviour. They found that failure to beat an earnings benchmark increases the probability of R&D being cut in the next accounting period, while pressure to achieve current-period earnings targets leads to contemporaneous cuts in R&D investment. They also found that the strength of the contemporaneous association between R&D spending and benchmark beating weakens as R&D intensity increases, consistent with management being less inclined to sacrifice long-term value creation for short-term earnings gains in firms where R&D investment represents a particularly important source of future earnings. Conversely, investors penalise all cuts in R&D spending made by high R&D-intensive firms with equal severity in the presence of earnings growth..

Green et al. (1996) using a sample of firms for the period 1990 to 1992, they regressed the companies' market values against book value of equity, R&D expense and residual income. Their findings suggest that, on average, the R&D expense has a positive statistically significant relation with market values. They interpreted this result as the market perceives R&D expense as a capital expenditure i.e. the market reverses the expensed R&D.

Further, Stark and Thomas (1998) employed a sample of UK companies for the period 1990 to1994. In contrast to Green et al. (1996), they regressed companies' market values against earnings before extraordinary and exceptional items (instead of utilising residual income). Nevertheless, their results are similar with those obtained from Green et al. (1996). The R&D expense is perceived as a capital component (i.e. asset) instead of being treated as any other expense. Oswald (2008) concludes that 'managers choose the correct method for accounting for R&D'. Considering the conclusion of Oswald it is argued by Stark (2008) that the adoption of IAS 38 would remove a useful way companies use to communicate information. This argument is also consistent with Wyatt (2008) who suggests that giving management discretion 'might facilitate more value relevant information on intangibles

As a consequence, F. Tsoligkas and I. Tsalavoutas perceived these arguments to test the Value relevance of R&D in the UK after IFRS mandatory implementation (2009). They examined whether the R&D reported assets and expenses are value relevant after the adoption of IFRS in the UK. Additionally, it examined any size-related valuation consequences of R&D after IFRS mandatory implementation in the UK. They concluded that, against the concerns that the adoption of IFRS may lead to less value relevant R&D reporting in the UK, during the first three years of IFRS mandatory implementation, the capitalised portion of R&D expenditure is positively value relevant. Also following the transition to IFRS there are size related valuation advantages with reference to R&D expenditure in the UK. The expensed portion of R&D is significantly value relevant only for large companies with a significantly lower coefficient compared to the corresponding of small companies. So they provide evidence that IFRS better reflect companies' fundamentals.

CHAPTER 3

METHODOLOGY

In this chapter we will study the methodology of previous researches, whose results are cited in the previous chapter. We will also conclude to our sample data and our regression model the results of which will be presented in the next section of our research.

Dennis Chambers, Ross Jennings and Robert B. Thompson II, in their research "Evidence on the Usefulness of Capitalizing and Amortizing Research and Development Costs" (1998) tried to test the magnitude of the financial reporting benefits that might be achieved by adopting a policy that permits capitalization and amortization of R&D costs. They considered two alternative R&D accounting rules that require firms to capitalize and amortize R&D costs, but which give preparers no more discretion than presently permitted under SFAS 2. The first required capitalization of all R&D expenditures, and imposed the same "one-size-fits-all" amortization period on all firms in the economy. The second differed by allowing amortization periods to vary across industries. If R&D costs in the aggregate are reasonable surrogates for future benefits, these alternatives would have the potential to increase the informativeness of accounting numbers by making them more relevant for valuation and more comparable across R&D-intensive and non-R&D-intensive firms. For each of these alternative R&D accounting rules, they compared the extent to which reported earnings and book values (based on the requirement to expense R&D costs as incurred) and adjusted earnings and book values (based on capitalization and amortization of R&D costs) explain the observed cross-section of share prices.

Their study was based on firms in the Compustat PST, full coverage, and merged research quarterly and annual databases for any year from 1986 to 1995. They first identified 9,941 firm-years for which at least 10 years of R&D expense (current year and preceding nine years) were available. Ten years of R&D expense were required to simulate various amortization periods. From this sample, they eliminated 2,372 firm-years for which other Compustat data were not available. Their main sample was based on the remaining 7,569 firm-years, with yearly observations ranging from 708 to 808. This sample included 1,472 firms distributed across 52 two-digit (263 four-digit) SIC codes.

Their comparison assumed that security prices reflect all public, value-relevant data, and that the usefulness of accounting numbers lies in their ability to summarize these data. Their regression specification took variation in weights into account. Specifically, they ranked firms, within years, on the basis of the ratio of net income to total assets. They then assigned observations in the top 25 percent, middle 50 percent, and bottom 25 percent of this ranking to “high,” "middle," and "low" earnings-to-assets groups, respectively, and permit intercepts and slope coefficients to vary across groups.

In summary, to compare the extent to which reported and adjusted earnings and book values explain cross-sectional variation in share prices, they used their sample to estimate the following cross-sectional regressions:

$$P_i = \sum_{t=1}^{10} Z_{ti} \sum_{j=1}^{3} D_{ji} \; [a_{0jt} + a_{1jt}\, ER_i + a_{2jt}\, BVR_i] + e_i \qquad (1)$$

$$P_i = \sum_{t=1}^{10} Z_{ti} \sum_{j=1}^{3} D_{ji} \; [b_{0jt} + b_{1jt}\, EA_i + b_{2jt}\, BVA_i] + e_t \qquad (2)$$

In these regressions, Pi is firm i's stock price three months after the end of its fiscal year. In regression (1), ERi ("reported earnings") is per share income from continuing operations available for common stockholders, and BVRi ("reported book value") is the per share book value of common stockholders' equity at year-end, both as reported based on the current requirement to expense R&D costs. In regression (2), EAi ("adjusted earnings") and BVAi ("adjusted book value") are per share income from continuing operations available for common stockholders and per share book value of common stockholders' equity, respectively, both adjusted to reflect capitalization and amortization of R&D costs. In both regressions, indicator variables Dji (j = 1,..,3) and Zti (t = 1,..,10) permit intercepts and slope coefficients to differ across the low, medium, and high earnings-to-assets groups and across the 10 years in the study period, respectively.

To determine the length of the one-size-fits-all amortization period that best reflects the underlying economics of investments in R&D activities they estimated regression (2) for a range of amortization periods, which are designated as having length K. For each K, R&D amortization is equal to the sum of all R&D costs incurred in the current and K - 1 previous years, divided by K, and earnings is adjusted by adding back reported R&D expense and subtracting R&D amortization. To determine the industry-specific amortization periods required by their second rule, they estimated regression (2) for K = 2 to K = 10 separately for firm-years and selected the K for each industry that maximizes the regression (2) R^2 as the "best fit" amortization period for that industry.

They found that R^2 for regression (1), 0.7410, indicates that summary accounting measures based on the current requirement to expense R&D costs as incurred explain a large proportion of the cross-sectional variation in prices. At all levels of K, however, the R^2 s for regression (2), based on adjusted earnings and book values, are greater than the R^2 for regression (1). The R^2 difference increases monotonically until it reaches a maximum at K = 9, and then declines slightly when K = 10, suggesting an amortization period of nine years as the empirical "best fit" one-size-fits-all rule for the firms and years in their sample. At K = 9, the R^2 difference of 0.0135 has a Z-statistic of 4.14, which indicates rejection of the null hypothesis of equal explanatory power at or below the 1% confidence level.

They also estimated separate versions of regressions (1) and (2) (at K = 9) for the low, medium, and high earnings-to-assets groups in order to determine how their one-size-fits-all rule affects each group. For the low and high groups the R^2 difference is larger and more significant than for the sample as a whole, while for the middle group the R^2 difference is not statistically significant. This indicates that capitalization and amortization results in the greatest improvement in explanatory power when that explanatory power is provided primarily by either earnings or book values. They then compared R^2s for regression (2), based on earnings and book values adjusted using industry-specific amortization periods, to those for regression (1), based on reported accounting numbers. For the sample as a whole, the R^2 for regression (2) is significantly greater than that for regression (1) by 0.0157 (Z = 4.74). This difference is slightly greater than the difference reported for the one-size-fits-all amortization period. R^2 differences are also positive and significant for all three earnings-to-assets groups.

The results indicate that, for the sample as a whole, capitalizing and amortizing R&D costs using simple no-discretion rules applied uniformly by all firms results in a small but statistically significant increase in the extent to which earnings and book values jointly explain the cross-sectional distribution of share prices.

They also examined whether a policy of selective capitalization and amortization, under which some R&D costs are expensed and others are capitalized and amortized, has the potential to further enhance the usefulness of summary accounting measures for valuation. They re-estimated regression (2) using two different "proxies" for the accounting numbers, and compared the adjusted R^2s for these regressions to the R^2 for regression (1). The first proxy is that for observations whose pricing errors increased substantially as a result of capitalization and amortization they measured EA and BVA "as reported," i.e., based on immediate expensing of R&D costs. For all other observations, EA and BVA were based on capitalization of R&D costs with industry-specific amortization periods. Their second proxy was to expense R&D for observations that have (a) large negative pricing errors from regression (1) and (b) large R&D adjustments from capitalization and amortization. For all other observations, EA and BVA were based on capitalization of R&D costs with industry-specific amortization For their first proxy, the R^2increase from selective capitalization was 0.0405 (Z = 15.91), about two-and-a-half times as great as the R2 increase of 0.0157 (Z = 4.47) from uniformly applied capitalization and amortization. For the second proxy, the R^2 increase (0.0468, Z = 18.14) was somewhat larger

Their main results, indicate that “no-discretion” capitalization and amortization rules have very limited potential to increase the usefulness of summary accounting measures as indicators of value. In contrast, their analysis based selective capitalization suggests that allowing firms to exercise discretion in identifying costs to be capitalized can potentially result in a much greater increase in the usefulness of these measures.

S.P. Kothari, Ted E. Laguerre and Andrew J. Leone in their research “Capitalization versus Expensing: Evidence on the uncertainty of future earnings from current investments in PP&E versus R&D” (1998) focused on the relation between investments in R&D and the uncertainty of future benefits from those investments. The main hypothesis they tested was whether the variability of future earnings realizations is greater due to R&D investments than to capital expenditures i.e. investments in PP&E.

They used the followed cross-sectional regression model estimated annually:

$$\mathbf{SD(E_{t+1,t+5}) = a + b1_t CapEx_t + b2_t R\&D_t + b3_t MV_t + b4_t\ Leverage_t + error_{t+1,t+5}}$$

Where :

- $SD(E_{t+1,t+5})$ is the standard deviation of earnings before extraordinary items and discontinued operations.
- $R\&D_t$ is research and development per share, deflated by BVE or P
- $CapEx_t$ is the capital expenditure per share, deflated by BVE or P.
- MV_t is the natural logarithm of the market capitalization of equity at the end of year t and
- $Leverage_{t\ is}$ the ratio of long-term debt to the market value of equity plus long-term debt, both at the end of year t.

They obtained financial data from the 1997 Compustat Annual Industrial and Annual Research files for the period 1972-1997. For all variables except P and BVE the values are for the fiscal year t or for the end of fiscal year t. In contrast P and BVE are measured at the end of fiscal year t-1 because they are used as deflators. The earliest year is set at 1972 because prior to that year few firms on Compustat report their R&D outlays. In cases were earnings data are missing in of the periods from t+1 through t+5, the standard deviation of earnings $SD(E_{t+1,t+5})$ was set to equal to the mean $SD(E_{t+1,t+5})$.

The sample selection criteria yield a total of 55073 firm-year observations when book value of equity was used as the deflator and 52046 observations used price as the deflator.

They found the average coefficient on R&D was 0,067 and statistically significant with a t-statistic of 3,41. Everyone of the 21annual regression coefficient estimates on R&D was positive and the median was 0,052 which means the distribution of coefficients was not particularly right skewed. In comparison the average coefficient on capital expenditures was only 0,021 with a t-statistic of 3,47 or less than one-third as large as the average coefficient on R&D. Also the average coefficient on the advertising expense 0,025 with t-statistic of 8,52 was approximately of the same magnitude as that on capital expenditures but much smaller than that on R&D.

Their results strongly support the hypothesis that R&D investments generate more uncertain future benefits compared to investments in PP&E. Controlling for other known determinants of earnings variability, firm-size and leverage they found that the coefficient on current R&D expenditures was roughly three times that of the coefficient on current PP&E expenditures.

Louis K. C. Chan, Josef Lakonishok and Theodore Sougiannis in their research “The Stock Market Valuation of Research and Development Expenditures” (1999) examined whether stock prices fully reflect the value of firms’ intangible assets, focusing on research and development (R&D). They investigated whether the stock market appropriately accounts for firms’ expenditures on R&D. They did this by relating R&D spending to subsequent stock price performance.

Literature suggests numerous methods for measuring the stock of R&D capital, with a wide range of estimates for the useful life of expenditures and the amortization rate. For example, estimated amortization rates range from 6 percent (Baily (1972)) to 25 percent (Hirschey (1982)). Lev and Sougiannis (1996) estimated the impact of current and past R&D spending on earnings across a variety of industries. These estimates thereby measure the proportion of past spending that is still productive in a given year. Based on their estimates, they adopted the following tractable approximation of the stock of R&D capital, RDCit for firm i in year t based on current and past R&D expenditure (RDit):

$$\mathbf{RDCit = RD_{it} + 0{,}8^{*}\ RD_{it-1} + 0{,}6\ ^{*}\ RD_{it-2} + 0{,}4\ ^{*}RD_{it-3} + 0{,}2\ ^{*}RD_{it-4}} \qquad \textbf{(1)}$$

Effectively they assumed that the productivity of each dollar of spending declines linearly by twenty percent a year. Equivalently, the R&D expense (the periodic amortization of the capital), REit, is given by:

$$\mathbf{REit = 0{,}2\ ^{*}(RD_{it-1} + RD_{it-2} + RD_{it-3} + RD_{it-4} + RD_{it-5})} \qquad \textbf{(2)}$$

To explore further the impact on commonly-used valuation measures, they compared earnings under the current practice of immediately expensing R&D spending with “adjusted earnings” calculated using their estimate of R&D expense (equation 2). Similarly they compared the book value of common equity with a measure of book value (“adjusted book value”) which adds to the accounting book value the value of R&D capital (calculated using equation 1).

They have adjusted for size and book-to-market effects on returns by using control portfolios matched on those two characteristics. As a check that their results are robust to the return adjustment method, they used the Fama-French (1993, 1996) procedure, which adjusts for the sensitivities of stock returns to market, size and book-to-market factors. Specifically, time series regressions of the form:

$$\mathbf{R_{pt} - R_{ft} = a_p + b_p[R_{Mt} - R_{ft}] + s_pSMB_t + h_pHML_t + e_{pt}} \qquad \textbf{(3)}$$

They are estimated for each quintile portfolio p. Here Rpt -Rft is the monthly return on the portfolio in excess of the Treasury bill rate in month t, RMt -Rft is the excess return on the value-weighted market index, SMBt and HMLt are the returns on the Fama-French (1993) factor-mimicking portfolios for size and book-to-market, respectively. The model was estimated using monthly returns from each of the first three years following portfolio information.

Their results suggest that on average a firm which does R&D earns a rate of return that is no different from a firm with no R&D. Nonetheless R&D may have effects on firms' financial performance beyond average stock returns. So they tested whether there is any association between R&D and return volatility. Higher volatility could be a consequence of the nature of the business in technology-based industries (where R&D spending is mainly concentrated). With these considerations in mind, they estimated a cross-sectional regression of the form:

$$\sigma_{it} = \gamma_{0t} + \gamma_{1t}\,\mathbf{LNSIZE}_{it} + \gamma_{2t}\,\mathbf{LNAGE}_{it} + \gamma_{3t}\,\mathbf{RDS}_{it} + \sum_{j=1}^{L} \Phi_{jt}\,\mathbf{IND}_{ijt} + \varepsilon_{it}$$

The regression relates each stock's return volatility _it (the standard deviation of monthly returns based on the subsequent twelve months) to the following variables: the firm's stock market capitalization (in logarithms), LNSIZEit: the firm's age (in logarithms), LNAGEit as well as its R&D intensity relative to sales RDSit. In order to capture volatility associated with business conditions in the technology sector, the regression also includes dummy variables for industries INDijt. The industry classifications were based on 2-digit SIC codes and, specifically, include the technology industries. The average coefficient for R&D intensity is 0.0963 with a 't'-statistic of 6.49. Compared to firms with no R&D, therefore, the regression model predicts that monthly return volatility for highly R&D intensive companies is larger by about 2.21 percent, everything else equal. Since the average monthly volatility of returns for companies with R&D is about 13 percent, the impact of R&D intensity is economically important. Their results thus indicate that high R&D intensity tends to be associated with higher volatility, everything else equal. To the extent that that the limited disclosure of R&D contributes to the higher volatility there could be a cost associated with the present accounting treatment of R&D. In summary their evidence did not support a direct link between R&D spending and future stock returns. Indeed, the average return over all firms engaged in R&D activity did not differ markedly from firms who do not perform R&D.

Dennis Chambers, Ross Jennings and Robert B. Thompson II, in their research “Managerial Discretion and Accounting for Research and Development Costs” (2001) investigated the extent to which potential financial reporting benefits from capitalizing and amortizing R&D costs depend on increasing the level of discretion permitted to financial statement preparers. They extend previous research by examining the magnitude of financial reporting benefits from less conservative accounting schemes for R&D costs, and the extent to which those benefits depend on permitting substantial discretion to managers. To investigate this issue, they simulated the earnings and book value of net assets that would have been reported under a “one-size-fits-all” rule, as well as under several alternative R&D accounting rules that are designed to reflect increasing levels of managerial discretion.

Their assumptions are: First is that financial reporting data are aimed primarily at users who require information for making investment decisions. The second is that the usefulness of summary accounting measures—earnings and book values—lies in their ability to serve as indicators of value that facilitate such decisions. Third, they assumed that firms would have made the same non-R&D financial reporting choices and the same operating, financing, and investing decisions, including level of R&D investment, under any of the alternative R&D accounting policies being compared. Finally, they assumed that share prices reflect all public, value-relevant information.

Their regression specification takes variation in weights into account by allowing intercepts and slope coefficients to vary across profitability groups. Specifically, they ranked firms in their sample, within years, on the basis of the ratio of net income to total assets. They then assigned observations in the top 25 percent, middle 50 percent, and bottom 25 percent of this ranking to “high,” "middle," and "low" earnings-to-assets groups, respectively, and permitted intercepts and slope coefficients to vary across groups. In summary, to compare the extent to which reported and adjusted earnings and book values explain cross-sectional variation in share prices, they estimated the following cross-sectional regressions:

$$P_i = \sum_{t=1}^{10} Zti \sum_{j=1}^{3} Dji \; [a_{0jt} + a_{1jt}\, ER_i + a_{2jt}\, BVR_i] + e_i \qquad (1)$$

$$P_i = \sum_{t=1}^{10} Zti \sum_{j=1}^{3} Dji \; [b_{0jt} + b_{1jt}\, EA_i + b_{2jt}\, BVA_i] + e_t \qquad (2)$$

In these regressions, Pi is firm i's stock price three months after the end of its fiscal year. In regression (1), ERi ("reported earnings") is per share income from continuing operations available for common stockholders, and BVRi ("reported book value") is the per share book value of common stockholders' equity at year-end, both as reported based on the current requirement to expense R&D costs. In regression (2), EAi ("adjusted earnings") and BVAi ("adjusted book value") are per share income from continuing operations available for common stockholders and per share book value of common stockholders' equity, respectively, both adjusted to reflect a given alternative accounting policy for R&D costs. In both regressions, indicator variables Dji (j = 1,..,3) and Zti (t = 1,..,10) permit intercepts and slope coefficients to differ across the low, medium, and high earnings-to-assets groups and across the 15 years in the study period, respectively. For regression (1), earnings-to-assets groups are based on as-reported earnings and assets, but for regression (2) group assignment is based on adjusted earnings and assets. For a given alternative, if the R^2 for regression (2) is significantly larger than the R^2 for regression (1), they would conclude that substituting the alternative accounting rule would have the potential to enhance the usefulness of earnings and book values as indicators of share value.

Their study was based on domestic firms in the Compustat PST, full coverage, and merged research quarterly and annual databases with basic financial data (total assets and fiscal year-end month) for any year from 1986 to 2000. Their final sample consists of the remaining 14,573 firm-years, with yearly observations ranging from 782 to 1,171.

Their first alternative accounting rule required capitalization of all R&D expenditures and imposed a single "one-size-fits-all" amortization period on all firms in their sample. To find the length of the one-size-fits-all amortization period that best reflects the underlying economics of R&D investment for their sample as a whole, they estimated regression (2) for a range of amortization periods, designated as having length k. For each k, R&D amortization equals the sum of all R&D costs incurred in the current and (k–1) previous years, divided by k, and earnings were adjusted by adding back reported R&D expense and subtracting R&D amortization. They adjust earnings and book values in this way for k = 2 up to k = 10. The R^2 for this regression, 0.6172, indicates that summary accounting measures based on the current requirement to expense R&D costs as incurred explain a large proportion of the cross-sectional variation in prices. They found that R^2 increases monotonically until it reaches a maximum at k = 10, suggesting an amortization period of ten years as the empirical "best fit" one-size-fits-all rule for the firms and years in their sample. Capitalizing all R&D costs and amortizing these costs over ten years for all firms increases R^2 from 0.6172 to 0.6376. This is an increase of 0.0204, and the related Z-statistic (7.30) is significant at below the 1% confidence level.

Then they simulated alternative policies that permit managers to exercise discretion over both whether to capitalize R&D costs and the period over which the resulting R&D asset (if any) is amortized. Their general approach for each alternative accounting policy was to determine an amortization period for R&D costs for each sample observation that minimizes the absolute difference between (a) the actual share price at a given valuation date and (b) an accounting-based share valuation on that same date. The accounting-based valuation, a predicted share price obtained by applying estimated coefficients from regression (1) to pro forma earnings and book value for the alternative in question, is given by:

$$P_{ik} = \sum_{t=1}^{10} Z_{tt} \sum_{j=1}^{8} D_{jt} \, [a_{0jt} + a_{1jt} \, EA_{ik} + b_{2jt} \, BVA_{ik}] \qquad (3)$$

They then searched over all k permitted for a given policy alternative to find k*, the amortization period that minimizes | P_i - P_{ik} |, the difference between actual share price and accounting-based valuation. They re-estimate regression (2) based on the pro forma measures EAik* and BVAik* for the policy alternative under consideration. The five alternatives they concluded are:

Alternative 1—k≤ 5, no revision, past data. An amortization period no greater than five years was determined for each firm for R&D expenditures made each year. This amortization period was based on the relation between price and accounting valuation in the year preceding the current year, and may not be revised in subsequent years.

Alternative 2—k ≤ 10, no revision, past data. Identical to alternative 1 except that firms may amortize a given layer of R&D costs over a maximum of ten years.

Alternative 3—k ≤ 10, allowing revision, past data. Differs from alternative 2 in that firms may shorten or lengthen the amortization period over which the unamortized book value of prior R&D investments was amortized.

Alternative 4—k, unlimited, allowing revision, past data. Identical to alternative 3 except that the length of the amortization period is not restricted. In the extreme, if the amortization period is lengthened greatly, firms need not amortize R&D costs at all, in which case this policy resembles the current U.S. accounting standard for purchased goodwill.

Alternative 5—k, unlimited, allowing revision, current data. Identical to alternative 4 except that amortization periods are determined based on the relation between share price and accounting valuation in the current year.

The explanatory power of alternatives 1-5 increased monotonically in discretion. Especially R^2 for alternative 5 generated a significant R^2 improvement (0.1331, Z=24.54). Finally they modified regressions (1) and (2) to disaggregate R&D expense/amortization from earnings, and R&D assets from book value:

$$P_i = \sum_{t=1}^{10} Z_{ti} \left[a_{0t} + a_{1t}(ER + RDEXP)_i + a_{2t}\, RDEXP_i + a_{3t} BVR_i\right] + e_i \qquad (1')$$

$$P_i = \sum_{t=1}^{10} Z_{ti} \left[b_{0t} + b_{1t}(EA + RDAMORT)_i + b_{2t}\, RDAMORT_i + b_{3t} BVA_i + b_{4t} RDASSET_i\right] + e_i \qquad (2')$$

In these regressions, RDEXPi is reported R&D expense, RDAMORTi and RDASSETi are the pro forma R&D amortization and pro forma R&D asset under the relevant alternative accounting policy, and all other variables are as defined above. In this case, the as-reported R^2 improves from 0.5085 to 0.5499 when R&D measures are disaggregated. This mitigated the additional improvement that is possible from capitalizing and amortizing R&D costs. Thus, the concluded that the magnitude of the financial reporting improvement is less when measured on the basis of disaggregated earnings and assets, but it still appears to be economically meaningful as well as statistically significant.

Ronald Zhao in his research "Relative Value Relevance of R&D Reporting: An International Comparison" (2002) examined the relative value relevance of R&D reporting in France, Germany, the UK and the USA. France and the UK allow for the conditional capitalization of R&D costs, whereas Germany and the USA (except for the software industry) require the complete expensing of all R&D costs. In addition, a significant difference exists in the financial reporting environments of the four countries, with France and Germany having a code-law system, and the UK and the USA utilizing a common-law system.

They measured the value relevance of R&D reporting by investors' reaction to the disclosure of such information in relation to accounting earnings and book value. They first tested whether R&D reporting provides additional information to accounting earnings and book value. Their first hypothesis is: Ceteris paribus, R&D reporting increases the association of equity price with accounting earnings and book value. They tested this hypothesis by comparing the results of the clean surplus accounting model that excludes R&D information with those of an extended version of the model that includes

R&D information. First, they used the original clean surplus accounting model (Bernard, 1994; Feltham and Ohlson, 1995) to test the association of equity price with accounting earnings and book value regardless of R&D reporting:

$$Pit = Sji *Cki*[\alpha 0YRt + \alpha 1Eit + \alpha 2BVit + \varepsilon it] \quad (1)$$

Where :

- P_{it} is firm i's stock price at the end of year t,
- S_{ji} is a dummy variable for R&D accounting standard, j = 0 for standard requiring complete expensing of R&D costs, j = 1 for standard permitting conditional capitalization of R&D costs.
- C_{ki} is a dummy variable for reporting environment, k = 0 for code-law country, and k = 1 for common-law country,
- YR_{it} is a dummy variable for each year t, t = 1 for year of data, and t = 0 otherwise,
- E_{it} is firm i's reported earnings per share for year t,
- BV_{it} is firm i's book value of common equity per share for year t,
- e_{it} is a disturbance term.

They then introduced a new variable of predicted R&D intensity into equation (1) to control for R&D information:

$$Pit = SjiCki[\alpha 0YRt + \alpha 1Eit + \alpha 2BVit + \alpha 3R\&D^*it + \varepsilon it] \quad (2)$$

where R&D*it is firm i's predicted total R&D intensity for year t, based on Aboody and Lev (1999), which is calculated as follows:

$$R\&Dit = \alpha 0YRt + \alpha 1Sizeit + \alpha 2Profitabilityit + \alpha 3Leverageit + \varepsilon it \quad (3)$$

Where:

- $Size_{it}$ is the log of firm i's market value of equity at the end of year t,
- $Profitability_{it}$ is firm i's net income adjusted for total R&D costs divided by net sales for year t,
- $Leverage_{it}$ is firm i's long-term debt divided by equity for year t.

They used a time series regression of equation (3) to predict R&D costs for each firm-year observation, which is then included in equation (2) as an instrumental variable to account for R&D reporting by firms. Thus, a comparison of equations (2) with (1) would indicate if R&D reporting improves the association of equity price with accounting earnings and book values.

Their second hypothesis was: Ceteris paribus, the allocation of R&D costs between capitalization and expense increases the association of equity price with accounting earnings and book value. They decomposed accounting earnings and book value in the clean surplus accounting model into their R&D-related and non-R&D-related components to test hypothesis 2:

$$Pit = Cki[\alpha 0YRt + \alpha 1E^{*}it + \alpha 2ERDit + \alpha 3BV^{*}it + \alpha 4CRDit + \alpha 5Cap/R\&D^{*}it + \varepsilon it] \quad (4)$$

where :

- **E*it** is Eit adjusted for ERDit,
- **ERDit** is firm i's expensed R&D costs per share, including amortization of accumulated capitalized R&D costs, for year t,
- **BV*it** is BVit adjusted for CRDit.
- **CRDit** is firm i's capitalized R&D costs per share for year t, Cap/R&D*it is firm i's predicted capitalized R&D as a percentage of R&D intensity for year t.

All other variables are as previously defined. In order to estimate Cap/R&D*it for each firm-year observation, Cap, the predicted value of R&D capitalization, has to be calculated first (Aboody and Lev, 1998):

$$Capit = a0YRt + a1Sizeit + a2Profitabilityit + a3Leverageit + a4R\&Dit + eit \quad (5)$$

Where:

Capit is firm i's capitalized R&D costs for year t divided by net sales. The value of R&D capitalization for each firm-year observation can be predicted by using a time series regression of equation (5) to arrive at Cap/R&D*it.

The test data is obtained from Company Analysis, a Financial Times (FTSE) database. Their sample excludes financial and service companies, which are unlikely to have substantial R&D costs. It includes companies in the consumer goods (FTSE) and general manufacturing (FTSE) industries, including software firms, which are most likely to have R&D costs. Their data covers a ten-year period of 1990– 1999. The whole sample includes 1,842 firm-year observations for France, 1,518 for Germany, 4,625 for the UK, and 5,044 for the USA. Within the whole sample, 556 firm-year observations (30 per cent) for France, 262 observations (17 per cent) for Germany, 2,124 observations (46 per cent) for the UK, and 3,128 observations (62 per cent) for the USA actually report R&D costs.

Their tests showed that German and US samples have a significantly (at the 0.01 level) larger intercept (129.3579 and 28.4613, respectively) than the French and UK samples (–6.1489 and 0.9241, respectively), suggesting that the German and US market responses have a significantly larger fixed part. The coefficient estimate for a1 is significant at the 0.01 level for all the four countries, but the weights for France (2.6933) and the UK (8.0693) are greater than that for the USA (1.3896). These results are consistent with findings by Alford et al. (1993) that accounting earnings are more value relevant in France and the UK than in the USA.

Their test results resulted an adjusted R^2 of 0.7593 for France, 0.4403 for Germany, 0.4778 for the UK and 0.1453 for the USA. Between the code-law countries, the adjusted R^2 for France is higher than that for Germany, and between the common-law countries, the adjusted R^2 for the UK is higher than that for the USA. But, across the reporting environments, the adjusted R^2 for France is higher than those for the UK and the USA, and the adjusted R^2 for Germany is higher than that for USA. They found it difficult to interpret the varying explanatory powers of the country models by the reporting environment criterion alone. We offer an alternative explanation by pointing out the potential impact of R&D reporting, in addition to reporting environment, on the information content of accounting earnings and book value.

They next combined the four countries into expensing (Germany and the USA) and capitalizing (France and the UK) groups. The expensing group has a significantly (at the 0.01 level) larger intercept (101.3446) than the capitalizing group (6.2119), consistent with the by-country results. The coefficient estimates for a1 and a2 are significant for both groups (at the 0.01 level). The reporting environment dummy (Ck = 1 for common-law) is more negative for the expensing (–58.4270), than capitalizing (–7.4969), group, suggesting a stronger association of equity price with accounting earnings and book value in common-law capitalizing, than in code-law capitalizing countries. The adjusted R^2 of the expensing group is higher for the R&D-reporting subsample (0.7415) than for the whole sample (0.6362), but that of the capitalizing group is lower for the R&D-reporting subsample (0.6700) than for the whole sample (0.8052). Their results are consistent with those of the by-country results.

In summary Zhao's results suggest: (1) the reporting of total R&D costs increases the association of equity price with accounting earnings and book value in countries with complete R&D expensing standard, (2) the allocation of R&D costs between capitalization and expense provides incremental information content over that of total R&D costs in countries permitting conditional capitalization of R&D costs.

Anne CAZAVAN-JENY and Thomas JEAN-JEAN in their working paper "**VALUE RELEVANCE OF R&D REPORTING: A SIGNALLING INTERPRETATION**" (2003), tested empirically R&D accounting issues on a sample of 95 French firms on a three years period (1998-2000). They deal with the value relevance of research and development (R&D) costs' financial reporting. Their goal is to take advantage of a specific feature of the French institutional context. French standard setters allow conditional capitalization of R&D costs or expensing of such R&D costs. French firms have the option to choose the expensing or the capitalization of R&D outlays (under conditions). Their research design was based on two value relevance studies (explanation of the cross sectional returns and explanation of the year-end share price).

They created a sample of expensers and capitalizers among the French listed firms. Their main difficulty was to identify capitalizers because most of the databases use a US format of balance sheet, where R&D assets are not identified. For instance, on the Thomson financial database, R&D assets are registered as intangible assets (as with brands, patents, other intangibles). To identify expensers, they used the Thomson financial database (who reports the amount of R&D expensed). To identify capitalizers, they used the DIANE (DIsque pour l'Analyse Economique) database, specialized on French firms. Capitalized R&D is reported on a specific line of the balance sheet. 95 large French listed firms compose their sample on a three year period (1998-2000). The total sample size was 254 observations (firm-year), which was quite small given that 1,404 non financial firms are present on the Thomson Financial database. Their sample represents only 6.77% of the French listed firms.

To examine the value relevance of R&D accounting treatment (expensed versus capitalized) they used two approaches: associating stock returns with contemporaneous financial data and associating stock prices with financial data. First they examined the link between stock returns, annual R&D capitalization and expensed R&D data using a model derived from the Fama and French (1992) and Aboody and Lev (1998) models. They estimated the following cross sectional regression:

$$Rit = a_{0+}\, a_1\, RDES_{it+}\, a_2\, RDCapTA_{it} + a_3 ln(Size)_{it} + a_4 Growth_{it} + a_5\, ROE_{it} + a_6\, Beta_{it} + a_7 Lev_{it} + a_8 Ln(BTP)_{it} + a_9 HT_{it} + a_{10} Yr_{it} + e_{it} \quad (1)$$

Where:

- Rit: annual stock return at the end of year t for firm i.
- RDESit: annual amount of expensed R&D costs to sales, for firm i.
- RDCapTAit: annual amount of net capitalized R&D costs to total assets, for firm i and year t.
- Ln(Sizeit): logarithm of market value of the firm i at the end of fiscal year t.
- Growthit: rate of growth for company i, measured as change in sales between t and t-1.
- ROEit: return on equity ratio (earnings / book value) for firm i at the end of year t. It measures the profitability of the firm.
- $Beta_{it}$: measure of risk, CAPM-based beta of company i.
- Levit: leverage ratio for firm i in year t, measured as long term debts on total capital.

- Ln(BTPit): logarithm of book value (minus capitalized R&D) per share to price at the end of year t.
- HTit: dummy variable for industry group coded one for high-technology firms and zero for traditional firms.
- YRit: time indicator variable that equals to one if an observation is from fiscal year Y, and zero otherwise.

Model (1) deals with the value relevance of the annual capitalized and expensed R&D costs. To study the value relevance, in the association sense, of the R&D asset reported on the balance sheet and the expensed R&D costs, they ran the following regression:

$$P_{i,t} = b_0 + b_1 RDEPS_{i,t} + b_2 RDCapPS_{i,t} + b_3 EPS_{i,t} + b_4 BVPS_{i,t} + b_5 \ln(Size)_{i,t} + b_6 Beta_{i,t} + b_7 HT_{i,t} + b_8 YR_{i,t} + \varepsilon_{i,t} \quad (2)$$

With,

- Pi,t: stock price at the end of the fiscal year t for firm i.
- RDEPSi,t: annual amount of expensed R&D costs per share.
- RDCapPSi,t: annual amount of net capitalized R&D costs per share.
- EPSi,t: reported annual earnings per share.
- BVPSi,t: book value of equity per share.
- Ln(Sizeit), Betait, HTit and YRit: as defined above.

To summarize, their results show for both regressions a positive association between capitalized R&D costs and stock return or stock price and a negative relation between expensed R&D and return or price. The way of reporting R&D costs seems obviously not to be neutral, it carries a signal to investors. These results give support to the capitalization of R&D when the project fulfils certain conditions, as recommended by IAS 38 and PCG 99.Currently, capitalized R&D bears a value relevant and positive information for investors in assessing the value of companies. They argued that if one of the most important objectives of financial accounting is to provide useful information to investors, then capitalization of R&D should be recommended. Overall, their findings give support to a capitalization of R&D costs under conditions of commercial success.

Dennis R. Oswald & Paul Zarowin in their study “**Capitalization of R&D and the Informativeness of Stock Prices**” (2007). They investigated the effect of firms’ decision to capitalize R&D expenditures on the amount of information about future earnings reflected in current stock returns, as captured by the association between current-year returns and future earnings (FERC). They examine whether capitalization of R&D expenditures is associated with more informative stock prices, relative to expensing R&D. They define stock price informativeness as the amount of information about future earnings that is reflected in current period stock returns, as captured by the association between current-year returns and future earnings.

Their stock price informativeness measure (how much information about future earnings is capitalized into price) is based on Collins et al. (1994). The goal of their paper is to see whether the market’s future earnings expectations, as implied in stock returns, are closer to future earnings realizations for firms that capitalize R&D costs, that is, whether capitalization results in current returns that are more highly associated with future earnings.
They resulted in a regression of current annual stock returns, R_t, on current and future annual earnings changes:

$$R_t = a + b_0\Delta E_t + b_1\Delta E_{t+1} + u_t \quad (1)$$

where the earnings variables are in per share form and are scaled by the share price at the beginning of the current year (to avoid having to delete firms with negative or zero beginning-of-period earnings), and the stock returns are total annual stock returns, defined as capital gain plus dividend yield (measured over the period from nine months prior to fiscal year end to three months after fiscal year end). In order to make the regression results comparable for capitalizers and expensers, they adjust capitalizers’ earnings to be on a ‘pro-forma’ expense basis. They construct capitalizers’ pro-forma earnings by subtracting the excess (or adding the deficit) after-tax amount of development costs capitalized minus amortization expense, from reported net income. Using earnings changes as explanatory variables assumes that earnings follow a random walk. Rather than impose this condition, they followed Lundholm and Myers (2002) and estimate the levels form of the regression:

$$R_t = a + b_0 E_{t-1} + b_1 E_t + b_2 E_{t+1} + u_t. \qquad (2)$$

To help mitigate the errors in variables bias, we follow Collins et al. and include the future return as a control variable and estimate the model:

$$R_t = a + b_0 E_{t-1} + b_1 E_t + b_2 E_{t+1} + b_3 R_{t+1} + u_t. \qquad (3)$$

Their goal was to compare the future earnings response coefficient, between capitalizers and expensers. The null hypothesis is that FERC is equal for both groups. If capitalizers' FERC is greater than expensers' FERC, then capitalization of R&D is associated with more informative stock prices.

Their initial sample included all UK firms on DataStream (active and dead files) that disclosed either a R&D asset or R&D expense in any year t = 1990–1999. They begun in 1990 because prior to the revised SSAP No. 13 in 1989 many firms did not voluntarily report their R&D expenditure (the revised SSAP No. 13 made this disclosure mandatory). Their search yields 4,566 firm-year observations (840 firms). For observations with a positive value of R&D asset, they examined the firm's notes to the financial statements to ensure that the amount recorded by DataStream in fact relates to an R&D asset. They also required data on industry membership, earnings, number of shares outstanding and corporate tax rate (lagged, contemporaneous and the subsequent three years), stock price and stock return (contemporaneous annual return and the subsequent three-year buy-and-hold return) to be available on DataStream. Removal of inappropriate observations and observations with missing data reduces the sample to 3,091 firm-year observations (520 firms). They classified each firm-year observation as a capitalizer in that year if the firm reported either a non-zero value for the R&D asset or a non-zero amount for R&D amortization; otherwise the firm-year observation is classified as an expenser. They used the top three R&D industries (defined by number of firm-year observations) in order to have enough observations to estimate our informativeness regression. This gave them a sample of 1,098 firm-year observations (205 firms). Finally, in later tests they required their firms to have lagged values of R&D expenditures, therefore they removed observations in 1990. This gave them a final sample of 1,002 firm-year observations (201 firms), ranging from 112 firms in 1991, to a high number of 115 firms in 1994, 1995 and 1998, and ending with 108 firms in 1999.

As an empirical proxy to capture whether a firm meets the five capitalization conditions of UK GAAP, they used the ratio:

$$\text{RD\_VALUE} = \frac{\text{MV} - \text{BV}}{\text{R\&D Expenditure}}.$$

Thus, their Probit model is:

$$\begin{aligned}\text{CAP}_{it} = \beta_0 + \beta_1\text{EARN\_VAR}_{it} + \beta_2\text{EARN\_SIGN}_{it} + \beta_3\text{SIZE}_{it} + \beta_4\text{M/B}_{it} \\ + \beta_5\text{RDINT}_{it} + \beta_6\text{BETA}_{it} + \beta_7\text{RD\_VALUE}_{it} + \varepsilon_{it}.\end{aligned} \quad (4)$$

The second stage returns regression includes the inverse Mills ratio as a control variable, allowing its coefficient to vary between the two groups:

$$\begin{aligned}R_t = \alpha_0 + \Phi_1 E_{t-1} + \Phi_2 E_t + \Phi_3 E_{t+\tau} + \Phi_4 R_{t+\tau} + \Phi_5\text{CAP}_t + \Phi_6\text{CAP}_t^{*}E_{t-1} \\ + \Phi_7\text{CAP}_t^{*}E_t + \Phi_8\text{CAP}_t^{*}E_{t+\tau} + \Phi_9\text{CAP}_t^{*}R_{t+\tau} + \Phi_{10}\text{MILLS}_t \\ + \Phi_{11}\text{MILLS}_t^{*}\text{CAP}_t + \mu_t.\end{aligned}$$

In summary their results suggest that capitalization is associated with greater stock price informativeness (higher FERC). Thus, their results provide the first empirical evidence consistent with the proposition that capitalization of R&D provides more information (about future earnings) to the market, as capitalization’s proponents have suggested.
Beatriz García Osma & Steven Young in their study “R&D Expenditure and Earnings Targets” (2009) examined whether firms cut R&D spending in response to short-term earnings pressures and how equity markets interpret such behaviour.

Their sampling frame comprised the population of DataStream UK non-financial firms that reported positive R&D expenditure at least once between December 1989 and December 2002. Before the switch to International Financial Reporting Standards, accounting for R&D in the UK was governed by Statement of Standard Accounting Practice No. 13 Revised (SSAP 13 Revised). Their sampling period excludes pre-December 1989 year-ends because SSAP 13 Revised only applied to financial years beginning on or after 1 January 1989. Empirical tests require three consecutive years of R&D data. They therefore retained only those firm-years where contemporaneous, one- and two-period lagged values were not missing. They also required data for their control variables to be available. They excluded fiscal years longer than 13 months and shorter than 11 months to ensure time-series comparability of accounting data, and they minimised the impact of extreme observations by trimming the top and bottom one percentiles of their sample according to (scaled) R&D expenditure and reported earnings. Their resulting sample comprises 3,866 firm-year observations. Although 21 DataStream level-4 industries were represented in their final sample, just five industries (software & computer services, engineering & machinery, electronic electrical equipment, support services and pharmaceuticals) accounting for 51% of the sample. They simplified their subsequent analysis by focusing exclusively on firms that expensed all R&D. To avoid sample selection bias, they employed Heckman (1976, 1979) sample selection methods in their multivariate tests.

Their analysis focused on R&D spending cuts made in response to short-term earnings targets, which they labelled 'unexpected' reductions in R&D activity. They treated such changes as distinct from those driven by business fundamentals such as shifts in corporate strategy, changes in funding constraints and variation in the set of positive NPV opportunities, which they classified them as part of 'normal' or 'expected' variation in R&D activities. They employed two measures of target earnings in their empirical tests: positive earnings and positive earnings growth. They examined the lagged association between targets and R&D spending using two indicator variables. Their first variable (EARNt21 _ 0) takes the value of one if last period's earnings were less than or equal to zero, and zero otherwise; their second variable (DEARNt21 _ 0) takes the value of one if last period's earnings change was less than or equal to zero, and zero otherwise. If failure to beat last period's earnings benchmark had a detrimental impact on current-period R&D spending then the incidence of unexpected cutbacks in R&D investment should be positively related to EARNt-1≤0 and DEARNt-1≤0.

The contemporaneous association between target earnings performance and R&D examined using the procedure employed by Baber et al. (1991), Perry and Grinaker (1994), Bushee (1998), Cheng (2004) and Oswald and Zarowin (2007).They began by constructing a measure of pre-managed earnings by adding R&D expenditure back to reported earnings. Then they partitioned their sample according to the level of pre-managed earnings relative to target. Firm-years where pre-managed earnings exceed target were allocated to the ABOVE partition. Firm-years where pre-managed earnings undershoot target by an amount that could be reversed by pruning R&D expenditure were allocated to the WITHIN partition.

Their univariate tests failed to control for factors correlated with earnings performance that could also affect R&D spending. They therefore estimated the following multivariate logistic regression relating the probability of an unexpected cut in R&D spending to current and lagged earnings performance (relative to target), and a vector of control variables:

$$\log \left[\frac{pit}{1-pit}\right] = \gamma_0 + \gamma_1 \text{ EARN}_{it-1} \leq 0 + \gamma_2 \Delta\text{EARN}_{it-1} \leq 0 + \gamma_3 \text{ WITHIN}_{it} + \gamma_4 \text{ BELOW}_{it} + \Sigma\lambda_{\kappa}\text{Control\_R\&D}_{kit} + \Sigma\delta_j \text{ Control\_OTH}_{jit} \quad (1)$$

where pit is the latent probability that firm i unexpectedly cuts R&D spending in year t (y_{it} =1) and 1- p_{it} is the latent probability that firm i maintains or increases R&D expenditure in year t (y_{it}=0); $EARN_{it-1}$≤0 is an indicator variable equal to one if lagged reported earnings for firm i were less than or equal to zero, and zero otherwise; $DEARN_{it-1}$≤0 is an indicator variable equal to one if the lagged reported earnings change was less than or equal to zero, and zero otherwise; $WITHIN_{it}$ is an indicator variable equal to one for firm-years in the WITHIN portfolio and zero otherwise; $BELOW_{it}$ is an indicator variable equal to one for firm-years in the BELOW-portfolio and zero otherwise; $Control\_R\&D_{it}$ is a vector of K variables controlling for expected changes in periodic R&D expenditure and $Control\_OTH_{it}$ is a vector of J controls for the propensity or opportunity for management to adjust R&D spending in response to short-term earnings pressures.

Their indicator variables WITHINt and BELOWt are both positive and significant at the 5% level or better. This confirms their univariate result that firms prune R&D expenditure when contemporaneous pre-managed earnings are negative. The effect appears stronger for the WITHIN partition, consistent with management's ability to fully overturn the earnings shortfall by cutting R&D spending. In sum, their findings provide evidence of a statistically and economically significant link between unexpected cuts in R&D spending and reporting pressures associated with short-term earnings targets.

They then explored the capital market implications of shaving R&D investment to boost earnings performance. They tested whether investors discount earnings growth achieved at the expense of an unexpected cut in R&D investment. They permitted the valuation multiple on earnings growth to vary with unexpected R&D spending decisions and used the following regression model (Barth et al., 1999; Skinner and Sloan, 2002; Kasznik and McNichols, 2002):

$$\mathbf{R_{it} = \gamma_o + \gamma_1 \Delta EARN_{it}{>}0 + \gamma_2 \Delta RD_{it}{<}0 + \lambda_1 \Delta EARN_{it}{>}O * \Delta RD_{it}{<}0 + v_{it} \quad (2)}$$

where Rit is the 12-month share return for firm i ending three months after the balance sheet date in period t, $\Delta EARN_{it}>0$ is an indicator variable taking the value of one for positive earnings changes for firm i in period t and zero otherwise, $\Delta RD_{it}<0$ is an indicator variable taking the value of one for cuts in R&D spending during period t and zero otherwise; and v_{it} is the regression residual. They found that the estimated coefficient on the interaction term was negative and significant, signifying lower market rewards when earnings growth is accompanied by a reduction in R&D expenditure. The net effect (0.32 -0.09) remained positive and significant, however, suggesting that the average market penalty to cutting R&D is outweighed by the reward to benchmark beating.

In summary they found that R&D expenditure is sensitive to both current and lagged earnings performance relative to target (where target is defined as either earnings>0 or earnings-growth>0). Specifically, failure to beat an earnings benchmark increases the probability of R&D being cut in the next accounting period, while pressure to achieve current-period earnings targets leads to contemporaneous cuts in R&D investment. They also found that the strength of the contemporaneous association between R&D spending and benchmark beating weakens as R&D intensity increases, consistent with management being less inclined to sacrifice long-term value creation for short-term earnings gains in firms where R&D investment represents a particularly important source of future earnings. Finally they provided evidence that, investors penalise all cuts in R&D spending made by high R&D-intensive firms with equal severity in the presence of earnings growth.

F Tsoligkas and I. Tsalavoutas in their research "**Value relevance of R&D in the UK after IFRS mandatory implementation**" examined whether the R&D reported assets and expenses are value relevant after the adoption of IFRS in the UK and if there is any size-related valuation consequences of R&D after IFRS mandatory implementation in the UK.

They test the following hypothesis:

- H1: The capitalised as well as the expensed portions of R&D expenditure are value relevant in the UK, after 2005.
- H2: There are different valuation effects of the R&D reporting between large and small companies in the UK, after 2005.

In order to examine the value relevance of accounting information, they employed empirically a theoretical extension of the fundamental Ohlson (1995) model where the market value of a firm can be expressed as a linear function of its book value of equity and net income. In its simple form, the model is as follows:

$$\mathbf{MVE_{it} = a_o + a_1BVE_{it} + a_2NI_{it} + e_{it}} \qquad \textbf{(1)}$$

where:

- MVE_{it} is the market value of equity measured for the company i;
- BVE_{it} is the book value of equity for company i for the respective year of observation (t)
- NI_{it} is the net income for company i for the respective year of observation (t)
- e_{it} is the mean zero disturbance term;

Additionally, they decomposed NI across the R&D expenses (hereafter ExpRD) and income before charging the R&D expenses (hereafter ANI). This resulted in Model (2). The coefficients of interest in this function are b2 and b4:

$$\mathbf{MV_{it+3} = b_o + b_1 ABVE_{it} + b_2 CapRD_{it} + b_3 ANI_{it} + b_4 ExpRD_{it} + e_{it} \qquad (2)}$$

where:

- MV_{it+3} is the market value of equity measured three months after the year end for the company i.
- $ABVE_{it}$ is the adjusted book value of equity for company i for the respective year of observation (t), excluding the capitalised R&D investment
- $CapRD_{it}$ is the capitalised R&D amount, for company i for the respective year of observation (t)
- ANI_{it} is the adjusted earnings for company i for the respective year of observation (t), prior the R&D expense
- $ExpRD_{it}$ is the R&D expense, for company i for the respective year of observation (t)
- e_{it} is the mean zero disturbance term

Similar to Shah et al. (2009), the examination of any size-related advantages in R&D, is pursued by introducing in the previous equation a dummy variable differentiating large from small companies. (As a benchmark for size companies median market value with reference to the latest year of examination is used.) So they resulted in equation 3. The coefficients of interest in this function are b_5 and b_9:

$$\mathbf{MV_{it+3} = b_o + b_1{*}S + b_2ABVE_{it} + b_3ABVE_{it}{*}S + b_4CapRD_{it} + b_5CapRD_{it}{*}S + b_6ANI_{it} + b_7ANI_{it}{*}S + b_8ExpRD_{it} + b_9ExpRD_{it}{*}S + e_{it}} \quad \mathbf{(3)}$$

where:

- S = 1 if the company is classified as large and =0 otherwise
- $ABVE_{it}$*S is the adjusted book value of equity multiplied by the dummy variable
- $CapRD_{it}$*S is the capitalised portion of R&D multiplied by the dummy variable
- ANI_{it}*S is the adjusted earnings multiplied by the dummy variable
- $ExpRD_{it}$*S is the R&D expense multiplied by the dummy variable
- e_{it} is the mean zero disturbance term

In order to undertake the research, they identified firms with 'R&D . In order to identify such activity, they used the 2006 to 2008 UK R&D Scoreboards. The UK R&D Scoreboard is prepared annually by listing the top 850 companies (top 800 companies for 2006) undertaking R&D investment (DIUS, 2008) and concentrates on companies with R&D activity on the year before it gets published. The initial number of listed companies that are featured in the Scoreboards for all the three years under examination was 310 (930 observations). From those, 491 firm year observations have been used. Their sample consisted of 262 observations with no R&D asset and 229 observations with R&D asset. This provides a comparative advantage of their study over prior research (e.g. Zhao, 2002) as a large number of the companies examined do capitalise R&D expenditure. Financial data has been collected from DataStream and directly from the companies' annual reports.

Their findings that the explanatory power of the model (i.e., R^2) is 73% is consistent with the corresponding finding of King and Langli (1998) who indicate that accounting numbers in the UK have about 70% relationship with share prices (ibid, p. 530). Additionally, in line with Arce and Mora (2002), the showed that the coefficient of BVE is 0.957 whereas the coefficient of NI is 7.338 (both significant at 1% level), indicating that the market continues to give more weight on NI compared to BVE after IFRS. The coefficient of CapRD is positive (4.436) and statistically significant at 5% level. Hence, it can be concluded that R&D asset is positively value relevant. This finding illustrates that when companies report under IFRS investors perceive the capitalised portion of R&D expenditure as an asset with expected economic benefits. Focusing on the expensed portion of R&D (i.e. ExpRD), it they showed that it is also statistically significant at 1% level but with a negative coefficient (-5.834), suggesting that the R&D expenses are negatively value relevant. On that basis, their first hypothesis has been supported. The capitalised as well as the expensed portions of R&D expenditure are value relevant in the UK, after 2005.

Moreover for both small and large companies, they found that the coefficient of capitalised R&D is positive and significant at 5% level (2.445 and 6.538 respectively). However, the difference between these two coefficients (4.092) is not significant. In contrast, the coefficient of R&D expenditure is significant only for large companies (at 1% level). Additionally, it is significantly lower (by 8.687) than the corresponding coefficient of small companies. Therefore, they supported their second hypothesis as well.

CHAPTER 4

OUR VALUATION MODEL AND DATA

Data sample

In order to undertake our research we identified UK firms with R&D activities. To collect our sample we used the UK R&D Scoreboards from 2003 to 2009. UK R&D Scoreboard is prepared annually by listing the top 850 companies undertaking R&D investment (DIUS, 2008) and concentrates on companies with R&D activity on the year before it gets published. At first we found the top 130 companies which are active in R&D activities. We excluded firms with not available data and our final sample consists of 74 companies. The comparative advantage of our study compared to prior researches is that our sample is between 2000 and 2009 and we can compare the treatment of R&D activities under IFRS and UK GAAP also.

Methodology

Our main hypothesis that we want to test is that the capitalised as well as the expensed portions of R&D expenditure are value relevant in the UK, after 2005 when IFRS was adopted.

Following prior research (e.g. Shah et al., 2008; Oswald, 2008; Shah et al., 2009) in order to examine the value relevance of accounting information, we employ empirically a theoretical extension of the fundamental Ohlson (1995) model where the market value of a firm can be expressed as a linear function of its book value of equity and net income. In its simple form, the model is as follows:

$$P_{it+3} = a + b_1 NI_{it} + b_2 BVE_{it} + e_{it} \qquad (1)$$

Where:

- P_{it+3} is the share price for the company i
- o BVE_{it} is the book value of equity for company i for the respective year of observation (t)

- NI_{it} is the net income for company i for the respective year of observation (t)
- e_{it} is the mean zero disturbance term

Easton (1999, p.402) highlights that one of the main advantages of the model is that “it forms a framework for understanding the relationship between prices and accounting data”. Another major advantage of this model is that net income and book value of equity can be decomposed across different components, and hence examine the value relevance of individual items from a company’s financial statements.

We examine the link between prices and total R&D expenditures with a second model which includes the variables coming from previous literature and so we estimate the following cross-sectional regression:

$$\mathbf{P_{it+3} = a + b_1NI_{it} + b_2BVE_{it} + b_3RD\_Total_{it} + b_4Size_{it} + b_5Growth_{it} + b_6Leverage_{it} + e_{it}} \quad \mathbf{(2)}$$

Where:

- P_{it+3} is the share price for the company i
- BVE_{it} is the book value of equity for company i for the respective year of observation (t)
- NI_{it} is the net income for company i for the respective year of observation (t)
- RD_Total_{it} is the total amount of R&D expensed plus the change in R&D capitalised from one year to the other per share
- $Size_{it}$ is the logarithm of market value of the firm i at the end of fiscal year t
- $Growth_{it}$ is the rate of growth for company i, measured as change in sales between t and t-1
- $Leverage_{it}$ is the leverage ratio for firm i in year t, measured as long term debts on total capital
- e_{it} is the mean zero disturbance term

We have to note that a large number of companies did not capitalise their R&D expenditures probably because they did not meet the appropriate criteria.

For our further analysis we decompose BVE across the BVE before the capitalisation of R&D and the R&D assets. Additionally we decompose NI across the R&D expenses and income before charging the R&D expenses. This results in our third model. The coefficients of interest in this function are b3 and b4:

$$\mathbf{P_{it+3} = a + b_1NI^*_{it} + b_2BVE^*_{it} + b_3RD\_Expensed_{it} + b_4RD\_Capitalised_{it} + b_5Size_{it} + b_6Growth_{it} + b_7Leverage_{it} + e_{it}} \quad (3)$$

Where:

- P_{it+3} is the share price for the company i
- BVE_{it} is the book value of equity per share for company i adjusted for RD_Capitalised for the respective year of observation (t)
- NI_{it} is the net income per share adjusted for RD_expensed for company i for the respective year of observation (t)
- $RD\_Expensed_{it}$ is the total amount of R&D expensed for company i for the respective year of observation (t)
- $RD\_Capitalised_{it}$ is the total amount of R&D Capitalised for company i for the respective year observation (t)
- $Size_{it}$ is the logarithm of market value of the firm i at the end of fiscal year t
- $Growth_{it}$ is the rate of growth for company i, measured as change in sales between t and t-1
- $Leverage_{it}$ is the leverage ratio for firm i in year t, measured as long term debts on total capital
- e_{it} is the mean zero disturbance term

Results and Discussion

The results of our first regression model are presented in table 1 under UK GAAP and in table 2 under IFRS respectively. The findings regarding model (1) are consistent with prior research which examined the value relevance of accounting information in the UK. More specifically, the finding that the explanatory power of the model (i.e. R^2) is 58.9% is consistent with the corresponding finding of King and Langli (1998). Although the coefficient of BVE is 2.603951 whereas the coefficient of NI is 2.423540 (both significant at 1% level), indicating that the market gives more weight on NI compared to BVE under UK GAAP which contrasts Arce's and Mora's conclusion (2002) which was opposite. After adaptation of IFRS (2005) we find a slight increase in the explanatory power of model (1) with an R^2 equal to 59.4%. The coefficient of BVE is 2.12319 while the coefficient of NI is equal to 1.417421 both significant at 1% level.

Moving into the results with regard to the model (2) it can be seen that the explanatory power of the model ($R^{2)}$ is 64% under UK GAAP and 65% under IFRS respectively. That increase in the explanatory power of model is very slight to justify whether there is more stock price informativeness after forcing all UK companies to capitalize their development costs. From 2000 to 2004 as we can see in Table 3, variables as Size, NI, BVE and Leverage are statistically important at 1% level except leverage which is important statistically at 5% confidence level. Size, Leverage, NI and BVE have positive coefficients. Growth variable is not statistical important while our main variable (RD_Total) is statistically important at 5% level of confidence but with a negative coefficient of -0.009786 which means that total research and development expenditures are negatively value relevant.

From 2005 to 2009 we don't observe many changes except that Growth variable is now statistically important with a negative coefficient. Our main variable (RD_Total) is also statistically important at 5% confidence level with a negative coefficient of -0.017050 which means that after IFRS adaptation total R&D expenditures are still negatively value relevant.

In our third model where we compare R&D expenditures separately we find that under UK GAAP the explanatory power of model is very small because R^2 is 0.102253 while under IFRS it increases at 0.254213 but it is also a very small number. From 2000 to 2004 NI, BVE, growth and leverage are statistically important at 5% level and size at 1%. All this variables have positive coefficients. For our two main variables we observe that focusing on the expensed portion of R&D, it is statistically significant at 5% confidence level but with a negative coefficient (-0.169979) suggesting that R&D expenses are negatively value relevant. This result is consistent with prior research (Zhao,2002; Cazavan-Jeny and JeanJean,2006;Tsoligkas and Tsalavoutas,2009) suggesting that the R&D expense is perceived by the market as unsuccessful projects with no economic benefits. On the other hand the capitalized portion of R&D expenses is not statistically relevant which contrasts our main hypothesis perhaps because most of the firms did not capitalize their development expenses before 2005.

From 2005 to 2009 and IFRS we find that there are no many differences in comparison to the previous period. We also observe that the expensed portion of R&D expenses is statistically relevant but at 5% confidence level with a negative coefficient (-0.277326). The capitalized portion of R&D expenses is not statistically relevant which leads as to the conclusion that under IFRS there isn't an increase in stock price informativeness when businesses capitalize their development expenditures. This result is inconsistent with previous research of Tsoligkas and Tsalavoutas (2009) which found that R&D asset is positive value relevant. In this point we have to note that a large number of companies in our sample did not capitalize their development costs perhaps because they did not meet the criteria to capitalize their R&D expenses.

Conclusion

The subtle differences between UK GAAP and IFRS regarding the accounting treatment of R&D expenditure have raised concerns with regard to the valuation implications of R&D reporting in the UK prior and after 2005. For that reason the present study examined whether the R&D reported assets and expenses are value relevant before and after the adoption of IFRS in the UK and whether there is more stock price informativeness if firms capitalise their development expenditures.

Our results suggest that the expensed portion of R&D expenditures is negatively value relevant before and after the adoption of IFRS. This result is consistent with prior research (Zhao, (2002), Cazavan-Jeny and JeanJean, (2006), Tsoligkas and Tsalavoutas, (2009)) suggesting that the R&D expense is perceived by the market as unsuccessful projects with no economic benefits. On the other hand the capitalized portion of R&D expenditures is not statistical important neither before neither after the adoption of IFRS which contrasts prior evidence of Tsoligkas and Tsalavoutas (2009). For that reason we conclude that the capitalization of development expenditures is not value relevant i.e. does not lead to more stock price informativeness. Our findings do not support the expectations of Barth (2008) and Ball (2006) that IFRS better reflect companies' fundamentals.

Before the adoption of IFRS only few companies of our sample capitalized their R&D expenditures. There are also many companies in our sample that do not capitalize their R&D expenditures after the adoption of IFRS because they did not meet the criteria. An economical explanation for our results could be that due to the length of our sample, we are limited to a 5 year horizon after the adoption of IFRS, which does not capture all of the benefits of R&D that require a longer gestation period. Another economical explanation could be that because of the economic crisis (2007), companies which invested in R&D might have not attributed economic benefits and for that reason the expensed portion of their R&D expenditures relates negatively with their stock prices.

APPENDIX

TABLE 1 ($P_{it+3}= a+ b_1NI_{it}+ b_2BVE_{it} +e_{it}$)

Dependent Variable: SHARE
Method: Panel Least Squares
Date: 01/20/12
Sample: 2000 2004
Periods included: 5
Cross-sections included: 74
Total panel (balanced) observations: 370

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NI	2.423540	0.472885	5.125012	0.0000
BVE	2.603951	0.149434	17.42548	0.0000
C	0.970641	0.373323	2.600006	0.0097

R-squared	0.589880	Mean dependent var	4.633078
Adjusted R-squared	0.487100	S.D. dependent var	8.084278
S.E. of regression	5.789722	Akaike info criterion	6.358121
Sum squared resid	12302.16	Schwarz criterion	6.389852
Log likelihood	-1173.252	Hannan-Quinn criter.	6.370724
F-statistic	176.2191	Durbin-Watson stat	2.361364
Prob(F-statistic)	0.000000		

TABLE 2 ($P_{it+3}= a+ b_1NI_{it}+ b_2BVE_{it} +e_{it}$)

Dependent Variable: SHARE
Method: Panel Least Squares
Date: 01/20/12
Sample: 2005 2009
Periods included: 5
Cross-sections included: 74
Total panel (balanced) observations: 370

Variable	Coefficient	Std. Error	t-Statistic	Prob.
NI	1.417421	0.430907	3.289391	0.0011
BVE	2.123190	0.156434	13.57240	0.0000
C	2.432559	0.355129	6.849790	0.0000

R-squared	0.594036	Mean dependent var	5.475965
Adjusted R-squared	0.380679	S.D. dependent var	7.152620
S.E. of regression	5.628892	Akaike info criterion	6.301777
Sum squared resid	11628.19	Schwarz criterion	6.333509
Log likelihood	-1162.829	Hannan-Quinn criter.	6.314381
F-statistic	114.4071	Durbin-Watson stat	2.379018
Prob(F-statistic)	0.000000		

TABLE 3 (P_{it+3}= a+ b_1NI_{it}+ b_2BVE_{it} +$b_3RD\_Total_{it}$ +b_4Size_{it}+ $b_5Growth_{it}$+ $b_6Leverage_{it}$+e_{it})

Dependent Variable: SHARE
Method: Panel Least Squares
Date: 01/20/12
Sample: 2000 2004
Periods included: 5
Cross-sections included: 73
Total panel (balanced) observations: 365

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.739526	0.139834	5.288599	0.0000
RD	-0.009786	0.043786	-2.223499	0.0233
NI	3.291391	0.441296	7.458457	0.0000
LEVERAGE	2.688500	1.614951	2.664757	0.0368
GROWTH	-1.87E-09	2.11E-08	-0.088385	0.9296
BVE	2.948745	0.146883	20.07546	0.0000
C	4.595228	0.959511	4.789136	0.0000

R-squared	0.641262	Mean dependent var	4.696545
Adjusted R-squared	0.635249	S.D. dependent var	8.121231
S.E. of regression	4.904784	Akaike info criterion	6.037291
Sum squared resid	8612.372	Schwarz criterion	6.112083
Log likelihood	-1094.806	Hannan-Quinn criter.	6.067014
F-statistic	106.6570	Durbin-Watson stat	2.465392
Prob(F-statistic)	0.000000		

TABLE 4 (P_{it+3}= a+ b_1NI_{it}+ b_2BVE_{it} +$b_3RD\_Total_{it}$ +b_4Size_{it}+ $b_5Growth_{it}$+ $b_6Leverage_{it}$+e_{it})

Dependent Variable: SHARE
Method: Panel Least Squares
Date: 01/20/12
Sample: 2005 2009
Periods included: 5
Cross-sections included: 73
Total panel (balanced) observations: 365

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.977234	0.133101	7.342072	0.0000
RD	-0.017050	0.025959	-2.656778	0.0117
NI	1.619999	0.377270	4.294005	0.0000
LEVERAGE	9.650964	1.345966	7.170288	0.0000
GROWTH	-5.39E-08	1.38E-08	-3.910074	0.0001
BVE	2.371306	0.157951	15.01288	0.0000
C	5.989008	0.931705	6.428009	0.0000

R-squared	0.657346	Mean dependent var	5.550978
Adjusted R-squared	0.549927	S.D. dependent var	7.172530
S.E. of regression	4.811868	Akaike info criterion	5.999040
Sum squared resid	8289.160	Schwarz criterion	6.073832
Log likelihood	-1087.825	Hannan-Quinn criter.	6.028763
F-statistic	75.12634	Durbin-Watson stat	2.539676
Prob(F-statistic)	0.000000		

TABLE 5 (P_{it+3}= a+$b_1NI^*_{it}$+ $b_2BVE^*_{it}$ +$b_3RD\_Expensed_{it}$ +$b_4RD\_Capitalised_{it}$ + b_5Size_{it}+ $b_6Growth_{it}$+ $b_7Leverage_{it}$+e_{it})

Dependent Variable: SHARE
Method: Panel Least Squares
Date: 01/20/12
Sample: 2000 2004
Periods included: 5
Cross-sections included: 74
Total panel (balanced) observations: 370

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.746709	0.214988	3.473267	0.0006
RDEXP	-0.169979	0.209023	-2.813205	0.0166
RDCAP	-0.055486	0.083675	-0.663115	0.5077
NI	0.164321	0.142487	2.153237	0.0496
LEVERAGE	5.888100	2.523197	2.333587	0.0202
GROWTH	7.98E-08	3.13E-08	2.545973	0.0113
BV	0.027005	0.021629	2.248570	0.0126
C	-1.760775	1.499637	-1.174134	0.2411

R-squared	0.102253	Mean dependent var	4.633078
Adjusted R-squared	0.084893	S.D. dependent var	8.084278
S.E. of regression	7.733518	Akaike info criterion	6.950389
Sum squared resid	21650.24	Schwarz criterion	7.035006
Log likelihood	-1277.822	Hannan-Quinn criter.	6.984000
F-statistic	5.890238	Durbin-Watson stat	2.101992
Prob(F-statistic)	0.000002		

TABLE 6 (P_{it+3}= a+$b_1NI^*_{it}$+ $b_2BVE^*_{it}$ +$b_3RD\_Expensed_{it}$ +$b_4RD\_Capitalised_{it}$ + b_5Size_{it}+ $b_6Growth_{it}$+ $b_7Leverage_{it}$+e_{it})

Dependent Variable: SHARE
Method: Panel Least Squares
Date: 01/20/12
Sample: 2005 2009
Periods included: 5
Cross-sections included: 74
Total panel (balanced) observations: 370

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	1.307883	0.173362	7.544240	0.0000
RDEXP	-0.277326	0.683152	-2.405952	0.0350
RDCAP	-0.024596	0.034576	-0.711357	0.4773
NI	0.115043	0.174057	0.660950	0.0391
LEVERAGE	5.859723	1.676289	3.495651	0.0005
GROWTH	5.21E-08	1.56E-08	3.341838	0.0009
BV	0.024809	0.034521	2.718664	0.0428
C	-4.934600	1.239697	-3.980487	0.0001

R-squared	0.254213	Mean dependent var	5.475965
Adjusted R-squared	0.239791	S.D. dependent var	7.152620
S.E. of regression	6.236366	Akaike info criterion	6.520057
Sum squared resid	14079.00	Schwarz criterion	6.604673
Log likelihood	-1198.211	Hannan-Quinn criter.	6.553667
F-statistic	17.62757	Durbin-Watson stat	2.332145
Prob(F-statistic)	0.000000		