R&D EFFECT: MARKET ANOMALY OR ANOTHER OMITTED RISK FACTOR

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Abstract

The last 15 years, it was observed an unprecedented growth of R&D investment in many developed economies. This growth of R&D investment provided an ideal opportunity for researchers to consider the relation between R&D expenditures and subsequent earnings and more specifically the reflection of the market stock price in the value of R&D investments. The purpose of the research is to investigate if the association between R&D expenditures and the market stock price is due to a systematic mispricing or due to other omitted risk factors and if the immediate expensing of R&D is conservative or aggressive, relative to reporting under R&D capitalization. For that purpose, the sample will consist 17 IT firms that have R&D expenses, listed on the Athens Stock Exchange (ASE). The period will cover 5 years. These firms must also have a complete monthly stock return history to provide unbiased connection between earnings changes and excess returns. Finally, it will be used Accounting Data Stock price Data and maybe intangible assets Data. However, despite convergence initiatives, there are many differences between the International Accounting Standard Board (IASB) framework and Greek Accounting Standards (GAS) framework, so it is important to analyze the differences in financial reporting relating to R&D capitalization.

Keywords: R&D , Conservative; Intangibles; Market valuation; Mispricing

Introduction

The last 20 years, it was observed an unprecedented growth of R&D investment in many developed economies and the occurrence of new, science based industries as software, biotechnology, and telecommunications. This growth of R&D investment provided an ideal opportunity for researchers to consider the relation between R&D expenditures and subsequent earnings and more specifically the reflection of the market stock price in the value of R&D investments (Lev and Sougiannis, 1996). Sometimes investors view R&D expenditures as investments that are expected to produce future benefits, and they take such benefits into consideration when pricing shares (Lev and Sougiannis, 2004).

Recent studies have estimated that R&D expenditures and subsequent earnings for a large section of R&D firms are positively associated with subsequent excess (risk-adjusted) stock returns. Usually, two offered explanations about these results are: Firstly, the association between subsequent returns and R&D expenditures is due to a systematic mispricing of the shares of R&D-intensive firms (market inefficiency), mainly because investors fail to see through earnings distortions caused by conservative accounting for R&D costs (Champers et al, 2002). Secondly, the association between subsequent returns and R&D expenditures is due to the R&D capital proxying for other omitted risk factors (equilibrium returns), causing measured excess returns for R&D intensive firms to be biased upward (Lev and Sougiannis, 1996).

The "mispricing" scenario exists when the resulting financial statements mislead the investors and therefore, the excess returns for stocks to R&D firms may be reduced or eliminated (under priced) in an order to better reflect the expected future benefits of R&D activities. The "other omitted risk factors" scenario exists when studies do not control completely for "known" risk characteristics, meaning that may there is an additional risk characteristic associated with the R&D activities for which investors are being compensated (D. Champers et al, 2002).

As in Fama and French (1992), the study focus mainly on three widely-used indicators of performance: the return on equity (ROE), return on assets (ROA), and earnings growth (momentum) and examine the validity of these indicators on the sample data. The regression analysis examines mainly two significant issues: Firstly, R&D expensing or capitalizing enterprises signify a conservative or aggressive accounting. In Greece, accounting rules require that development costs are recognised as assets (capitalization) but if they don't meet the criteria for recognition as assets expenditure is recognised as an expense when incurred (expensing). These accounting rules usually provide established effects on valuation, such as those of firm size, book-to-market, and R&D intensity. Secondly, R&D reflects an additional risk factor. The R&D effect captures the return demanded by investors for the uncertainty associated with R&D investments.

In this paper, the results indicate that R&D cannot be viewed as risk factor relative to excess returns, in contrast to various studies (e.g. Lev and Sougiannis (1996), Chan et al. (2001), Chambers et al. (2002), Penman and Zhang (2002), Eberhard et al (2004)) which have documented a significant positive association between R&D intensity and subsequent stock returns (R&D effect). Further, R&D capital instead of improving Fama and French model seems to worsen it. Thus, there is no evidence of mispricing scenario neither of risk factor arguments. In addition, the contribution identify that R&D expensing or capitalizing

enterprises does not signify a conservative or aggressive accounting therefore it cannot be noticed any overvaluation or undervaluation on stock prizes when companies report aggressively or conservatively, respectively.

The remainder of the paper continue as follows: Section 1 contains Literature Review: examination in previous empirical results, definition and analysis of conservative and aggressive accounting and accounting treatment for intangible assets. Section 2 contains Methodology: Data and measures and analysis of regression methodology. Section 3 contains Summary Statistics such as regression analysis. Section 4 contains concluding remarks.

1. Literature Review

1.1. Previous studies

The economic importance of intangible assets has long been recognised. The unexpected growth of intangible assets has become recently a major concern for governments, regulators, enterprises, the accounting profession, investors and other enterprise stakeholders. However, enterprise stakeholders pay a lot of attention in research and development (R&D) activities because they lead to the creation of new products, new services and new technology. Research & development is a significant input in the creation of new products in many firms, particularly those in technology and science-based sectors. Firms that engage in 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 capitalize versus expense choice, these effects may be statistically detectable.

Various studies includes extensive research related with the magnitude of R&D expenditures and both share prices and returns. To understand better this event, it is important to analyze some empirical studies about the market reaction to R&D expenditures and to discuss their results. These studies attempt to reconcile the theory with the evidence by considering the fundamentals of numerous companies and detailing the context in which the R&D capitalization takes place.

Lev and Sougiannis (1996) provide alternative interpretations for the presence of the excess returns and result significant excess market returns associated with R&D intensive firms by estimating the contribution of current and past R&D spending on earnings across a variety of industries. They investigate whether a relevant and reliable relationship exists between R&D expenditures and subsequent earnings and market values. The extent of the misstatement depends on the growth rate of R&D: R&D capitalization for higher R&D growth rate enterprises will give a higher return on shareholders' equity (Abernethy and Wyatt, 2003). Lev and Sougiannis (1999) and Fama and French (1993) in a following study, find that enterprises with a high R&D growth rate relative to profitability earn significant positive excess returns. In this study, they identify, a three-factor model, (overall market return, firm size and the book-to-market ratio) that are associated with stock returns. This factor model provides a parsimonious explanation of the cross-section of stock returns, except for firms that they describe as small, high-growth firms. An important issue regarding the specification of the three-factor model is that there is a significant unexplained negative component of returns for the smallest, high-growth firms.

Amir, Lev and Sougiannis (1999) support that the incremental information provided by analysts is significantly higher in high-

technology firms and in firms with high levels of R&D by comparing the association between annual excess returns and a broad set of information items derived from financial statements with the association between excess returns and that information set plus the present value of five-year ahead analysts' earnings forecasts. Chan, Lakonishok and Sougiannis (2000) present some evidence that high R&D intensity has a discreet effect on returns for two groups of stocks: one with high R&D spending and the other with no R&D, which may appear to be equally expensive under standard criteria like price-to-book ratios and price-to-earnings.
Penman and Zhang (2002), following the mispricing scenario, predicts that the excess returns are negative (positive) (decline) in R&D investment because investors are misled by reported earnings numbers that are too low (too high). Further, expensing R&D costs when incurred can have distorted effects on accounting profitability measures when R&D investment is expected to generate future benefits.

Champers, Jennigs and Thompson (2002) argue that there is a positive association between level of R&D investment and subsequent excess returns. They argue that the relationship between the level of R&D investment and excess returns is the result of an unspecified risk factor, not under valuation. According to this hypothesis they find that positive average excess returns to R&D-intensive firms persist for up to ten years when sample observations are aligned in "event time", but vary greatly from year to year in calendar time. They provide evidence supporting the theory that the subsequent excess returns generated by high R&D growth enterprises are caused by the bias induced by the accounting treatment of intangible assets. Daniel A. Bens et al (2002), investigate the effect of R&D on the cross-sectional variation of stock returns. Based on Fama and French (1993) study, they analyze the role that research and development (R&D) plays in the Fama and French three-factor model and propose alternative explanations for why R&D can complicate the model. They support that R&D expenditures may complicate the application of the Fama-French model in at least two ways. First, investment in R&D may constitute a source of risk that is not sufficiently captured by the Fama-French model. Second, the measurement of the book-to-market ratio (one of the Fama-French factors) can be affected by the accounting rules for R&D, which requires the immediate expensing of R&D expenditures despite the fact that, empirically, R&D has a useful life longer than a single year these outlays. However, they find that firms with high R&D outlays tend to earn higher returns. They also find that the R&D effect and the book-to-market effect each provide information that is incremental to that of the other variable. They argue that R&D is related with an additional risk factor. On the other hand, book-to-market ratios may proxy for a larger phenomenon such as financial distress, while the R&D effect may proxy for the uncertainty associated specifically with investments in R&D activities.

Lev et al(2004) examine two significant issues: Firstly, the conditions under which the expensing of intangibles assets, and more specific the expensing of R&D will be conservative or aggressive, relative to the capitalization of R&D and secondly, the relationship between capital market and conservative or aggressive financial reporting. Moreover, they provide systematic evidence of mispricing. Dennis R. Oswald and Paul Zarowin (2004) examine the association between the capitalization of R&D expenditures and stock prices, relative to expensing R&D. As far as concerning stock prices, they use information about future earnings that is reflected in current period stock returns, as possessed by the relation between future earnings and current period stock returns. In addition, they predicts that firms whose stock returns reflect more information about future earnings have higher stock price informativeness.

1.2. Conservative and Aggressive reporting

Another issue that has to be examined in the study is the conditions under which the expensing of R&D is conservative or aggressive, relative to the capitalization of R&D. So, it is important to define and explain the role of conservative and aggressive accounting. Conservative accounting means that the company underestimates earnings and the value of assets. On the other hand, aggressive accounting means that the company misconstrues income statements for the purpose of pleasing investors and inflating stock prices (Lev, 2003).

In many enterprises, when there is a mismeasurement of investment in intangibles assets caused by the accounting system, the common wisdom is that the immediate expensing of the intangibles is good because it is "conservative". Nevertheless, the lives of the assets, their creation costs, and the cash flow generated have a time dimension which is fixed. Therefore, if a company is "conservative" in some periods, it will end up being "aggressive" in other periods (Lev, 2003). Moreover, over the lifetime of the enterprise, if reported earnings under a conservative accounting rule are understated (relative to a less conservative rule) during certain periods, they have to be overstated in other periods, given that conservative/aggressive accounting procedures essentially shift earnings from one period to another (Lev et al, 2004) . By conservative accounting a growth (decline) in R&D investment, as measured by increases (decreases) in the magnitude of unrecognized R&D assets, occurs when new R&D expenditures during a period exceed (are less than) R&D amortization.

Therefore, reported earnings based on immediate expensing tend to be smaller than (larger than) adjusted earnings based on capitalization and amortization (Champers et al, 2002). In addition, these lower earnings create unrecorded reserves that enhance the ability of the firm to report more income in the future. An increase in the investment reduces the earnings and as a consequence these reserves may be increased. So, the reserves can be released, creating earnings, by subsequently reducing investment or reducing the rate of growth in investment. If the change in investment is temporary, the induced change in earnings is also temporary and not indicative of subsequent earnings. Therefore, the quality of earnings raises many questions as a result of real activity and accounting policy rather than changes in accounting methods and estimates. The effect is perverse: reducing investment reduces future earnings from investments but, with conservative accounting, increases current earnings, making them a poor indicator of future earnings (Penman and Zhang, 2002).

Generally, conservative accounting is the practice, consistently applied, that keeps the book values of net assets relatively low. Therefore, LIFO accounting for inventories is conservative relative to FIFO (if inventory costs are increasing), depreciation methods using short estimated asset lives (so as to record depreciation in excess of economic depreciation) are conservative, policies that consistently overestimate allowances for doubtful accounts, sales returns or warranty liabilities are conservative and expensing research and development (R&D) expenditures rather than capitalizing and amortizing them is conservative (Penman and Zhang, 2002).

Above all these, is a myth that the mismeasurement of profitability and assets due to expensing of investments in intangibles

results in conservative accounting. Assuming, expensing intangibles is conservative for some companies, aggressive for others and inaccurate for all (Lev, 2003).

1.3. The Accounting Treatment for Intaginble Assets

Capital markets have become increasingly globalized due to the enormous growth of technology and communications, which have effectively linked the markets of the world (Hora et al, 1997). The globalization of world's capital markets has increased the need for one set of accounting standards that will be used throughout the world to produce comparable financial information and to support the varied transactions and operations of these markets. Due to the globalization of capital markets, the enterprises are enforced to reexamine the culture and their strategy in this new environment (Athianos et al, 2004). These objectives can be achieved by the use of common code of communication (Economic University of Athens, 2003). In an effort to eliminate differences among international and national standards many countries intend to adopt the International Accounting Standards (Athianos et al, 2004). Despite this effort, there remains considerable variation between national accounting standards and International Accounting Standards (IFAD 2000).

The European Commission required that all companies listed on EU stock exchanges should prepare their financial statements in accordance with IFRS until 2005 onwards. Thus, this decision enforced Greek companies to elect their faculties and to rival equally in the international ground (Panagiotidis, 2004). Furthermore, under IFRS, it is expected that the financial statements of all Greek companies will become directly comparable with those of publicly traded corporate entities in all other euro zone countries. (Country Governance study, 2005) Additionally, the adoption of International accounting standards by the listed companies will improve the picture of Athens Stock Exchange (ASE) and will help the development of Greek economy. (Christodoulakis, 2002).

The R&D expensing companies which were selected for the purpose of the study reports their financial statements under IFRS from 2004 onwards. The reported financial statements under IFRS seem to be lengthier and more detailed than the format published under Greek GAAP therefore it is important to examine the differences between the two frameworks. Even though, there are many differences among various reporting areas, the study will focus on the reporting area of intangible assets, including research and development.

The objective of IAS 38 is to prescribe the accounting treatment for intangible assets that are not dealt with specifically in another IAS (www.iasplus.com). According to IAS 38 intangible assets and development costs are recognised as assets but if they don't meet the criteria for recognition as assets expenditure is recognised as an expense when incurred. Regarding measurement, an intangible asset is carried at cost, less any accumulated amortisation and accumulated impairment losses. (IAS 38, par.74) In addition, intangible assets may be carried at revalued amount (fair value), less any subsequent accumulated amortisation and any accumulated impairment losses. (IAS 38, par. 75) The most important disclosures that the IAS specifies are: amortisation method, the useful life of assets, accumulated amortisation and impairment losses, gross carrying amount and reconciliation of the carrying amount(IAS 38, par 118).

Greek requirements are mainly based on Corporate Law 2190/1920, accounting standards issued by the Ministry of National Economy, the interpretations issued by the National Accounting Standards Board

(ESYL) and the Greek General Chart of Accounts approved by Presidential Decree 1123/80. (www.iasplus.com). According to Greek General Chart of Accounts Intangible assets are these assets that have no physical substance, ensure to their holder certain exclusive rights, provide to the enterprise future profits and have relatively big useful life (Athianos et al, 2004). Similar to IFRS, Greek GAAP requires that intangible assets and development costs are recognised as assets, although they are not normally capitalized, but when they don't meet the criteria for recognition as assets they are expensed (www.iasplus.com). As far as concerning measurement, intangible assets that are bought are evaluated at their cost of acquisition. The cost of acquisition of these assets is amortized in a straight-line method during its useful life. (Athianos et al, 2004) Moreover, research costs and pre-operating costs may be capitalized (www.iasplus.com).

To sum up, the International Accounting Standards guidance for intangible assets therefore and for R&D costs seem to be similar to Greek GAAP rules. The only difference is that under IASs an intangible asset is carried at cost, less any accumulated amortisation and accumulated impairment losses while under Greek GAAP an intangible asset is evaluated at the cost of acquisition less accumulated amortization.

2. Methodology

2.1. Data and measures

The purpose of the study is to investigate the association between R&D expenditures and the market stock price and if this association is due to a systematic mispricing of the shares of R&D-intensive firms, or due to other omitted risk factors. For that purpose annual balance sheets, income statements and stock prices were collected from the Athens stock exchange. The sample consists of 20 firms listed in the Athens Stock Exchange, which have R&D expenses during the five- year period from 2001 to 2005. These firms must also have a complete monthly stock return history to provide unbiased connection between earnings changes and excess returns. It is also important to note that the last two years (2004, 2005) companies reports the financial statements according to International Financial Reporting Standards (IFRS) that have been published by International Accounting Standards board (IASB).

However, the firms with R&D expenditures, which have found in the Athens Stock Exchange are mainly IT firms, pharmaceutical firms and telecommunication firms. The following table describes these firms according their section:

IT	PHARMACEUTICAL	TELECOMMUNICATION
ALTEC ABEE	LAVIFARM	COSMOTE
BYTE COMPUTER ABEE	VETERIN	LANNET
CPI SA	IASO	
INFOQUEST AEBE		
INFORMATICS AEBE		
INFORMER SA		
INTRACOM S.A.		
LOGIC DATA S.A.		
MLS S.A.		
POULIADIS AEBE		
SPACE HELLAS S.A.		
UNIBRAIN S.A.		

UNISYSTEMS S.A.		
PC SYSTEMS S.A.		

For the purpose of the research, the above firms were divided into three categories: 1) Firms that expense R&D expenditures (income statement) 2) Firms that capitalize R&D expenditures (balance sheet) and 3) Firms that expense and capitalize R&D expenditures. The first ones report R&D expenses in their balance sheet and more specifically in the account of intangible assets.

Furthermore, following Lev et al (2004), the study examines the general conditions under which R&D expensing and capitalising firms generate conservative (understated) or aggressive (overstated) performance measures, relative to performance measured under the capitalization of R&D. The aim of this examination is to be shown if R&D expenditures have under certain circumstances future benefits. Therefore, the study focus on three indicators of performance—the return on equity (ROE), return on assets (ROA), and earnings growth (momentum)—and examine whether R&D expensing result in overstated or understated values of these indicators, relative to capitalized R&D (Lev et al, 2004).

A main issue is the comparison of these profitability indicators when the firm expenses R&D expenditure in year t as opposed to capitalizing it over T years (assuming that cash flows are not affected by the accounting policy). Thus, it is important to focus on the following proposition:
The R&D expensing firm reports a higher ROA than the capitalizing firm if and only if:
$ROA \geq \frac{(1-\tau)g}{1+1/2g}$ The analogous result for ROE is $ROE \geq g/(1+ g/2)$

Another important issue is where R&D investment determines earnings growth. Therefore, it is important to examine two significant indicators: ***Earnings Momentum and R&D Growth Rate.***

If and only if $EMt \geq g$, the R&D expensing firm reports a higher earnings growth rate (EM) than the capitalizing firm. Additionally, if and only if the growth of R&D expenditures is slow relative to the reported earnings growth, the expensing method results in a higher reported earnings momentum (Lev et al, 2004).

Finally, except of the comparison of profitability indicators, it is important to compare two significant categories of R&D expenditures, in an order to examine whether and when they generate conservative or aggressive accounting conditions. Thus, it will be analyzed the following indicator:
Therefore, the last proposition is:

If and only if $R\&D_E > R\&D_C$, R&D expenditures generate conservative accounting. Even more, if and only if expensed R&D expenditures are lower than capitalized R&D expenditures, R&D expenditures generate aggressive accounting.

The above propositions indicate two significant issues: 1) when reported profitability will be conservative meaning that the reported indicators (ROE,ROA, earnings growth) are lower under expensing than under capitalization, and 2) when reported profitability is aggressive meaning that reported indicators are higher under expensing than under

capitalization. According to finance and accounting literature, market value should be based on economic profitability, and any manipulation of economic profitability measures due to the implementation of economically inconsistent accounting rules might lead to stock market misvaluations if investors mislead on reported profitability.

For all IT industries, the 5-year growth rate of R&D generally portrays a negative image over the years. Based on the data, the 60% of IT industries, the 100% of Telecommunication firms and the 65% of Pharmaceutical firms appear a declining growth. Even though, the average of firms appears a declining R&D growth, those firms which capitalize R&D expenditures (mainly pharmaceutical firms) present a high growth rate. On the other hand R&D expensing companies (mainly IT firms) present a low growth rate. Particularly, R&D capitalizing companies have a competitive advantage against R&D expensing companies. The whole picture of R&D growth drives to the conclusion that the Greek industry may suffer from a weak competitiveness, mainly in the software sector.

The earnings growth portrays a totally different picture than that of R&D growth. The earnings growth of IT companies appear to increase (60%) over the examined period, while the telecommunication industries do not present any significant change in earnings growth. On the contrary, the earnings growth of pharmaceutical firms decreased (100%) over the period. The most important thing here is that those firms which capitalize R&D expenditures present a descending growth in earnings, even though their R&D growth appears increasing growth rates.

Returns on equity (ROE) values vary across years and industries. In year 2000, 30% of industries had negative ROEs while in year 2005 only 15% of companies had negative ROEs. Obviously, the average of companies generates additional earnings through the recourses provided by its shareholders.

Regarding the profitability indicators driving the analysis, the 54% of the sample firm-years had an R&D growth rate which was higher than the earnings momentum, leading according to the above propositions, to conservative reporting of earnings growth and to potential market under-valuation. In the remaining 46% of the sample cases, the R&D growth rate was lower than the earnings momentum, leading to an aggressive earnings growth reporting and to potential market over-valuation. As far as concerning the relation between R&D growth and ROE, the results show a different picture than that of earnings-R&D growth. More specifically, in 31% of the firm-years, R&D growth was higher than ROE, leading according to the above propositions to conservative ROE reporting with potential market under-valuation, and aggressive reporting in the remaining 69% of the cases with potential market over-valuation. Finally, R&D expensed Dummy mainly indicates that R&D intensive firms report conservatively.

To summarize, there is not a clear image about the conditions under which R&D expensing and capitalising firms report conservatively or aggressively driving to the conclusion that expensing intangibles is conservative for some companies, aggressive for others and inaccurate for all (Lev, 2003).

2.2. Regression methodology

The regression methodology is similar to the one used by Lev et al (2004) who follow Fama and French (1992) by relating stock returns to lagged values of fundamental variables. In particular, Fama and

French (1992) regresse stock returns on lagged values of the following fundamentals: systematic risk (β), firm size (market capitalization), the book-to market ratio, financial leverage, and the earnings-to-price ratio. Lev et al (2004) following Lev and Sougiannis (1996) added to these variables an R&D intensity measure-the R&D capital-to-market ratio and found its coefficient to be positive and highly significant. Moreover, Lev et al (2004) added to the model another variable relating to the reporting bias in ROE or earnings momentum. They also use the variables {RDG/[(RDG/2)+1]}-ROE and RDG(5)-EM(5) directly in the regression and they construct bias score variables as suggested by Fama and MacBeth (1973). Thus, it will be estimated the following cross-sectional regression:

$R_{i,t+j} = a_0 + a_1 RM_{i,t} + a_2 LN(M)_{i,t} + a_3 LN(B/M)_{i,t} + a_4 LN(A/B)_{i,t} + a_5 (E/M)_{i,t} + a_6 (E/M\ dummy)_{i,t} + a_7 LN(RDC/M)_{i,t} + a_8 (ROE\ bias\ score)_{i,t} + e_{i,t+j}$.

Where:

$R_{i,t}$ = returns: monthly stock returns of firm i, starting with the 7th month after fiscal t year-end.

$RM_{i,t}$ = market returns: monthly stock market returns of firm i.

$M_{i,t}$ = size: market value of each firm i, calculated as monthly stock return multiplying by the number of shares outstanding at 31-12-2005.

$(B/M)_{i,t}$ = book-to-market: ratio of book value of common equity, of firm i at fiscal year- end, calculated as shareholder's equity divided with size (M).

$(A/B)_{i,t}$ = leverage: ratio of book value of total assets to book value of common equity of firm i at fiscal year-end.

$(E/M)_{i,t}$ = earnings/price ratio: ratio of positive earnings before extraordinary items plus income statement deferred taxes, to the market value of common equity of firm i at fiscal year-end. When earnings are negative this variable is set equal to 0.

$(E/M\ dummy)_{i,t}$ = 1 if earnings of firm i for fiscal t are negative, and 0 if earnings of firm are positive.

(RDC/M)i,t = R&D capital: estimated R&D capital over market value of equity at fiscal year-end. The R&D capital at the end of year t (RDCt) is the sum of the unamortized R&D expenditures (vintages) which are still productive:

$$RDC_{it} = RD_{it} + 0.8 \times RD_{it-1} + 0.6 \times RD_{it-2} + 0.4 \times RD_{it-3} + 0.2 \times RD_{it-4}$$

(ROE bias)i,t = ROE bias score:g/(1+ g/2) minus ROE. The growth rates of R&D are estimated over five years: (R&D t - R&D t-1)/ R&D t-1.

However, in this study, the regression analysis will be estimated for all the above indicators by using nested models. Further, the regression methodology will be analyzed based on the following hypotheses:

First Hypothesis:

$H_{1,0}$: R&D is a significant risk factor.

$H_{1,1}$: R&D is not a significant risk factor. (Alternative)

Second Hypothesis:

$H_{2,0}$: R&D expensing or capitalizing, signify conservative or aggressive reporting

$H_{2,1}$: R&D expensing or capitalizing, doesn't signify conservative or aggressive reporting

Summarizing, the following analyses will try to provide empirical support for the related hypotheses $H_{1,0}$ and $H_{1,1}$: by focusing on R&D effect, R&D is a significant factor or not. In general, companies with high (low) R&D expenditures generate high (low) stock returns. The analysis will try to provide evidence related to hypotheses $H_{2,1}$ and $H_{2,2}$: the expensing of intangible investments generally leads to conservative or aggressive reporting or not. Overall, companies with a high R&D growth rate relative to their profitability report conservatively, while firms with a low R&D growth rate report aggressively.

3. Regression Analysis

In an order to provide additional evidence on whether stock returns are associated with the above variables I estimate a regression which analyses the effects on monthly returns. Additionally, in an effort to better examine the variables, it will be analyzed imposing restrictions on the original model to arrive at a restricted formulation that will be nested within the original specification. So, first I will examine the relation between returns and beta then the relation between returns, beta and size and so on.

In table 1, the estimated coefficient of Market Return is not statistically significant, indicating that the relation between stock return and beta is flat. This assumption is consistent with that of Fama and French (1992) and (Chou et al, 2004), who support that there is no relation between size and average return, when there is only one explanatory variable. In addition, the goodness of fit of each model is assessed using the R square and the adjusted R square statistic. These two quantities show that RM does not improve the goodness of fit, because the excess returns of market are not able to explain the variability of the stock annual returns.

Table 2 reports that large companies do not generate high stock returns as the coefficient estimated for size is 0.108, which is not statistically significant indicating that there is no obvious size effect in Greek companies. Furthermore, the value of is computed at 0.005 and the value of is computed at 0. By examining R square and adjusted R square it can be seen that the company's size is not able to explain the variability of excess returns.

The scores of variable a_2 (0.124) and variable a_3 (0.270),in table 3, indicate that there is a significant positive relationship between size and stock returns and a significant positive relationship between book to market ratio and stock returns. The results seem to be relative to Fama and French (1992, 1993) results, which control for systematic return behavior, associated with firm size (market capitalization) and book-to-market ratio and predict that both of them are often interpreted as proxies for "riskiness". R square is computed at 0.171 and the value of adjusted R square is computed at 0.126. By the examination of these two quantities, it is observed that the book to market ratio improve the regression model. Moreover, it can be seen that book to market ratio is able to explain the variability of stock returns. Thus, the addition of the variable B/M improves the goodness of fit.

Table4 reports that estimated coefficient of variable a_2 is 0.128, which is significant at the 5% level. Estimated coefficient for the variable a_3 is 0.271, which is significant at the 1% level. As it is observed, size and book to market ratio are significantly associated

with stock returns but Market return and total assets to equity ratio are not statistically significant. The results are again similar to that of Fama and French (1992, 1993), who find that the cross-sectional variation in average stock returns can be explained as well by firm size and book-to-market equity ratios, as it can by the more traditional CAPM model. R square is computed at 0.173 and the value of adjusted R square is computed at 0.113. The above quantities identify that book value of total assets to book value of common equity ratio worsen the goodness of fit measures as the above variable is not able to explain the variability of stock returns.

By examining the coefficients of table 5, only two are found significantly associated with the stock returns, the rest of them are not statistically significant. The estimated coefficient of variable a_2 is 0.142, which is significant at the 5% level. The estimated coefficient of variable a_3 is 0.025, which is significant at the 1% level. Again the results indicate that size and book to market ratio are positively associated with stock returns as in Fama and French (1992, 1993) study. Even though, previous studies support that earnings are consistent with a risk explanation for measured excess returns to R&D-intensive firms, the above regression shows that the additional variables of earnings momentum and earnings momentum Dummy are not significantly related with stock returns, therefore they cannot be viewed as indicators of risk. R square and adjusted R square measures are estimated at 0.206 and 0.116 respectively. The above measures indicate that earnings momentum and earnings momentum Dummy improve a little the goodness of fit.

In table 6, the coefficients confirm once again that two variables are highly significant: the size and the book to market ratio. By measuring the coefficient for the variable a_2, the score is estimated at 0.143, which is significant at the 5% level. By measuring the coefficient for the variable a_3, the score is estimated at 0.247, which is significant at the 1% level. Once more, similar to Fama and French (1992, 1993) study, the results indicate that size and book to market ratio act as indicators of risk because of the positive relationship with the stock returns. Even though previous studies predict a strong positive coefficient for RDC/M, indicating that R&D capital is consistent with a risk explanation for measured excess returns to R&D-intensive firms, this study does not indicate that RDC/M is acting as associated risk factor. Nevertheless, by adding the variable RDC/M, the regression estimates an insignificant coefficient for R&D capital, implying that R&D capital is not significantly associated with stock returns. Clearly, there is no obvious R&D effect -high R&D expenditures do not generate high excess returns- in Greek companies. The evidence from the regression provides strong support for the hypothesis $H_{1,\ 1,}$ that R&D is not a significant factor. Moreover, R square and adjusted R square indicate that R&D capital is not able to explain the variability of stock returns signifying that the addition of the variable RDC/M worsens the goodness of fit.

Table 7 presents all the variables involved in the basic model of regression analysis. The final model predicts another variable, except of size and book to market ratio, which seem to be highly significant: earnings momentum. Measuring the coefficients of variables $a_{2,}$ $a_{5,}$ the scores are estimated at 0.151 and 0.220 respectively, which are significant at the 5% level. The coefficient of variable a_3 is estimated at 0.246, which is significant at the 1% level. From the above coefficients it is obvious that size, book to market ratio and earnings momentum are positively associated with stock returns so the three variables can be viewed as indicators of risk. The most important issue is that the additional variable ROE bias does not indicate a statistically significant relation between bias in ROE and stock

returns, as it is expected to be, but rather it indicates a statistically significant correlation between earnings momentum and stock returns. A possible explanation is that earnings can be measured by the ratio of earnings to the book to market ratio therefore it is involved in a way in the variable of ROE bias. Even more ROE bias shows that firms with R&D growth greater than earnings growth earn positive but not significant abnormal returns. So, by combining these variables, it can be resulted that high earnings growth leads to higher subsequent returns. The above estimation provides evidence for the hypothesis $H_{2,2}$ that R&D expensing or capitalizing does not signify conservative or aggressive reporting due to the insignificant relationship between ROE bias and stock prices. In a further measurement of R square and adjusted R square, estimated at 0.226 and 1.104 respectively, it is quite obvious that ROE bias improves the goodness of fit.

Conclusions

The purpose of the research is to investigate the effect of R&D on the cross-sectional variation of stock returns. It is examined further, whether the association between R&D expenditures and the market stock price is due to a systematic mispricing or due to other omitted risk factors. It also investigates if the immediate expensing or capitalizing of R&D is conservative or aggressive, relative to reporting under R&D capitalization.

In an order to examine these issues, following Lev et al (2004), a model of profitability reporting biases was constructed in an order to identify two important key drivers: the differences between R&D growth and ROE and between R&D growth rate and earnings momentum. In contrast to Lev and Sougiannis (1996, 1999, 2004), it is found that R&D expensing or capitalising companies relative to their profitability does not report neither conservatively nor aggressively. Even more, by examining the additional factor of R&D capital, it was found that firm's R&D expenditures is not a value related to investors. As far as there is no obvious R&D effect in Greek R&D enterprises, the scenario of mispricing and that of other omitted risk factors cannot practically be explained.

However, by using nested models in the regression analysis, it is found a strong size effect and book-to-market effect and that the relation between stock returns and beta is flat relevant to the seminal work of Fama and French (1992). In addition to Fama and French (2002) results, earnings momentum is positively related with stock returns. Nevertheless, it is important to notice that in regression analysis, earnings are associated with firms stock returns only when ROE bias is included to the model as an additional factor.

The results are subject to a number of important caveats. First, the tests are based on 20 R&D industries. Also, the sample is limited to a five year horizon, which does not capture all of the benefits of R&D that require a longer gestation period. Moreover, another significant issue is the change in the accounting policy from year 2003 to year 2004 due to the implementation of the International accounting standards in all listed companies in the Athens stock exchange. The decision of the European Commission for all companies listed on EU stock exchanges to prepare their financial statements in accordance with IFRS has affected the reporting of financial statements of all Greek companies. Thus, even if the guidance is similar, there are differences in the application, which have a material impact on the financial statements of the company.

Finally, since the capitalization prediction model is imperfect, it may not have been captured all existing predictability. In this case, the evidence that there is no obvious R&D effect might be due to the adoption of IFRS and due to the fact that the Greek industry consists of early cycle life companies at the early stage of development capturing the image of an emerging market.

In summary, given the growing importance of R&D activities in the general economy, this is an important area for further research in the examination of the R&D effect and his consequences, by using a sample with a greater number of R&D companies and a lengthen time horizon .

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Appendices

Table 1: Regression of Annual stock Returns on Annual Market Returns lagged one Year

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + e_{i,t}$$

	a_o	a_1	*R square*	*Adj R square*	*F-statistic*	*#obj*
coefficient	-0,059	0,098	0,002	0,000	0,122	60
t-statistic	-0,731	0,349			-	
P-value	0,468	0,72			0,727	

Notes: Numbers are rounded to three decimal points

Table 2: *Regression of Annual stock Returns on various explanatory variables*

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + a_2 LNM_{i,t} + e_{i,t}$$

	a_o	a_1	a_2	*R square*	*Adj R square*	*F-statistic*	*#obj*
coefficient	-0,417	0,108	0,020	0,005	0,000	0,141	60
t-statistic	-0,468	0,380	0,403				
P-value	0,641	0,705	0,688			0,868	

Notes: $RM_{i,t}$: annual market returns lagged one year.
$LNM_{i,t}$: natural logarithm of firm size lagged one year.
Numbers are rounded to three decimal points

Table 3: *Regression of Annual stock Returns on various explanatory variables*

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + a_2 LNM_{i,t} + a_3 LNB/M_{i,t} + e_{i,t}$$

	a_o	a_1	a_2	a_3	*R square*	*Adj R square*	*F-statistic*	*#obj*

coefficient	-2,226	0,085	0,124**	0,270*	0,171	0,126	3,842	60
t-statistic	-2,262	0,323	2,247	0,081				
P-value	0,028	0,748	0,029	0,001			0,014	

Notes: RM $_{i,t:}$ annual market returns lagged one year.
LNM $_{i,t}$: natural logarithm of firm size lagged one year.
LNB/M $_{i,t}$: natural logarithm of book to market ratio lagged one year.
Numbers are rounded to three decimal points
* indicates significance at the 1% level
** indicates significance at the 5% level

***Table 4**: Regression of Annual stock Returns on various explanatory variables*

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + a_2 LNM_{i,t} + a_3 LNB/M_{i,t} + a_4 LNA/B_{i,t} + e_{i,t}$$

	a_o	a_1	a_2	a_3	a_4	*R square*	*Adj R square*	*F-statistic*	*#obj*
coefficient	2,299	0,090	0,128**	0,271*	0,030	0,173	0,113	2,880	60
t-statistic	2,282	0,339	2,266	3,333	0,409				
P-value	0,026	0,736	0,027	0,002	0,684			0,031	

Notes: RM $_{i,t:}$ annual market returns lagged one year.
LNM $_{i,t}$: natural logarithm of firm size lagged one year.
LNB/M $_{i,t}$: natural logarithm of book to market ratio lagged one year.
LNA/B $_{i,t}$: natural logarithm of book value of total assets to book value of common equity ratio lagged one year.
Numbers are rounded to three decimal points
* indicates significance at the 1% level
** indicates significance at the 5% level

***Table 5**: Regression of Annual stock Returns on various explanatory variables*

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + a_2 LNM_{i,t} + a_3 LNB/M_{i,t} + a_4 LNA/B_{i,t} + a_5 (E/M)_{i,t} + a_6 (E/M\ dummy)_{i,t} + e_{i,t}$$

	a_o	a_1	a_2	a_3	a_4	a_5	a_6	*R square*	*Adj R square*	*F-statistic*	*#obj*
coefficient	-2,620	0,112	0,142**	0,025*	0,030	0,215	0,055	0,206	0,116	2,289	60
t-statistic	-2,533	0,421	2,482	2,924	0,405	1,475	0,324				
P-value	0,014	0,675	0,016	0,005	0,687	0,146	0,747			0,049	

Notes: RM $_{i,t:}$ annual market returns lagged one year.
LNM $_{i,t}$: natural logarithm of firm size lagged one year.
LNB/M $_{i,t}$: natural logarithm of book to market ratio lagged one year.
LNA/B $_{i,t}$: natural logarithm of book value of total assets to book value of common equity ratio lagged one year.
(E/M) $_{i,t}$: earnings/price ratio lagged one year.

(E/M dummy) $_{i,t}$: Dummy of earnings momentum lagged one year.(1 if earnings of firm i for fiscal t are negative, and 0 if earnings of firm are positive)
Numbers are rounded to three decimal points
* indicates significance at the 1% level
** indicates significance at the 5% level

***Table 6**: Regression of Annual stock Returns on various explanatory variables*

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + a_2 LNM_{i,t} + a_3 LNB/M_{i,t} + a_4 LNA/B_{i,t} + a_5 E/M_{i,t} + a_4 (E/M\ Dummy)_{i,t} + a_7 LN(RDC/M)_{i,t} + e_{i,t}$$

	a_o	a_1	a_2	a_3	a_4	a_5	a_6	a_7	*R square*	*Adj R square*	*F-statistic*	*#obj*
coefficient	-2,628	0,111	0,143**	0,247*	0,030	0,215	0,056	0,001	0,206	0,099	1,925	60
t-statistic	-2,410	0,410	2,275	2,838	0,402	1,461	0,322	0,025				
P-value	0,019	0,684	0,027	0,006	0,690	0,150	0,749	0,980			0,084	

Notes: RM $_{i,t}$: annual market returns lagged one year.
LNM $_{i,t}$: natural logarithm of firm size lagged one year.
LNB/M $_{i,t}$: natural logarithm of book to market ratio lagged one year.
LNA/B $_{i,t}$: natural logarithm of book value of total assets to book value of common equity ratio lagged one year.
(E/M) $_{i,t}$: earnings/price ratio lagged one year.
(E/M dummy) $_{i,t}$: Dummy of earnings momentum lagged one year.(1 if earnings of firm i for fiscal t are negative, and 0 if earnings of firm are positive)
LN(RDC/M) $_{i,t}$:natural logarithm of R&D capital lagged one year.
Numbers are rounded to three decimal points
* indicates significance at the 1% level
** indicates significance at the 5% level
*** indicates significance at the 10% level

***Table 7**: Regression of Annual stock Returns on various explanatory variables*

$$R_{i,t+1} = a_0 + a_1 RM_{i,t} + a_2 LNM_{i,t} + a_3 LNB/M_{i,t} + a_4 LNA/B_{i,t} + a_5 E/M_{i,t} + a_4 (E/M\ Dummy)_{i,t} + a_7 LN(RDC/M)_{i,t} + (ROE\ bias\ score)_{i,t} + e_{i,t}.$$

	a_o	a_1	a_2	a_3	a_4	a_5	a_6	a_7	a_8	*R square*	*Adj R square*	*F-statistic*
coefficient	-2,756	0,076	0,151**	0,246*	0,033	0,220**	0,010	0,006	0,012	0,226	0,104	1,858
t-statistic	-2,522	0,278	2,394	2,834	0,440	1,500	0,058	0,136	1,144			
P-value	0,015	0,782	0,020	0,006	0,662	0,014	0,954	0,892	0,258			0,088

Notes: RM $_{i,t}$: annual market returns lagged one year.
LNM $_{i,t}$: natural logarithm of firm size lagged one year.

$LNB/M_{i,t}$: natural logarithm of book to market ratio lagged one year.
$LNA/B_{i,t}$: natural logarithm of book value of total assets to book value of common equity ratio lagged one year.
$(E/M)_{i,t}$: earnings/price ratio lagged one year.
$(E/M\ dummy)_{i,t}$: Dummy of earnings momentum lagged one year.(1 if earnings of firm i for fiscal t are negative, and 0 if earnings of firm are positive).
$LN(RDC/M)_{i,t}$:natural logarithm of R&D capital lagged one year.
$(ROE\ bias\ score)_{i,t}$: g/(1+ g/2) minus return on equity lagged one year.
Numbers are rounded to three decimal points
* indicates significance at the 1% level
** indicates significance at the 5% level
*** indicates significance at the 10% level

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