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The Effect of R&D Expenses on Earnings and Market Value

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Abstract

The aim of this paper is to examine the effect that Research and Development (R&D) expenditures have on a company's market value and earnings. Prior literature shows that R&D expenses have a positive impact on a firm's market performance, as well as a positive impact on a firm's earnings. The goal of this paper is not only to test the relation between R&D expenses and earnings and between R&D expenditures and market value, but also to prove that this relation changes as time passes. We show that while R&D expenses have an impact on market value in the short-run, their impact on earnings is stronger in the long-run. The sample consists of the companies listed in the North American Stock exchanges for the period 1993-2013 and for the industrial sector. Our results show a positive relation between R&D expenses and market value and between R&D expenses and earnings.

Keywords: R&D expenses, earnings, market capitalization

JEL Classification: M40, M41, M48

1. Introduction

This paper investigates the relation between a company's earnings and performance with the R&D expenses. The role of R&D expenses in the prediction of a company's performance has been widely examined, while the studies that examine the relation between R&D expenses and earnings are limited. The aim of this paper is to add evidence to the existing literature regarding the impact of R&D expenses on earnings and performance, as well as to show that future earnings rather than present earnings reflect accurately the impact of the R&D expenses.

The remainder of this paper is structured as follows. Section 2 analyses the existing literature regarding the value relevance of R&D expenses, section 3 describes the data collected and the methodology, section 4 presents the empirical results and section 5 concludes the paper.

2. Previous Literature

The literature regarding the relation between investments, tangible and intangible, and a company's future performance is vast; however, most of these studies examine the predictability of investments in relation to a firm's market performance, measured in most cases with the firm's stock returns. As stock returns are associated to the expected

investment, the expected profitability and the book-to-market ratio, most of the studies test the relation between stock returns and these three variables.

Numerous studies test the association between future stock returns and research and development expenses (R&D) as a measure of investment activity. Most of these studies provide evidence that future returns are positively related to R&D expenses. Lev and Sougiannis (1996) and Chan et al. (2001) find positive relation between returns and R&D investments (4,6% and 6,1% respectively). Moving to other variables, Chan et al (2001) find that firms with high advertising expenses have positive future returns, Deng et al (1999) find positive association with the returns for firms with patents, and Aboody and Lev (1998) find positive returns for firms with high software development expenses.

Other studies that support the hypothesis that high R&D firms earn high returns in the future are those of Chambers et al (2002), Eberhart et al (2004), Lev et al (2005), Shah et al (2008), Ali et al (2009), Ehie (2010), Pindado et al (2010), Apergis and Sorros (2014). In an attempt to explain this relation, researchers conclude that the presence of R&D expenses leads the investors in mispricing the stocks which results in future positive returns¹. Chambers et al (2002) give a different explanation to this positive association; they find positive relation between R&D and excess returns for the period 1979-1998, suggesting that this relation is not the result of mispricing but the result of a compensation for the inability to control for risk.

Apergis and Sorros (2014) find positive association between R&D expenses and the profitability of energy US firms for the period 1990-2011. They divide their group in two sub-groups (fossil energy and renewable energy) and find that for the renewable energy firms, the relation between R&D expenses and profitability is stronger.

Pindando (2010) tests whether specific characteristics of a firm can affect R&D expenses and indicates positive relation between R&D expenses and size and market prices, whereas he concludes that there is negative relation between R&D expenses and free cash flows, external financing, labor intensity and capital intensity.

Donelson and Resutek (2012) reject both these explanations. In their study of the relation between R&D, earnings forecasts and returns for the period 1973-2008, they find that R&D activity is not associated to future earnings and also investors' forecasts are unbiased. They support that this relation is due to the different expectations of analysts and investors, which are related to the value/growth anomaly rather than to the R&D level of a firm.

Evidence also supports the hypothesis that investment in intangibles do not lead to higher returns as these are invisible to investors². For this reason, Stein (1988) and Edmans (2011) agree that managers tend to invest less in intangibles. Edmans (2011) examines the relationship between employee satisfaction and long-run stock returns for the companies listed in the "100 Best Companies to Work for in America" for the period from 1984 to 2009. He finds that employee satisfaction is positively correlated with stock returns and that the stock market does not fully value intangibles.

There are also empirical studies that test the impact of R&D expenses on earnings instead of future returns. Healy et al (2002), Ballester et al (2003) and Monahan (2005) find that firms with high R&D expenditures earn higher future earnings. The study of Yuan et al (2011) for 212 firms included in the S&P 500 for the 10 year period from 1996 till 2005 also observes a positive relation between earnings and R&D expenses.

¹ This explanation is supported by Lev and Sougiannis (1996), Chan et al (2001), Lev et al (2005).

² According to Lev (2004), investors ignore R&D expenditures as their positive impact on future earnings is unsure, although it is a variable clearly presented in the income statement.

On the other hand, Kothari et al (2002), Schilit (2002) and Nelson et al (2003) do not support the hypothesis of an association between R&D expenses and firm earnings.

Interestingly, there is a lack of empirical evidence regarding the impact of tangible (capitalized) investment activity on future returns, in comparison to the literature that links R&D expenses to future market performance. Sloan (1996), Titman et al (2004) and Cooper (2006) find that future returns are negatively associated to investments in tangible assets.

Titman et al (2004) test the relation between capital expenditures and future returns for the period between July 1973 and June 1996 for the companies listed on the three major stock exchanges in the United States (New York Stock Exchange, American Stock Exchange and Nasdaq). They find negative association between future returns and capital expenditure for the first five years after the investment and this negative relation is more intense for firms with lower debts or higher cash flows. Their findings of negative relation between investments and returns are consistent with the findings of Richardson and Sloan (2003) for the period from 1963 to 2000.

Shukor et al (2005) examine whether the information provided through the financial statements concerning tangible and intangible non-current assets is useful in predicting future earnings and cash flows. For the companies listed in the Kuala Lumpur stock exchange between 1995 and 1999 (that is before, during and after the Asian economic crisis), they observe that the information of tangible non-current assets is more useful than this provided from intangible non-current assets in predicting future performance during crisis period. In periods where there is no crisis, the intangible non-current assets are the same or more useful than the tangible non-current assets.

Anderson and Garcia-Feijóo (2006) test the relation between firm-level investment, market value of equity and book-to-market ratio in an attempt to find the link between expected returns and investments and changes in valuation for the period 1976-1999. Their findings suggest that firms classified by the Fama and French method as low book-to-market increase their investments in capital, resulting in an increase at their market value. In contrast, firms considered high book-to-market reduce their investments in capital and thus their market value. Moreover, they provide evidence that average stock returns are lower for firms that have increased investment spending (according to them, investment contains information similar to book-to-market ratio). In addition, consistent with Titman et al (2004), they find a negative relation between investment and stock returns, with the difference that they interpret their findings from a risk-based point of view, while Titman et al (2004) connect their findings to overinvestment theories.

A firm's capital investment is mainly represented by the firm's non-current tangible assets, which comprise a large percentage of the firm's net book value of equity³. Recent studies also support the hypothesis that the book-to-market ratio varies according to the firm's investment decisions⁴.

Berk et al (1999) developed a model in which returns and risk are related to firm characteristics such as size and book-to-market ratio. In their model, the firm value is the value of assets in place and growth options. The risk exposure of firms changes according to their investment decisions, eg. low risk investments lower the risk of cash flows which leads to lower returns. Also, changes in assets imply an explanatory role for market value, as in most of the cases firms with high market value have more assets and higher cash flows, and therefore growth options can change. Book-to-market value of equity is the firm's risk from

³ Deesomsak et al (2004) and Singh and Nejadmalayeri (2004).

⁴ Berk et al (1999), Gomes et al (2003), Cooper (2006).

an asset base, while size is related to growth options and both can change over time according to the importance of growth options in relation to the existing assets.

Gomes et al (2003) in contrast, form a model similar to the one of Berk et al (1999) and suggest that future stock returns and capital expenditure should have negative relation, as in their model, growth options are riskier than assets-in-place.

Cooper (2006) argues that high book-to-market firms have higher systematic risk. Assuming that capital investment remains constant, the book-to-market ratio of a distressed firm increases (as its market value decreases). This company can expand easily without new investment providing high payoff to stockholders, fact that increases its systematic risk.

DeBondt and Thaler (1985, 1987), Lakonishok et al (1994) and Barberis et al (1998) find a positive association between book-to-market ratios and returns and argue that this relation is caused by the reaction of investors concerning past stock returns. As a result to investor reaction, for firms with poor past performance, and high book-to-market ratios, prices are kept in low levels and therefore firms with high book-to-market ratios have high returns when actual earnings are realized and prices go up.

Fama and French (1992, 1993, 1995, and 1997), form a different explanation and support the hypothesis that firms with high book-to-market ratios (and hence poor past returns) are considered riskier and thus they should have higher future returns.

Daniel and Titman (2006) investigate the relation between stock returns and accounting information. They distinguish accounting information in tangible information that is information about past performance, and intangible information that is information about future performance. They find that future returns are not related to past information provided through the financial statements (tangible information), however future returns are strongly related to past returns that cannot be explained by tangible information, findings that support the hypothesis that book-to-market ratios can predict future returns as the book-to-market ratio is a good proxy for past intangible returns. They also examine whether there is a relation between stock issuance and future stock returns and they provide empirical evidence that there is a strong negative relation between them.

Tan et al (2007) examine the relationship between intellectual capital and financial performance for 150 companies listed in the Singapore Stock Exchange between 2000 and 2002. They measure intellectual capital using the "Value Added Intellectual Coefficient" (VAIC) developed by Pulic (1998, 2000) in an attempt to provide information about the value creation efficiency of tangible and intangible assets within a company. This VAIC is the sum of physical capital coefficient, human capital coefficient and structural capital coefficient, whereas financial performance is measured with three different ratios: return on equity, earnings per share and annual share returns. Their findings imply a positive relation between intellectual capital and company performance.

Although there is much evidence concerning the relation between investments and future returns, there is a lack of evidence regarding the relation between investment activities and earnings or profitability. As profitability and investments are related to the book-to-market ratio, current investment should also be related to future profitability. This paper aims at adding evidence in the existing literature by examining the relation between present and future earnings and R&D expenses.

3. Data and Methodology

3.1 Sample Selection

Our sample consists of 2,088 industrial companies⁵ listed in the North American Stock exchanges over the period 1993-2013. For these companies, we collected yearly data on Research and Development Expenses (RD), Operating Income (OI), Market Capitalization (MC), Gross Fixed Assets (GFA) and Number of Employees (Em). Data was obtained from the Bloomberg database according to Bloomberg Classification.

3.2 Methodology

The performance of the company in the market is expressed with the market capitalization and therefore the following model is formed in order to examine the impact of R&D expenses on present and future market performance:

$$MC_{it} = a + a_1GFA_{it} + a_2Em_{it} + a_3RD_{it} + e_{it}$$

where:

MC_{it} : Market Capitalization of company i at year t

GFA_{it} : Gross Fixed Assets of company i at year t

Em_{it} : Number of employees of company i at year t

RD_{it} : R&D expenses of company i at year t

On the other hand, operating income is used to express present and future earnings and therefore the following model is formed in order to test the relation between R&D expenses and earnings:

$$OI_{it} = a + a_1GFA_{it} + a_2Em_{it} + a_3RD_{it} + e_{it}$$

where:

OI_{it} : Operating Income of company i at year t

GFA_{it} : Gross Fixed Assets of company i at year t

Em_{it} : Number of employees of company i at year t

RD_{it} : R&D expenses of company i at year t

Following previous empirical evidence and using panel data analysis, we expect to find a positive relation between R&D expenses and both market capitalization and operating income of the same year. We also expect that this relation becomes stronger when comparing the R&D expenses with future operating income and market capitalization.

4. Empirical results

4.1 Descriptive Statistics

Table 1 summarizes descriptive statistics for earnings, market performance and R&D expenses for the companies of our sample. It is worth mentioning that the average R&D expenses are \$42,000 while the median is zero, indicating that most of the companies of our sample do not have expenses for research and development.

⁵ According to Bloomberg classification.

Table 1
Descriptive Statistics

	OI	MC	RD
Mean	191	2.277	42
Median	12	182	0
Maximum	25.565	507.216	6.506
Minimum	-2.181	0	0
Std. Dev.	883	13.551	236
Skewness	14	22	12
Kurtosis	285	609	211
Jarque-Bera	42859707	1.97E+08	23415573
Probability	0.000000	0.000000	0.000000
Sum	2434962	29096562	536187
Sum Sq. Dev.	9.97E+09	2.35E+12	7.10E+08

4.2 Regression results

The results from running multivariate regressions of the two models are presented in tables 2 and 3. Table 2 indicates positive relation between R&D expenses and operating income, which becomes stronger when taking into account R&D expenses of previous years. All estimates are statistically significant at the 1% level. Unlike Kothari (2002), Schilit (2002) and Nelson et al (2003) that support no relation between earnings and R&D expenses, our results are consistent with the findings of Healy et al (2002), Ballester et al (2003), Monahan (2005) and Yuan et al (2011) and indicate a positive impact of R&D expenses on earnings, which is stronger on future earnings.

Table 2
OLS regressions of operating income

RDlag	a	a₁	a₂	a₃	AdjR²
0	-13,36	0,098	0,006	0,97	0,83
1	-15,14	0,1	0,006	0,95	0,83
2	-14,3	0,1	0,006	0,97	0,83
3	-15,23	0,1	0,007	0,99	0,83
4	-15,83	0,1	0,007	1,01	0,83
5	-17,37	0,1	0,007	1,13	0,84

Multivariate regressions of variation in present and future operating income for the 2088 companies listed in North American Stock Exchanges categorized under the industrial sector according to Bloomberg classification for the period 1993 to 2013, a: constant, a₁: the coefficient for GFA (Gross fixed assets), a₂: the coefficient for Em

(number of employees), a_3 : the coefficient for RD (the R&D expenses), RDlag: R&D expenses for previous years. Estimation is by OLS and standard errors are calculated using White's heteroskedasticity – consistent method, p-values are nil for all estimates. ($OI_{it} = a + a_1GFA_{it} + a_2Em_{it} + a_3RD_{it} + e_{it}$)

Table 3 shows the multivariate regression analysis of variation in market performance for our sample. We find positive relation between R&D expenses and market capitalization, indicating that the companies' market value is positively influenced by R&D expenses. Moreover, we find that the impact of R&D expenses is stronger in future performance. All estimates are statistically significant at the 1% level. Our results are consistent with the findings of Apergis and Sorros (2014) for the energy sector, Pindando (2010), Lev at al (2005), Chambers et al (2002), Aboody et al (1998) for the software development expenses among others.

Table 3
OLS regressions of market capitalization

RDlag	a	a ₁	a ₂	a ₃	AdjR ²
0	-588,63	1,506	0,085	10,836	0,711
1	-629,26	1,556	0,084	10,745	0,697
2	-621,12	1,55	0,091	11,871	0,711
3	-647,5	1,568	0,092	12,189	0,71
4	-671,64	1,579	0,092	12,987	0,711
5	-691,54	1,5631	0,088	14,961	0,713

Multivariate regressions of variation in present and future market capitalization for the 2088 companies listed in North American Stock Exchanges categorized under the industrial sector according to Bloomberg classification for the period 1993 to 2013, a: constant, a_1 : the coefficient for GFA (Gross fixed assets), a_2 : the coefficient for Em (number of employees), a_3 : the coefficient for RD (the R&D expenses), RDlag: R&D expenses for previous years. Estimation is by OLS and standard errors are calculated using White's heteroskedasticity – consistent method, p-values are nil for all estimates. ($MC_{it} = a + a_1GFA_{it} + a_2Em_{it} + a_3RD_{it} + e_{it}$)

5. Conclusion

In this study we test the impact of R&D expenses on a company's market performance (measured by the market capitalization) and earnings (measured by the operating income). Following the results of previous studies, our aim is to show that R&D expenses influence positively the market performance and the earnings of the companies and that this relation becomes stronger when taking into account past R&D expenses. Our motivation is that the

studies that examine the relation between R&D expenses and present and future earnings are limited and therefore we want to provide evidence supporting our hypotheses.

The results from our test can be summarized as follows. R&D expenses are positively related to operating income and market capitalization. Also, R&D expenses from previous periods are more correlated with the above variables. This is logical as the results for a company from its investments in research and development are not immediately obvious because projects need some years to be completed and be ready for commercialization.

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