

Impact of R&D Expenses and Corporate Financial Performance

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The paper investigates the R&D impact on the financial value of the company. The first part focuses on the previous findings in the existing literature and the relationships between R&D and earnings, operational performance, revenue growth and market value, in order to evidence the high potential of change in terms of new indicators. The second part includes the empirical analysis using a sample of 103 companies which registered high values of R&D, between 1979 and 2013. Overall, we assume a positive impact of R&D on the corporate value, using a new variable that includes both decision and outcome features.

INTRODUCTION

The benefits on R&D expense on the corporate performance have been widely studied in the financial literature. However, the results highlighted mixed trends. In light of the critical importance of R&D in the worldwide marketplace as an instrument to survive the fierce competition, the academic community findings confirm the positive relationship between a business's R&D expenditure and its financial performance. Once a company heavily invests in R&D to create a new product or service, it enjoys a higher return if the innovation can be marketed on a larger scale (Das et al., 2009, p. 2).

In recent years, new technologies have not always determined an increase of the corporate value, leading to failure in regards to business expectations. However, the evolution of the business community has shown a great interest for R&D expenditure.

Given the need to calibrate the performance of intellectual capital outcomes, Thompson and Vanderpal (YEAR) developed a new method for building an innovation efficiency ratio. The aim is to offer an instrument for both the academic community and the business arena to assess the efficiency of a company in utilizing its intellectual capital, through innovation, in order to create value added. An extensive study of the literature showed that firms do not currently possess the necessary means to perform external comparisons with competitors in terms of the efficient use of IC resources. Hence, the innovation efficiency ratio created by Thompson and Vanderpal (YEAR) attempts to fill this gap.

The authors used research and development expenses as a proxy for internal IC as a source of innovation, while intangible assets (IA) are treated as IC assets acquired from the company's external environment.

$$\text{Innovation ratio} = \frac{\text{Operating income}}{R \& D4QTRAVG + AIA4QTRAVG} \quad (1)$$

Operating income is obtained by subtracting operating expenses from revenues. Innovation may lead to the creation of products or services that might improve revenues, or it may turn to be a process that

would diminish operating expenses. The use of operating income as a proxy allowed the authors to capture both potential.

One of the limitations of Thompson and Vanderpal (YEAR) construction refers to the fact that innovations may also be developed and implemented in the absence of a formal R&D process and would not have been expenses as such. Despite the importance of informal innovation processes, innovations involving substantial financial efforts are driven by the acquisition on intangible assets and/or formal R&D processes.

In the present paper, we use two dependent variables, R&D expense and R&D expense to operating income, to check the relationships between investments in research and development and the indicators of financial performance (revenue, net income, ROA, ROE and equity). The analysis consists of two panel regressions, in order to capture a double perspective on the above mentioned correlations. The aim is to compare the results obtained and to highlight the fact that R&D expense to operating income indicator offers more valid and strong outcomes and can be used as a new variable counting the relationship between R&D spending and performance.

LITERATURE REVIEW

The investigation of the impact R&D investments have on corporate performance has been a topic of great interest for both the academic arena and the business environment, especially over the past three decades. Extensive analyses in economics, finance and accounting describe how stakeholders consider R&D undertakings as investments that are predicted to return future monetary benefits. For instance, some researchers highlight that R&D efforts enhance corporate value (*inter alia*, Sougiannis, 1994; Toivanen et al., 2002; Pindado et al. 2010, Duqi and Torluccio, 2011). Other academics reveal how changes in market values are positively associated with new announcement about R&D initiatives (Chan et al. 2001; Eberhart et al. 2004).

A large array of studies that explored the valuation of expenditures on intangibles (*inter alia*, Chan et al. (1990), Sougiannis (1994), Lev and Sougiannis (1996), Lev and Zarovin (1999), Shi (2003), Anagnostopoulou, 2008) focused on research & development costs, investments in brand names and trademarks (Barth et al., 1998), goodwill (Chauvin and Hirschey, 1994), patents (Hall et al., 2005) and human resources (Hanson, 1997). The findings provided by these analyses largely indicate that investment in intangibles enhances the value of a company.

Intellectual property (IP) (for instance, patents, trademarks, copyrights) has often been regarded by many economic agents as mere legal instruments or basic tools for the business arena. Many organizations have explored this group of assets and managed it as a powerful competitive weapon and source of unexpected earnings (Shapiro and Varian, 1999; Rivette and Kline, 2000; Ramanatyhan et al., 2001; Taghaboni-Dutta et al., 2009; Germeraad, 2010).

The study of competitive advantages driven by IP requires the identification of certain critical factors, and the literature refers here to R&D expenditure ratios and innovation efforts inside the company. These elements allow businesses to enjoy competitive advantages in terms of market power and financial outcomes. As suggested by the findings of Rivette and Klein (2008), IP investments allow firms to improve their potential future earnings and in line with other structural capital, enhance the achievement of essential strategic and financial performance (Edvinsson and Malone, 1997).

Other researchers (Aboody and Lev, 1998; Mohd, 2005; Givoly and Shi, 2008) showed that the capitalization of development costs offer important insights to investors and limits the information asymmetry between external and internal participants. It has to be noted that investments in intangibles must led to a positive expected net present value, at least for the investing organization's management and also for the investors. Given that, Garcia-Garcia and Magdaleno (2010) study results confirmed that the market acknowledges the role of R&D expenditures and those investors accept the investments intangibles without any reserves.

Pandit et al. (2009) investigated the relationship between successful R&D expenditure and the volatility of future performance. In line with the uncertainty of R&D's benefits, existing studies indicate a

positive correlation between R&D and the variability of future earnings. The authors used measures of innovation outcomes, such as patent citations and stressed that future performance is positively associated with the quality degree and the number of patents. This relationship is more powerful for more productive and innovative organizations. The variability of future performance of the company is negatively associated with the quality of patents and the link is stronger for organizations with highly cited patents. Pandit et al. (2009) study also showed that the connection between R&D efforts and future earnings is easier to be perceived by embedding information about the productivity of a company's R&D outlays.

Consistent with the idea that R&D effort can be a highly uncertain undertaking, Kothari et al. (2002) compared the unpredictability of future benefits driven by the R&D, which in theory create intangible assets, with the potential performance of capital expenditure (CAPEX) that is likely to lead to tangible assets. The authors documented a positive correlation between R&D and the standard deviation of future earnings. This connection is more powerful than the link between CAPEX and the variability of earnings, indicating that the advantages driven by R&D are relatively more uncertain.

The study of Amir et al. (2007) further explored the findings of Kothari et al. (2002) by grouping their sample into different time intervals and industries. The authors discovered a positive link between R&D and the volatility of potential earnings intensely manifested within R&D-intensive industries. In addition, the authors indicated the absence of any significant difference in the association of R&D and CAPEX with the future earnings volatility in non-R&D intensive sectors.

Hsieh et al. (2003) also showed a positive correlation between R&D intensity and the company's performance and highlighted an impact of R&D investments two times higher on market capitalization compared with the investment in tangible assets.

The literature also includes works that examined the relationship between R&D and subsequent operating performance, and found a positive relation linking the two notions.

According to Sougiannis (1994), the reported earnings after adjustments are beneficial for the R&D efforts. On average, an increase of one dollar in R&D expenditures determines a two-dollar profit improvement within a seven years period time. Similarly, Lev and Sougiannis (1996) highlighted a positive correlation between operating income and current and lagged R&D figures. Additionally, the findings revealed that the impact time of R&D on current operating results varies depending on the industry sector.

However, there are studies that do not support this theory; the results showed that different profitability levels among companies in a specific industry are not the necessarily the effects of R&D investments and advertising (Megna and Mueller, 1991).

As suggested by Eberhart et al. (2004), it is more viable to focus on the relationship between R&D investment and profitability taking into account the future R&D increases rather than current and past levels. Eberhart et al. (2004) indicated a positive link between abnormal operating performance and R&D increase in a five years' time window.

The existing panoply of scholarly works proves that the correlation between R&D and subsequent market performance has been a critical research topic. The findings highlighted a positive link between R&D and the future market growth (Anagnostopoulou, 2008). However, the studies published *ex ante* 1994 provide no concrete evidence of the R&D impact on market value. The researchers used various methodologies, such as Tobin's Q, market-to-book and abnormal returns models or market value. In 1978, Ben-Zion analyzed the investment nature of R&D based on a model where R&D and advertising capital influence the market value. The results suggested an intense positive connection between R&D, profitability and the organization's market value. The various studies that worked with Tobin's Q methodology returned similar results (for instance, Hirschey and Weygandt, 1985; Cockburn and Griliches, 1988; Hall, 1993). Hirschey (1982) and Chauvin and Hirschey (1993) applied a market-to-book approach and obtained a positive relationship between R&D and market value. Additionally, Bublitz and Ettredge (1989) used a different methodology to explore the market reaction. The authors concluded that on average, the impact of advertising is visible in the short-run, while the R&D has a significant influence in the long run.

The empirical study of Duqui et al. (2011) that evaluated the impact of R&D on stock returns for a group of European countries found a positive significant effect of research and development investments in estimating future returns. The authors also identified other important variables, such as book-to-market and firm size. Duqui et al. (2011) tested a group of assumptions in order to capture the relevant country specific factors, for instance the development of domestic equity and credit markets, the level of disclosure for publicly listed companies and the minority investor protection. The results showed that financial arena values R&D undertakings better in investor-friendly environments, characterized by a high degree of legal protection.

The usefulness attached to the accounting information about a company's R&D investments is generally limited. A more important aspect is related to the accounting treatment of R&D spending, as some states are legally required to completely expense the cost in the year incurred (Duqui et al., 2011). Hence, some popular indicators used in the literature, such as price-earnings ratios and market-to-book ratios, may be confusing. Other countries are allowed to capitalize these expenses only under very specific conditions.

Given the unpredictability of the outcomes of R&D efforts, it is also possible that the market will fail to reap any potential benefit. If a company is valued by an investor based on accounting principles, the twisted implications of R&D could drive misleading or incorrect assessments. Some scholars consider that investor may display a myopic behavior or fail to reward long-term firm investments in its assessments (Hall, 1993). From a different standpoint, others stressed that the market valuation of IT businesses heavily investing in R&D is excessive, because of unjustified optimism related to the impact of R&D on future profits. Fama and French (1992) evidenced that stocks having a low book-to-market ratio are generally attached limited performances in the future, mainly driven by the investors' overestimated predictions on future returns.

The results of Das et al. (2009) study focused on the implications of R&D undertaking on three critical financial performance indicators-revenue improvements, profitability and market value in the context of Canadian IT firms offered no evidence that the performance of highly intensive R&D organizations is superior to that of non-R&D businesses. However, the regression analysis showed a positive influence of R&D intensity on the company's market value, as calibrated by Tobin's Q.

The literature includes expensive studies that document a positive linkage between R&D spending and revenue growth. For instance, Chen et al. (2005) studied 4,254 Taiwan Stock Exchange listed companies during 1992-2002 to discover the relationship between value creation efficiency and a business's market value and financial performance. The findings indicate a powerful positive relationship between R&D intensity and the increase in revenue. Lau (1998) also highlighted a strong positive connection between R&D intensity and revenue improvement in the context of Standard and Poor's (S&P) 500 companies active within the chemical and allied product industry.

The work of Dave et al. (2013) highlighted that financial sustainability is powerfully influenced by gross margins, which in turn are strongly dependent on R&D intensity. The authors also emphasized the positive impact of R&D activity on sales revenue and the negative consequences on the technological performance. However, the implications of the time lag between the moment of the R&D spending incurrence and the point at which it improves the financial sustainability varies from business to business, making the exploration of the impact of the R&D efforts on financial stability a difficult process. The findings of Dave et al. (2013) suggest a considerable relationship between the intensity of the R&D and the gross margin. This is the foundation of the pricing strategy designed by IT organizations. In addition, there is a powerful connection between the gross margins and the financial sustainability, calibrated by the return on assets (ROA).

The accounting treatment of R&D undertaking has direct effects on a company financial performance. If the R&D cost materializes within the incurrence period, it will diminish the net income and the profitability indicators (ROA and ROE) for the given period. In the case of the deference of R&D costs to future periods as intangible assets, they would not harm the current period net income and return on equity, but might put pressure on ROA (Das et al., 2009), given that total assets will be enhanced by

capitalization of the R&D spending as an intangible asset. The financial benefits of research and development efforts will emerge only when the particular R&D activities drive patent issuance.

An array of circumstances explains the direct impact on R&D undertaking on a company's profitability level. The implications may arise from the accounting alternatives to capitalize or expense the R&D efforts; a business strategy to increase or gain market share or income; the number of R&D activities that lead to the issuance of patents, or the speed or skills to market the innovations into the offerings that capture consumer needs and preferences (Das et al., 2009). However, the scholars' findings stress both a positive and a negative linkage between R&D intensity and profitability indicators. Chen et al. (2005) suggested a positive relationship among R&D efforts and ROE and ROA, which highlights its importance for the organization future profitability and revenue increase. Law (1998) argued that the difference in ROA among high and low R&D intensity business is marginally significant, although not as powerful as revenue growth. From the opposite perspective, Kotabe et al. (2002) documented a non-significant negative connection between ROA and R&D intensity. Quo et al. (2004) highlighted that R&D intensity adversely influences the business profitability.

Usually, innovation is positively correlated with the return on assets (Sher and Yang, 2005). In addition, as argued by Pandit et al. (2011), a company's performance can be measured using net income and operating cash flow. Pandit et al. (2011) highlighted a positive relationship between the future operating performances (FOP) – calculated as mean – and the quality of firm's patents. However, the standard deviation of FOP is negatively correlated with the quality of the company's patents. Innovation induces high operating performance and reduces the uncertainty in this area.

Mojtahedzadeh and Abedi (2010) formulated three main hypotheses regarding R&D expenditure, indicating: 1) a significant relationship between R&D expenditure and the volume of sales within a company; 2) a powerful connection among R&D spending and the reduction of total expenditure within a company; 3) a substantial relationship between R&D investments and the persistence of abnormal earnings.

Anagnostopoulou (2008) explored the relationship between R&D and the reaction of the markets in the period 1978 and 2007. The results described a significant correlation between these two variables and also emphasized other factors that triggered the market reaction, such as the actual and future performance, capital structure, the economic conditions and risks.

METHODOLOGY

We apply a panel data analysis technique in order to capture the dynamics of selected indicators, namely to highlight the nature of the relationship between R&D expense and companies' financial performance. Baltagi and Kao (2000) highlight the superiority of panel data analysis as it allows for possible development of correlations in time and units of study. The major advantages consist in obtaining clear results based on multiple degrees of freedom and a low degree of multicollinearity, thereby improving the efficiency of econometric estimates. In addition, the double perspective (temporal and individual) controls the effects of other variables (external influences), which are excluded from the model (Hsiao, 2006).

The analysis is performed in E-Views 7.00 and includes 8 variables, as follows: the dependent variables are income statement based indicators - **R&D Expense and R&D Expense to Operating Income** and the independent variables measure the firm's performance (revenue, equity, return on asset – ROA, return on equity – ROE and net income). Initially, the sample comprised 500 companies from different sectors; however, after a detailed assessment, the final sample consists of 103 firms. The criteria that underlined this action are mainly based on the existence of the variable in the income statement (some firms do not have the R&D expense component) and for the selected period we searched for concrete values at least in $\frac{3}{4}$ of the time. In addition, we selected the companies with the highest value of R&D for the year 2013. We removed the firms that do not fulfill these basic criteria, in order to be statistically valid for the regressions. The data was collected from Standard & Poor's Database, a complex resource for company and industry information.

TABLE 1
VARIABLES USED IN THE ANALYSIS

Name/Type	Definition
Ratio (R&D Expense / Operating Income) dependent variable	Research and development expenditure is the money spent on creative work undertaken on a systematic basis to increase the stock of knowledge and the use of this knowledge to develop new applications (OECD, 2001). Operating income results from a firm's primary business operations, excluding extraordinary income and expenses. It gives a more accurate picture of a firm's profitability than gross income.
Revenue independent variable	The income that a company receives from its normal business activities, usually from the sale of goods and services to customers.
Equity independent variable	The capital received from investors in exchange for stock, donated capital and retained earnings.
ROE independent variable	Measures the profitability of a company by comparing net income to its average shareholder's equity.
ROA independent variable	Measures the level of management efficiency in relation to the assets potential to generate earnings.
Net Income (NI) independent variable	The amount of money resulted after the deduction of all operating expenses, interest, taxes and preferred stock dividends from the total revenue.

The panel has two dimensions, as follows: the time dimension (T) that includes 35 periods (years), and the cross-sectional dimension (N) consisting of 103 elements - firms from different sectors (industrial products, electrical components, IT consulting and services, software and hardware, agriculture, oil and gas, aerospace and defense, pharmaceutical, food, construction, chemicals, automobile manufacturers, household products, industrial machinery, health care equipment). According to Gujarati (2011), when $N > T$, the sample is a macro-panel. In addition, we consider that the stability criterion is fulfilled due to its diversity. We aim to validate or invalidate the relationship of investing in R&D to increase the financial performance by running two panel regressions. The goal is to compare the results and to obtain evidence that supports the previous findings—we assume a positive relationship between R&D expense and company performance indicators. The first panel regression includes the R&D expense component as dependent variable, while the second one uses the *RATIO (R&D Expense to Operating Income)* as dependent variable. The reason for this choice is to compare the results and to highlight a dual correlation between the outcomes.

EMPIRICAL RESULTS

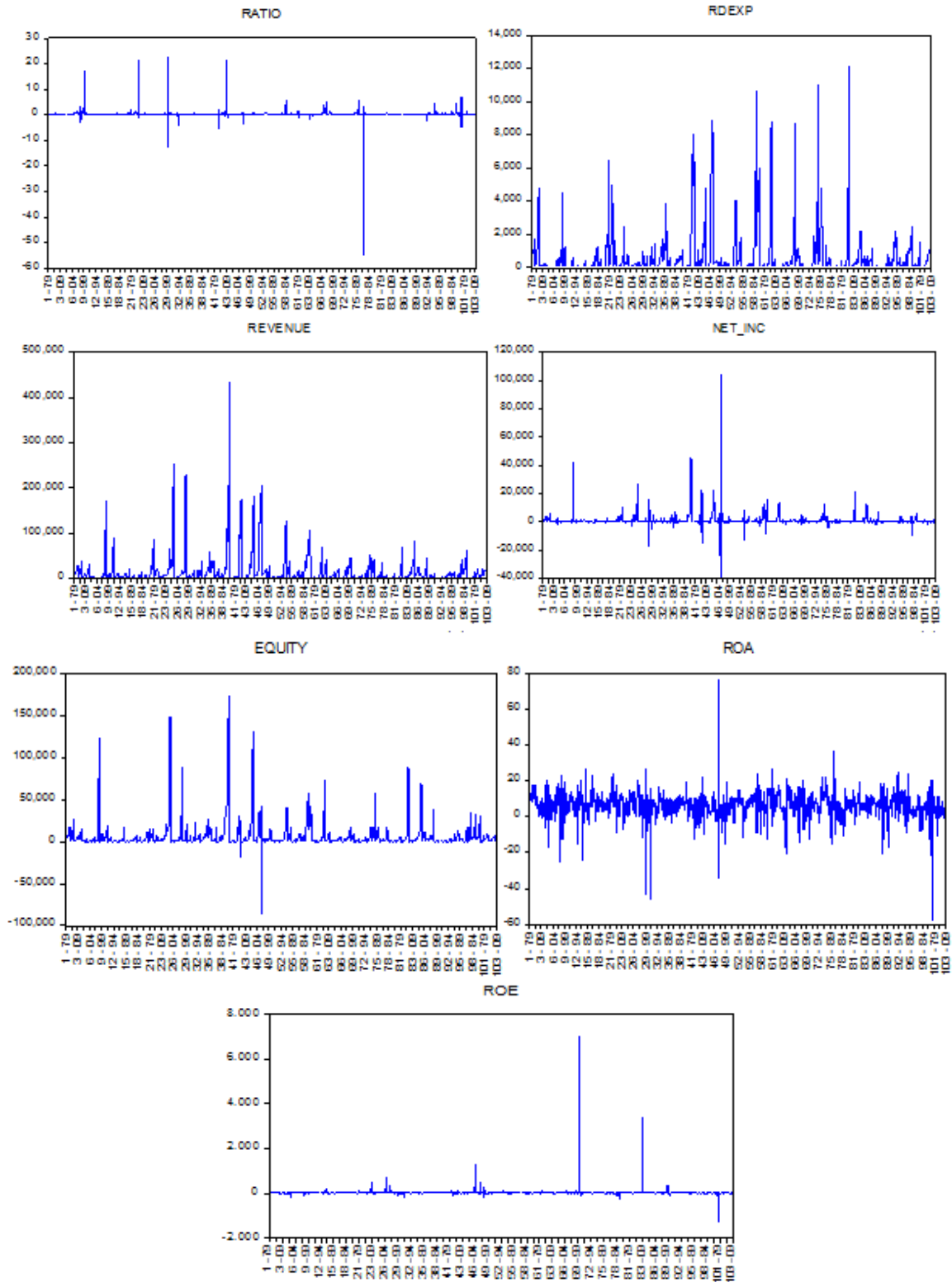
Table 2 reports summary statistics for the variables used in the empirical models.

TABLE 2
SUMMARY STATISTICS FOR THE VARIABLES USED IN THE REGRESSION MODELS

Variable	Mean	Std. Dev.
Ratio - R&D Expense/Operating Income	0.266430	1.246849
R&D expense	631.6454	1344.538
Revenue	16198.22	34455.16
Net Income	1181.569	3850.665
Equity	6594.244	14716.58
ROA	7.268193	5.896497
ROE	22.92158	138.3824

Source: Author's processing in E-Views 7.00

FIGURE 1
EVOLUTION OF THE VARIABLES USED IN THE REGRESSION MODELS



Source: author's processing in E-Views 7.00

Between 1979 and 2013, the *Pharmaceuticals* industry (represented by 7 companies within our sample) reached the highest level of research and development expenses, followed by *automobile manufacturers* (2 firms) and *IT consulting, services and computer hardware* (5 companies). Overall, the immense importance of pharmaceuticals as a global sector is well-known. Our findings evidence the potential of this area, according to the current realities on the markets. Moreover, the financial performance measured by ROA and ROE highlights similar patterns for these industries, in the same period of time. The numbers show a positive relationship between the level of R&D expense and the financial outcomes. Further, we plan to (in)validate this assumption from a statistical point of view and we investigate the intensity of the relationship.

In order to perform the regression, we test each variable for stationarity. According to the null hypothesis (H_0) the series has a common unit root (it is non-stationary). Otherwise, the series is stationary (H_1). If the associated probability is lower than 5%, the null hypothesis is rejected and H_1 is accepted.

TABLE 3
STATIONARITY OF THE VARIABLES INCLUDED IN THE MODEL (UNIT ROOT TESTING)

Variable Test	Ratio	R&D Expense	Revenue	Net Income	Equity	ROA	ROE
Levin, Lin & Chu t*	-5.3178 (0.0000)*	3.50011 (0.9998)	-0.55638 (0.289)	-3.23613 (0.0006)*	11.7798 (1.0000)	-10.3859 (0.0000)*	-13.6432 (0.0000)*
Breitung t-stat	6.48765 (0.0000)*	7.51951 (1.0000)	9.92040 (1.0000)	5.80726 (1.0000)	16.1709 (1.0000)	-10.3637 (0.0000)*	-7.96061 (0.0000)*
Im, Pesaran and Shin W-stat	-14.2195 (0.0000)*	5.92832 (1.0000)	3.57995 (0.9998)	-5.09298 (0.0000)*	11.7426 (1.0000)	-11.4968 (0.0000)*	-13.1098 (0.0000)*
ADF – Fisher Chi-square	798.379 (0.0000)*	148.121 (0.9992)	188.647 (0.8015)	403.412 (0.0000)*	112.357 (1.0000)	499.613 (0.0000)*	745.399 (0.0000)*
PP – Fisher Chi-square	1331.98 (0.0000)*	170.323 (0.9669)	108.948 (1.0000)	730.985 (0.0000)*	100.715 (1.0000)	901.105 (0.0000)*	1135.36 (0.0000)*

*Note: the values of probabilities associated to t statistics are between brackets, *significant at 5%*

Source: author's processing in E-Views 7.00

The results of stationary tests (see Table 3) show that four variables (Ratio - R&D Expense / Operating Income, net income, ROA and ROE) are stationary and three are non-stationary (R&D Expense, Revenue and Equity). Further, we generate new variables through differentiation and test them for stationarity.

TABLE 4
STATIONARITY RESULTS

Variable Test	Drdexp	Drevenue	Dequity	Dnet_income
Levin, Lin & Chu t*	-20.2632 (0.0000)*	-24.4164 (0.0000)*	-12.7652 (0.0000)*	-23.5255 (0.0000)*
Breitung t-stat	-3.58400 (0.0002)*	-6.02728 (0.0000)*	-1.63018 (0.0515)*	-7.00181 (0.0000)*
Im, Pesaran and Shin W-stat	-24.8863 (0.0000)*	-26.7941 (0.0000)*	-22.2720 (0.0000)*	-38.3789 (0.0000)*
ADF – Fisher Chi-square	1026.28 (0.0000)*	1108.09 (0.0000)*	905.470 (0.0000)*	1585.88 (0.0000)*
PP – Fisher Chi-square	4972.09 (0.0000)*	3005.05 (0.0000)*	1995.06 (0.0000)*	11462.5 (0.0000)*

*Note: the values of probabilities associated to t statistics are between brackets, *significant at 5%
Source: author's processing in E-Views 7.00*

In order to select the best model (fixed effects vs. random effects) we apply the Hausman test to find which of the two options is more stable (Greene, 2000). If the null hypothesis is not valid, H has a chi-square distribution with a number of degrees of freedom equal with the number of regressors. If the probability is lower than 5%, we reject the null hypothesis and conclude that the best model is the one using fixed effects (Clark and Linzer, 2012).

TABLE 5
RESULTS OF HAUSMAN TEST FOR THE FIRST PANEL REGRESSION

Test	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Values	56.898318	6	0.0000

Source: author's processing in E-Views 7.00

TABLE 6
RESULTS OF HAUSMAN TEST FOR THE SECOND PANEL REGRESSION

Test	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Values	10.476307	6	0.0160

Source: author's processing in E-Views 7.00

Depending on the results of the Hausman tests, $p < 0.05$, we will run both panel regressions with fixed effects (see Tables 5 and 6).

For the analysis of panel data there is no predefined test to obtain a valid result, in terms of homoscedasticity. However, in this case the viable option is to choose the category *Cross Section Weights* in order to have robust estimates. The estimators of the model parameters are effective, and the errors are not correlated. The features of both time and cross-sectional approaches have suffered modifications after the stationarity process. Before running the panel regression, the *T dimension* included 34 periods (in years, between 1980 and 2013) and the *N dimension* consisted of 103 elements (companies) and 3502 observations.

TABLE 7
RESULTS OF THE PANEL DATA ANALYSIS (I)

Independent variables		Dependent variable R&D Expense (rdexp)	
Dequity		0.005189	
		(0.000638)	[0.0000]*
Drevenue		0.004683	
		(0.000314)	[0.0000]*
Dnet_inc		-0.006801	
		(0.001156)	[0.0000]*
ROA		0.168291	
		(0.072491)	[0.0203]*
ROE		-0.004068	
		(0.003202)	[0.2041]
R-squared	0.175436	Durbin-Watson stat	2.026134

*Note: *significant at 5% level, ** significant at 10% level, otherwise non-significant, the values of the standard errors are in parentheses, while the values of associated probabilities are in square brackets, Source: author's processing in E-Views 7.00*

The results of the panel analysis evidence a positive relationship between R&D expense and equity, revenue and ROA. However, the level of research and development investments is negatively correlated with ROE. In different areas, as the sample consists of 103 companies, the general behaviour follows the pattern of an increase in revenues, incomes and performance that leads to an increase in the R&D spending. An important aspect is that firms have allocated more monetary resources to innovation and technology, as the expansion goal became a common desire (both under the theoretical and practical lines), complementing rising financial performances.

TABLE 8
RESULTS OF THE PANEL DATA ANALYSIS (II)

Independent variables		Dependent variable RATIO (R&D Expense / Operating Income)	
Dequity		4.41E-07	
		(6.10E-07)	[0.0498]*
Drevenue		-1.62E-07	
		(1.79E-07)	[0.0366]*
Dnet_income		6.79E-07	
		(1.02E-06)	[0.0554]*
ROA		0.008252	
		(0.000343)	[0.0000]*
ROE		-8.94E-06	
		(1.30E-05)	[0.4905]
R-squared	0.779063	Durbin-Watson	1.020514

*Note: *significant at 5% level, otherwise non-significant, the values of the standard errors are in parentheses, while the values of associated probabilities are in square brackets
Source: author's processing in E-Views 7.00*

In order to support the first findings, the second panel regression results contribute to the existing literature as follows. The dependent variable has not been used in the previous empirical studies - the level of R&D expense to operating income (*the ratio*) reflects the perspective of the company to invest in research and development as a part of the operating income. The approach aims to provide a tool to assess the efficiency of a company in utilizing its intellectual capital and anchoring it to the operating income. Moreover, the results show a negative link between *the ratio* and equity/revenue/ROA, which support the outcomes of the first panel regression. If the financial performance of the company improves, the level of R&D expenses relative to operating income will decline due to the increased efficiency of the intellectual, technological and human capital. In addition, there is negative statistical correlation between revenue and *the ratio*.

The second panel regression model is more robust, as the independent variables explain 77% of the evolution of the dependent variable (the value of R-squared is 0.7790).

Overall, the results point out the positive impact of research and development on the financial performance of companies subject to analysis during 1980 and 2013, and particularly the negative linkage between the level of R&D expense and net income in the first panel regression model; and the R&D expense to operating income and revenue in the second panel regression model, proxies for the financial *success* of the firm.

Limitations

In terms of limitations, specific issues affect the panel data analysis. The study performed has been influenced by the coverage problem. Initially, the sample consisted of 500 firms attached incomplete information, which made interpolation not a viable solution. Therefore, we have extracted only 103 companies considered stable enough to fit the panel regressions.

CONCLUSIONS

The impact of R&D investments on the corporate performance has been extensively debated within both the academic community and the business arena. The existing literature evidences different studies, which highlighted the impact of R&D expense on strategic, human and financial outcomes translated into various outcomes, as follows:

- ✓ positive correlations between R&D and the standard deviation of future earnings;
- ✓ impact of R&D investments two times higher on market capitalization compared to investments in tangible assets;
- ✓ R&D funding was a stronger determinant of differences in productivity growth within the sector;
- ✓ positive link between R&D and subsequent operating performance;
- ✓ different profitability levels among companies in a specific industry are not necessarily the effects of R&D investments and advertising;
- ✓ intense positive connections between R&D, profitability and the organization's market value;
- ✓ positive linkage between R&D spending and revenue growth.

The results of the panel data analysis on 103 companies from different fields during 1980 and 2013 show that R&D expense indicator is positively correlated with the financial performance of the company (revenues, net income, equity and ROE) and more specifically, emphasize a negative relationship between the level of R&D expense to operating income and financial indicators. The empirical construction (two panel regressions) has an original design, due to its flow and components. Testing for the impact of R&D expense on the financial performance of the companies provides solid results and creates the premise to repeat the statistical process using a new indicator, more complex, which gives insights on both decisions and outcomes. Moreover, final results are more consistent, in terms of solidity of the model, supporting the previous findings of the study.

The key points of the study which can be address both to the academic arena and the potential investors are the following:

- ✓ research and development expense has been considered an important premise for growth – in different industries, a high level of R&D has been correlated with positive findings, in terms of financial performance;
- ✓ the investment decision has to be based on a wide-spectrum analysis – in order to obtain valid results, search for a double perspective to support the first outcomes – design new tools, in this case - an indicator (R&D expense to operating income, to serve your scientific interests.

Overall, the innovation of the present research consists of a new approach (through a new indicator) for demonstrating a classical theory, on a sample of 103 companies, for a period of 34 years. The shift of perspective has enlarged the horizon using the old knowledge.

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