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The value relevance of R&D expenditure after the adoption of the International Accounting Standards by Italian publicly listed companies

Abstract

The author measures the utility for investors of financial data regarding expenditure on research and development, which are disclosed through the firm's financial statement. With this aim, financial and market data are analyzed on a sample of Italian quoted companies, starting from the year in which the International Accounting Standards (IAS) were applied. Through a single measuring model based upon Ohlson's equation (1995), the researcher simultaneously investigates the value relevance of the different research and development (R&D) accounting treatments (the portion of R&D expenditure which is capitalized and that which is expensed). It is found that disclosure, regulated by the IAS, contains value-relevant information. In particular, it is found that adoption of the IAS has, on the one hand, constrained management discretion and, on the other, increased the explanatory power earnings have for market values. Finally, it is found that R&D is one of the main contributors to the formation of the gap between market and book values in the sampled companies.

Keywords: IAS, R&D, capitalized R&D, expensed R&D, value relevance, Ohlson.
JEL Classification: M41, M21.

Introduction

Our investigation focuses on the degree to which financial data regarding two differing elements of R&D expenditure, that which is capitalized and that which is expensed, are stock price informative. Stock price informativeness is measured as the stock price reaction to the disclosure of financial information which is embedded in the firm's financial statement. Disclosure, which is associated with significant stock market price reaction, contains value-relevant information (Wyatt, 2008). "Relevant" is different from "Reliable". Information is value-relevant if it is considered by investors when they evaluate the firm (similarly, studies on value relevance aim to verify the statistical association between firms' accountable value and market value). Information is reliable when it is free from deliberate bias and material error, and is complete. Reliability refers to expected future benefits and the probability that these expected benefits are realisable (Wyatt, 2008). "Relevant" is different from "Reliable" in that some empirical evidence suggests that, in certain circumstances, investors overreact to intangible information (Woolridge and Snow, 1990; Chan et al., 1990; Szewczyk et al., 1996).

Only a few studies have tried to analyze the reliability of value relevance due to the difficulties involved measuring this aspect empirically. For example, Kothari et al. (2002) provide evidence on the volatility of returns on R&D-expenditure, as opposed to those on property, plant, and equipment (PPE), and their conclusion is that R&D is not necessarily an asset as a consequence of the high uncertainty of future benefits. Furthermore, Amir et al. (2007) find that earnings in industries with high R&D-intensity are more volatile than in those with just high physical capital intensity.

In this paper, we would like to make a contribution to the existing literature, which has not investigated the value relevance of the different R&D accounting treatments in depth. The literature is particularly rich in work on the value relevance of financial data produced by the application of that accounting treatment which foresees the capitalization of R&D expenditure, while there is a lack of work on the value relevance of financial data produced by the application of that accounting treatment which foresees the expensing of R&D. In the next section, a model based upon Ohlson's equation will be built, through which the value relevance of the capitalized and the expensed portions of R&D expenditure can be measured together. This goes beyond the existing literature since, to the best of our knowledge, there are no studies which address this issue with reference to Italy. This issue has been addressed for the UK, in the work of Tsoligkas and Tsalavoutas (2011) and of Shah et al. (2013), but these studies do not reach the same conclusions.

In countries in the E.U., empirical studies using data from before 2005 have found that discretionary R&D capitalization, which is permitted by national regulators (national GAAP), was used as a tool for earnings management and was, therefore, detrimental for the usefulness of financial information. Two examples of such studies are that of Cazavan-Jeny and Jeanjean (2006) in France and that of Markarian et al. (2008) in Italy. Consequently, discretion can have a negative effect upon the informativeness of capitalization. However, as a consequence of the application of International Accounting Standards (IAS) to Italian publicly listed companies since 2005, the matter is now being regulated differently from how things were previously done under the Italian GAAP. We make our contribution with regards to the very years, 2005-2013, in which IFRS was adopted by Italian publicly listed companies. In this way a review is performed, in the theoretical framework (the next section), of the new elements introduced by the IAS and hypotheses are made on the impact that they have on the value relevance of the different R&D accounting treatments (capitalized and expensed portions of R&D expenditure). In section 2, we present the empirical research, together with a description of the data, variables and methodology. The results will be discussed and conclusions will be drawn in final section.

1. The framework

Capitalization, be it partial or total, is permitted by certain regulators (some national GAAP or IAS) if the project complies with predetermined success factors. Italian accounting regulations have always allowed the capitalization of R&D costs. Before 2005, accounting for intangibles and R&D costs in listed Italian companies was regulated by *Principio Contabile* no. 24 (Accounting Standard No. 24). This standard distinguishes three different types of R&D cost:

1. Basic research, normally carried out for the general utility of a company (e.g., market research, updating, etc.), which consists of studies, surveys, and experiments that does not refer to a specific project.
2. Applied research, which consists of studies, surveys, and experiments that refer to specific projects.
3. Development, which consists of the application of research results to specific materials, tools, products, and processes which precede production.

Although the costs borne for basic research are to be expensed in the income statement, the costs related to applied research and development can only be capitalized if the following conditions are met:

1. The costs refer to a project for the realization of a clearly defined product or process.
2. The costs are identifiable and measurable.
3. The project to which they refer is technically feasible.
4. The company owns the resources necessary to complete and to exploit the project.
5. The costs are recoverable through the revenues generated by the exploitation of the project.

Managers are in charge of separating basic research from applied research and development costs, of verifying the occurrence of the above mentioned conditions, many of which are subjective, and of deciding whether to capitalize or expense such costs (even when the above mentioned conditions are met). This clearly shows that there was room for earnings management opportunities in the Italian R&D accounting framework. An empirical study by Markarian et al. (2008) found that discretionary R&D capitalization in Italy can be used as a tool for earnings management. Discretionary R&D capitalization may be detrimental to the usefulness of financial information (Cazavan-Jeny and Jeanjean, 2006).

Since the adoption of the International Accounting Standards (IAS) in 2005, the matter has been regulated for Italian publicly listed companies by IAS 38.

IAS 38 *imposes* the capitalization of just some R&D expenditures. In particular, Research expenditure may not be capitalized and development costs must be recognized as an asset only if the company satisfies six restrictive requirements:

a. it has the technical feasibility of completing the intangible asset so that it will be available for use or sale;
b. it intends to complete the intangible asset and make use of or sell it;
c. it is able to use or sell the intangible asset;
d. the intangible asset will generate probable future economic benefits;
e. there is the availability of adequate technical, financial, and other resources to complete the development and to use or sell the intangible asset;
f. it is able to measure reliably the expenditure attributable to the intangible asset during its development.

At first glance, it might appear that the treatment of R&D expenditure is very similar under Italian GAAP and IFRS. However, there is a subtle but important difference: IFRS *requires* the capitalization of the R&D expenditure which meets the specified criteria, whereas the Italian GAAP which *provides an option* to capitalize that R&D expenditure. Thereby, management discretion has been constrained since the transition to IFRS.

Since certain R&D expenditures are recognized as an asset under IAS 38 if there is the "reasonable certainty that the intangible asset will generate future economic benefits", we hypothesize that the capitalized portion of R&D is significantly positively related to market values, because the market perceives these items as successful projects with future economic benefits. Therefore, it is assumed that the portion of capitalized R&D expenditure is value relevant, that is that the stock price is informative for market participants.

The value relevance of R&D assets (capitalized R&D) has been studied in the literature. In this sense, R&D costs are positively related to market value (Hirschey and Weygandt, 1985; Shevlin, 1991; Sougiannis, 1994) and yield value-relevant information to investors (e.g., Aboody and Lev, 1998; Lev and Zarowin, 1999; Healy et al., 2002; Monahan, 2005; Ciftci and Zhou, 2014). However, the capitalization of R&D costs has always been a controversial accounting issue. For example, Dinh Thi and Schultze (2011) find that capitalizing R&D increases the explanatory power of earnings for market values, yet it is pointed out that considering the capitalizing of R&D as informative is controversial, indeed channels other than accounting already make the information included in market values available to the market in the form of 'other information'. They conclude that the informativeness of R&D capitalization is due to the fact that this other publicly available information is captured by R&D capitalization and internalized into the accounting, and, therefore, that there is an increase in the explanatory power of the full data set.

At this point, we note the expectations of the international regulator (IAS) and the claims in the literature which we have referred to in order to formulate our first hypothesis:

H1: there is a positive relationship between capitalized R&D expenditure and stock price (or, similarly, capitalized R&D expenditure is value relevant)

The supporters of the expensing of R&D expenditure are in the minority. They stress that R&D cannot be relied upon to generate streams of future economic benefits (e.g., FASB, 1974; Kothari et al., 2002). In particular, supporters of expensing claim that "expensing" is preferable to capitalization because it increases the objectivity of financial statements. That is, it eliminates the opportunity for managers to capitalize the costs of R&D projects that have low probabilities of success (Nelson et al., 2003; Schilit, 2002).

This empirical research explains why the additional explanatory power of earnings is greater when R&D is capitalized rather than being expensed. This is due to the fact that the research referred to was carried out in the U.S., where SFAS 2 does not permit R&D capitalization. Under SFAS 86, only capitalization of software development expenditure is permitted in the USA.

Other studies have been conducted using R&D data from countries where the corresponding GAAP allowed R&D to be capitalized. Such countries as Australia, France, Italy and UK have been the objects of such studies. For Australia, R&D capitalization has been shown to improve the value relevance of financial information (e.g. Abrahams and Sidhu, 1998; Smith et al., 2001; Ahmed and Falk, 2006; Mitrione and Tanewski, 2014). In E.U. countries, empirical studies using data from before 2005 have found that discretionary R&D capitalization, which is permitted by national regulators (national GAAP), was used as a tool for earnings management and was, therefore, detrimental for the usefulness of financial information. Two examples of such studies are that of Cazavan-Jeny and Jeanjean (2006) in France and that of Markarian et al. (2008) in Italy.

However, the matter of whether there is a negative relationship between expensed R&D and stock market values has been much debated in such countries as the U.K. and U.S., but this, as far as we know, is the first time a study of this issue has been carried for Italy.

In the U.K., contributions before 2005 discovered that, on average, the expensed R&D expenditures had a relationship with market values that was positive and statistically significant (Green et al., 1996; Shah et al., 2008; Zhao, 2002). This result has been interpreted as if the market perceived of R&D expense as a capital component (i.e. asset) instead of treating it in the same way as any other expense. Therefore, besides the actual economic effects indicated in financial statements, the market participants reverse the effects of expensed R&D and think that this expenditure will have additional positive economic effects in the future. The consistent evidence that, in the UK, R&D expenses are considered in the same way as capital components is consistent with evidence from the US (e.g. Lev and Sougiannis, 1996; Aboody and Lev, 1998; Healy et al., 2002 Lev et al., 2002; Ballester et al., 2003; Xu et al., 2007) and elsewhere (e.g. Han and Manry, 2004 for Korea). However, it has been suggested that SFAS 2 does not permit R&D capitalization in the U.S. Only the capitalization of software development expenditures is permitted under SFAS 86.

This aligning of the research results from the UK and US is to be linked to the fact that, although UK GAAP have permitted the capitalization of certain R&D expenditures (unlike in the U.S.), in practice, capitalization of R&D was unusual among British listed companies before 2005 (Green et al., 1996). The explanation for this may lie in the fact that, given the uncertainty of R&D projects, the policy of expanding these costs was the most commonly adopted by managers of public listed companies in order to avoid having to give explanations about failed projects (Lev, 2001).

If all expenditures of R&D are expensed, successful and unsuccessful projects end up being incorporated together. Moreover, R&D expensing may have a negative or positive effect on stock price depending on the relative magnitude of unsuccessful and successful projects. In particular, expensed R&D expenditures might have a positive relationship with share prices if the market thinks that these expenditures will have additional positive consequences in the future beyond the actual economic effects indicated in financial statements.

The accounting treatment of R&D by companies that adopt IAS has changed in the UK since 2005.

The studies which have looked at the question of the value relevance of R&D expenditures in UK, in the post-IFRS period have often reached conflicting conclusions. This can be seen in to recent works on the problem, that of Shah et al. (2013) and that of Tsoligkas and Tsalavoutas (2011). Shah et al. (2013) indicate that, in the UK from 2001 to 2011 (from the pre-IFRS to the post-IFRS period), there was a positive value relevance of capitalized R&D. However, the value relevance of capitalized R&D appears to have decreased from the pre-IFRS to the post-IFRS period. Finally, Shah et al. (2013) indicate that there is no value relevance of expensed R&D, either in the pre-IFRS period or the post-IFRS period. In contrast, on the other hand, Tsoligkas and Tsalavoutas's (2011) empirical research obtains different results. These results indicate that, due to the adoption of IAS 38, expensed R&D has been significantly negatively related to market values in the UK, under IFRS (i.e. since 2005), supporting the proposition that they are not indicative of any future economic benefits.

For Italian publicly listed companies in the post-IFRS period, we base our hypotheses on the expectations of the international regulator (IAS). We consider that, under IAS 38, given certain R&D expenses, that which remains after the capitalization of an aspect of R&D expenses is an expensed item that should be negatively related to market values. Expensed R&D is an expense item, since it would include unsuccessful projects (i.e. expenses are unlikely to bring future economic benefits). Therefore, as it is an expense item, the influence it has on market price takes a negative sign. Our second hypothesis is:

H2: there is a negative relationship between the expensed portion of R&D and stock price (or, similarly, expensed R&D expenditure is value relevant).

After having assumed that the capitalized portion of R&D is significantly positively related to market values, because the market considers these items to be successful projects which will have economic benefits in the future, we go one step further and reason as if market participants thought of these intangible assets as having the capacity to generate greater streams of future economic benefits than other assets. We base this reasoning on the weight of the following empirical evidence. Lev et al. (2005) verified empirically that firms which practice relatively higher R&D spending are those which generally perform best in the stock market subsequently. Aboody and Lev (2000) found that insider trading leads to a higher frequency of gain for firms with greater R&D intensity. Boone and Raman (2001) document that research and development (R&D)-intensive firms have relatively high bid-ask spreads, and low depth. Eberhart et al. (2004) document that firms which increased their R&D expenditures exhibit abnormal long-term positive returns.

Therefore, our third hypothesis is the following:

H3: capitalized R&D expenditure has a greater impact upon stock price than other assets do.

2. Methods, sample selection, variables and measurements

We have identified firms that might be useful in testing the formulated hypotheses from those that are listed on the Italian stock exchange and have a large expenditure on research and development. By excluding financial and assurance companies and using data and "filter" functions of the AIDA database, all of the companies listed on the Italian stock exchange were ordered according to the size of the rapport between average values of R&D (capitalized on balance sheet) and turnover as revealed for the years 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012 and 2013. Only companies that showed a relationship between R&D capitalized and turnover above the median value on the list were chosen for the subsequent phase. These constitute the 50% of companies listed on Italian Stock Exchange with the highest values of capitalized R&D (percentualized with respect to their turnover). We consider these to be R&D-intensive firms. Not all of the companies could be included in our sample because it emerged from an analysis of their annual reports that 11 of them had presented incomplete information regarding R&D costs for at least one of the nine years we observed. At the end of this phase, 37 firms could be considered useful for the following investigation. However, since relatively few firms were excluded because of the lack off all the required data in comparison with those included, it is possible to assert the sample can be considered representative of R&D-intensive firms listed on the Italian stock exchange. The data for each firm was gathered from the annual report for each of the nine years covered by the period 2005-2013. Therefore, the sample comprised a panel of 333 observations (37 firms over nine years).

Financial and non-financial data were collected through the companies' investor-relations websites and the *Borsa Italiana* website, so all data were extrapolated from official financial statements.

The source for data relative to the stock price of the sampled companies and, more generally, the values of the Italian stock market was Datastream.

The most well known model in value relevance analysis is that of Ohlson (Ohlson, 1995; Feltham and Ohlson, 1995).

The Ohlson model relates a firm's market value to basic accounting data and other kinds of information. The model relies on some basic assumptions (Dechow et al., 1999). One assumption is that firm's equity market value is equal to the present value of expected dividends. This assumption is derived from the dividend-discounting model (DDM), the traditional model for firm evaluation (Miller and Modigliani, 1961), which approaches the problem of firm evaluation from the shareholder's perspective.

Another basic premise which supports the model is the Clean Surplus Relationship. CSR means that goodwill (equity market value minus book value of the firm) will equal the present value of expected future abnormal earnings. Finally, the last assumption assumes that abnormal earnings follow an auto-regressive process in such a way that goodwill equals current abnormal earnings, standardized by a constant. As a consequence, it is possible to derive the firm's market value by simply assuming the stream of abnormal earnings without having to refer to expected dividends. In the model, dividends that are paid at present reduce book value with no affect on current earnings. Thus, two properties which are strongly related to Modigliani and Miller's work (1961, pp. 411-433, and 1958, pp. 261-297) are satisfied.

The equation at the base of Ohlson's equity-valuation model can be written as follows:

$$value_t = k(\varphi x_t - d_t) + (1 - k)bv_t + \alpha v_t, \quad (1)$$

where:

$value_t$ = a firm's equity market value at date t;

x_t = earnings over the period ending at date t;

d_t = net dividends as of date t.

bv_t = net asset book value on date t;

v_t = other information at date t,

$\varphi = (1 + rf)$, where rf = the risk-free rate (thus $\varphi > 1$),

Finally $0 < k < 1$ and $\alpha > 0$[1].

Studies have attempted to validate the Ohlson model. Bernard (1995) points out that with discounted cash flow, the Ohlson model, which uses *book value* and *earnings*, is a better model to explain the movement of share price. Penman and Sougiannis (1998) compare common business valuation methods, techniques based on accrual earnings, dividend discount techniques, and discounted free cash flow analysis. The results reveal that techniques based on accrual earnings (Ohlson model) are the best business evaluation models in all situations.

Equation 1 has to now be re-elaborated to account for studies into the value relevance of activities/ expenditure on R&D that underline the importance of applying distinctions between accounting data which refer to the different aspects of R&D (Aboody and Lev, 1998; Han and Manry, 2004). For example, Aboody and Lev (1998) use a more elaborate version of the Ohlson model to compare how the expensing rather than the (at least partial) capitalizing of R&D expenditure influences the market. The Ohlson's equity-evaluation model is re-elaborated and some transformations are made within the equations written by Ohlson. These transformations are aimed at grasping the various effects of the different components of R&D expenditure.

In particular, we separate the capitalized element of R&D expenditure (i.e. $rdcap_t$) from the book value of net assets. In this way, we avoid mixing capitalized R&D with the other assets within the equations so as to control what effects capitalized R&D has on share price and to distinguish these effects from those of the combination of the other assets. Thus, we write: bv^*_t as $bv_t - rdcap_t$. In other words bv^*_t is book value minus capitalized R&D.

Therefore, we rewrite equation 1 as follows:

$$value_t = k\varphi x_t - k\, d_t + (1\text{-}k)\, bv^*_t + (1\text{-}k)\, rdcap_t + \alpha\, v_t. \quad (2)$$

Moreover, we bear it in mind that the variable for earnings (x_t) can be broken down into sales ($sale_t$) minus R&D expenses ($rdexp_t$), and other expenses ($oexp_t$). Therefore, we can rewrite equation 2 as follows:

$$value_t = k\, \varphi sale_t - k\, \varphi oexp_t - k\, \varphi rdexp_t - k\, d_t + (1\text{-}k)\, bv^*_t + (1\text{-}k)\, rdcap_t + \alpha\, v_t. \quad (3)$$

In doing this, we show both the R&D expenditures that are capitalized (indicated by $rdcap_t$) and those

[1] The explanations of k and α are disregarded here. They do not appear explicitly in the final linear regression equations and are absorbed into the regression coefficient. For details, see Ohlson (1995).

that are expensed ($rdexp_t$) in the equation. We also distinguish the expenses of R&D that are capitalized from the firm's other assets. However, as is written, the equation places limits upon the continuation and verification of our hypotheses. Our aim is to study the different components of R&D expenditure, because they might influence share price differently in terms of the sign (positive or negative) and magnitude. With regards to this, the equation 3 presents the following limits.

Firstly, as $rdexp_t$ is an expense item, the influence it has on market price takes a negative sign in equation 3. This is in line with our hypothesis, *H2*. However, expenditure on R&D might have a positive relationship to price if the market thinks that, as well as the actual economic effects indicated in financial statements, this expenditure will have additional positive consequences in the future. Similarly, as $rdcap_t$ is an asset, the influence it has on market price takes a positive sign in equation 3. This is in line with hypothesis *H1*. Additionally, equation 3 shows that capitalized R&D expenditure ($rdcap_t$) affects price positively to the same degree as other assets do (bv^*_t). However, the market might give $rdcap_t$ a higher value than other assets as a result of its capacity for generating greater future economic benefits as opposed to those provided by the combination of the firm's other assets.

In order to overcome these limitations and evaluate the value-relevance of the capitalized and the expensed portions of R&D, we now pass from the deterministic model explained by equation 3 to the multiple linear regression model.

Equation 3 becomes the basis of our regression model. With this intention, we add the firm subscript *i* and consider the φ value to be stable over the 2005-2013 period and then we write equation 4. With respect to variabile "other information", Han and Manry (2004) note that the precise nature of Ohlson's v_t "other information" in Eqs. (1), (2) and (3) is unknown, and may be an omitted variable (see also Leccadito and Veltri, 2014). However, if v_t is omitted, then the intercept may proxy for the information in a multiple linear regression model.

Eq. (4) is the basis of the regression model to test the value-relevance of capitalized and expensed R&D and the impact on a firm's equity market value that, on the one hand, R&D assets and, on the other, the combination of the other remaining assets have.

Deflating all variables by the number of shares outstanding and adding the intercept b_0 to the equation, the regression model becomes:

$$P_{it} = b_0 + b_1 SALE_{it} + b_2 OEXP_{it} + b_3 RDEXP_{it} + b_4 D_{it} + b_5 BV^*_{it} + b_6 RDCAP_{it} + e_t. \quad (4)$$

Where:

P_{it} = the market value of a single common stock as measured three months after the end of year *t*. This 3-month period is to give investors enough time to become informed of the contents of the financial statements for year *t*. In order to avoid our revelations being influenced by eventual anomalous trends regarding a particular day's trading, we calculate P_{it} as the average stock market value calculated for the first 15 days of April in the year (*t+1*).

$RDCAP_{it}$= R&D expenditures capitalized in year *t*,

D_{it} = cash dividends in year t,

BV^*_{it} = BV_{it} (net asset book value at the end of year t) – RDCAP*it*,

$SALE_{it}$= sales in year *t*,

$OEXP_{it}$= expenses in year *t* beyond those on R&D,

$RDEXP_{it}$ = expensed R&D in year *t*.

While e_t represents the stochastic errors.

RDCAP, D, BV, SALE, OEXP, RDEXP variables are deflated by the number of shares outstanding.

Our predictions are verified if it is found that the values of the following regression coefficients are significantly different from 0 (at a level of statistical significance of $p < 0.05$ at least) and also:

- regarding *H1:* the coefficient "b_6" is positive;
- regarding *H2:* the coefficient "b_3" is negative;
- regarding *H3:* the coefficients "b_5" and "b_6" are positive and, moreover, that $b_6 > b_5$, as the impact on the share market value of R&D assets (*RDCAP*) is predicted to be greater than that of the firm's other remaining assets (BV^*).

Table 1 shows the descriptive statistics. We find that, on average, the firms are profitable, with an average ROE of about 6.9% and the 75th percentile at 11.3% among the most profitable. The firms are leveraged at 56.3% and the 75th percentile is 72% among the most leveraged. This indicates that debt financing is an important source of funds. Finally, an average market value of equity is 1.73 times its book value.

Table 1. Descriptive statistics

Variable	Mean	Median	SD	25%	75%
P	12.5401	9.0133	5.6174	0.9327	25.1331
RDCAP	0.0448	0.0345	0.0120	0.0030	0.0842

Table 1 (cont.). Descriptive statistics

Variable	Mean	Median	SD	25%	75%
D	0.2244	0.1656	0.0623	0.0132	0.3405
SALE	*7.3511*	*5.3143*	3.5738	*0.5941*	*15.9133*
OEXP	6.4585	4.6299	3.8415	0.5386	14.4527
RDEXP	0.3938	0.2704	0.1286	0.0290	0.7040
ROE	0.0690	0.0731	0.0289	0.0035	0.1131
M/B	1.7353	1.5915	0.3630	1.0333	2.1957
LEV	0.5631	0.6101	0.0720	0.4101	0.7213
N = 333. All monetary variables are deflated by the number of shares outstanding.					

Note: *P* is the market price of a single common stock. *RDCAP* is the R&D expenditures that are capitalized and deflated for the number of shares outstanding. *D* is cash dividends deflated by the number of shares outstanding. *SALE* is sales deflated for the number of shares outstanding. *OEXP* is expenses beyond those on R&D deflated for the number of shares outstanding. *RDEXP* is expensed R&D deflated for the number of shares outstanding. *ROE* is "net profit / book value of equity". *M/B* is the market value divided by the book value of equity. *LEV* is the total amount of debt over the total book value of assets.

Table 2 refers to the variables used by the value relevance analysis, based upon equation 4, which we have already written. Table 2, in particular, shows correlations of variables taken two at a time. Each independent variable (monetary ones are divided by the number of outstanding shares) correlates significantly with P_{it}. In particular, Table 2 shows certain significant correlations:

- ♦ P_{it} with D_{it}; BV^*_{it} with D_{it}; P_{it} with $OEXP_{it}$; are correlated at $p < 0.05$.
- ♦ P_{it} with $RDEXP_{it}$; $RDEXP_{it}$ with $SALE_{it}$; BV^*_{it} with $OEXP_{it}$ are significantly correlated (at $p < 0.01$).
- ♦ P_{it} with BV^*_{it}; P_{it} with $RDCAP_{it}$; P_{it} with $SALE_{it}$; $OEXP_{it}$ with $SALE_{it}$ are strongly correlated (at $p < 0.001$).

Table 2. Correlation matrix

	Variables	2	3	4	5	6	7
1	P_{it}	0.178***	0.189***	-0.099*	-0.129**	0.171***	-0.119*
2	BV^*_{it}	1	0.073	-0.137**	0.107*	0.181***	-0.113*
3	$RDCAP_{it}$		1	0.051	-0.035	-0.062	-0.023
4	$OEXP_{it}$			1	-0.034	0.193***	-0.019
5	$RDEXP_{it}$				1	0.145**	-0.009
6	$SALE_{it}$					1	0.015
7	D_{it}						1

Notes: Pearson's product-moment correlation coefficients. $N = 333$; 1-tailed: † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3 presents regression results and test results. The significance of each regression coefficient is evaluated by using the *t*-statistic. As predicted by hypothesis 1, the values of the regression coefficients on $RDCAP_{it}$ are significantly different from 0 (the coefficient is $b_6 = 1.168$ at $p < 0.001$). Therefore, our regression analysis shows that capitalized expenditures on R&D can provide future economic benefits such as assets. On the other hand, our regression analysis shows that expensed expenditures on R&D do not provide future economic benefits such as assets. Indeed, the coefficient on $RDEXP_{it}$ is negative and significantly greater than 0 (the coefficient is $b_3 = -0.721$ at $p < 0.01$). The finding of a negative coefficient on *RDEXP* is in line with predictions of hypothesis 2, which consider *RDEXP* as just another expense item and, consequently, associate it with a negative impact on market price. If $RDEXP_t$ is negatively related to price, it is because the market does not believe that this R&D expenditure has future economic benefits, and this conforms with what is expressed in the firm's income statement.

According to hypothesis *H3* both coefficients (b_5) and (b_6) are positive. These coefficients are significantly different from 0 ($p < 0.001$).

The final line of Table 3 shows the differences between the coefficients regarding R&D assets (b_6) and the firm's other remaining assets (b_5). This difference is statistically significant (at $p < 0.05$). It is positive, that is b_6 coefficient is larger than b_5, and, hence, *H3* is supported. This means that the impact of R&D assets (*RDCAP*) on the share market value is predicted to be greater than that of the firm's other remaining assets (BV^*).

Table 3. Coefficient estimates from regression (of price) based on the following equation: $P_{it} = b_0 + b_1 SALE_{it} + b_2 OEXP_{it} + b_3 RDEXP_{it} + b_4 D_{it} + b_5 BV*_{it} + b_6 RDCAP_{it} + e_t$; the results of the *t*-statistics test are reported for all of the coefficients.

Coefficient and test statistics		
Variable	Coefficient	*t*-statistics
$SALE_{it}$	0.259 (b_1)	3.537***
$OEXP_{it}$	-0.341 (b_2)	1.79*
$RDEXP_{it}$	-0.721 (b_3)	2.439**
D_{it}	-0.193 (b_4)	1.903*
BV^*_{it}	0.297 (b_5)	3.331***
$RDCAP_{it}$	1.168 (b_6)	3.253***
R^2		0.107
Fsign		6.521***
$RDCAP_{it}$ - BV^*_{it}	0.871	2.121*

Note: N = 333; *t*-statistics test: * significant at 0.05 (one-tailed); ** significant at 0.01 (one-tailed); *** significant at 0.001 (one-tailed).

The model is fit, particularly explains about 10% of the variance and is strongly significant since F_{sign} = = 6.521 (significance at 0.001 level). In addition, we examine the variance inflation factor (*VIF*) of each independent variable in the regression model in order to detect potential problems with multicollinearity. The *VIF* value is particularly low in the model, in particular it is equal 1.49 so multicollinearity is not a problem[1].

Discussion and conclusion

We began this paper by asking ourselves the question: does disclosure of financial data of expenditure on research and development contain value-relevant information for market participants? Our research has answered this question for each of the constituent components of R&D that is for both the capitalized and the expensed portions of R&D. We first built a theoretical framework and then we gathered data relative to listed Italian companies since 2005, when they began to apply International Accounting Standards (IAS).

Before 2005, accounting for intangibles and R&D costs in listed Italian companies was regulated by *Principio Contabile* no. 24 (Accounting Standard No. 24). This *permitted* the capitalization of certain R&D expenditures which met the specified criteria. From 2005, following the adoption of International Accounting Standards (IAS), the matter has been regulated by IAS 38, which *requires* the capitalization of certain R&D expenditures that meet the specified criteria. Initially, the ways R&D expenditure is treated under Italian GAAP and IFRS may seem to be very similar. On closer examination, though, GAAP and IFRS present a subtle but important difference. IFRS requires (or better, *imposes*) the capitalization of R&D expenditure when the specified criteria are satisfied, whereas the Italian GAAP gives a choice of whether to capitalize R&D expenditure when it meets these criteria. This means that management discretion has been constrained as a consequence of the transition to IFRS.

Since certain R&D expenditures are recognized as an asset under IAS 38 if there is the "reasonable certainty that the intangible asset will generate future economic benefits", we have hypothesized *(H1)* that the capitalized portion of R&D is significantly positively related to market values, because the market perceives of these items as successful projects which will have economic benefits in the future.

Other effects should be consequential to the fact that IFRS puts a constraint upon management discretion. In particular, what remains of R&D expenses after the portion of R&D which has been capitalized is an expense item which is unlikely to bring future economic benefits. Therefore, we expect *(H2)* that expensed portions of R&D are negatively related to market values, since they would include unsuccessful projects.

Finally, we have hypothesized (*H3*) that market participants can perceive of intangible R&D assets (capitalized portion) as having the capacity to generate greater streams of future economic benefits than other assets.

To test all our hypotheses, we analyze data on those Italian listed companies that are quoted on the Milan stock exchange, which perform the most intensive R&D activity. In particular, we analyze a panel of 333 observations which reveals data on 37 firms over the nine years from 2005 to 2013. This opening year is not casual, but, rather, is the year in which Italian listed companies were obliged to apply International Accounting Standards (IAS) to draw up their balance statements. Our analyses totally support the predictions made. In particular, the analyses

[1] A VIF which is above 10 indicates the presence of problematic multicollinearity (Kennedy, 1992).

presented here provide strong support for hypothesis 1. There is a strong and positive statistical association ($p < 0.001$) between information on capitalized R&D (as expressed in the firm's financial statement) and share market value. Under IAS, information about the capitalized R&D of Italian listed companies is value-relevant and is considered by investors in their firm evaluation process.

Our research supports hypothesis 2. There is a negative statistical association (at $p < 0.01$) between information on expensed R&D (as expressed in the firm's financial statement) and share market value. Under IAS, information about Italian listed companies' expensed R&D is value-relevant and is considered by investors in their firm evaluation process. Market participants perceive that expensed R&D only contains unsuccessful projects that give no future benefit, but reduces the firm's value in the same way as any other expense. Finally, the analyses presented here provide support, albeit weak ($p < 0.05$), for hypothesis 3. From the investors' point of view, capitalized R&D expenditures have a positive impact on share price, and this impact is proportionately greater than that generated by other assets. We draw the conclusion that R&D assets contribute (proportionately) more than other assets to the widening of the gap between market and book values in the sampled companies. This gap has been measured and reported in Table 1 as $M/B = 1.7353$. Our finding contributes to the body of knowledge dealing with the impact of financial information (found within the firm's financial statement) that has on share market value, since it shows that market participants believe that R&D intangible assets (capitalized portion) are more capable of generating flows of future economic benefits than other assets are. Due to limited space available, we do not explain in this paper what the probability is that these expected benefits can be realised by sampled companies. This is an important question due to the fact that Kothari et al. (2002), for example, indicate that R&D-expenditures have a higher earnings volatility than property, plant, and equipment (PPE). With respect to this literature, we suggest that, on average, among the sampled companies analyzed, greater R&D assets are associated with higher market values. These incorporate higher expected future benefits, but also a higher uncertainty regarding the realization of these future benefits. The problem is that for firms whose value is largely composed of intangible assets such as R&D, management faces higher future uncertainty in transforming firm assets into revenues. The gap between market and book value is a useful indicator of what difficulties the firm's managers will encounter in the future when trying to maintain and/or extend their market value and, above all, what difficult tasks await the management in their transforming that (higher) market value into (greater) streams of earnings.

The results in this paper may be of interest to policy makers and academics. We find that the application of IAS 38 improves the value-relevance of financial information for R&D-intensive firms since capitalized R&D is value-relevant in the post International Financial Reporting Standards (IFRS) periods. In the same period, information about Italian listed companies' expensed R&D is also value-relevant and is considered by investors in their firm evaluation process. Market participants perceive that expensed R&D only contains unsuccessful projects that give no future benefit, while reducing the firm's value in the same way as any other expense. All of this can be seen to indicate that adopting of IAS has increased the explanatory power earnings having regarding market values. This study extends the existing literature which analyzed data on R&D expenses in Italy up until 2005, when the Italian GAAP provided firms with the option of capitalizing the R&D expenditure which met specific criteria. When analyzing pre 2005 data, empirical studies have found that discretionary R&D capitalization was used as an earnings management tool and that this was, consequently, deleterious in terms of the utility of financial information (Markarian et al., 2008 for Italy). Therefore, the discretion which Italian GAAP allowed before 2005 influenced the informativeness of capitalization negatively.

In addition, our study may be of interest to future research, given that it proposes the measuring of the value relevance of the different R&D accounting treatments (that is the value relevance of both the capitalized and the expensed portions of R&D) within a single model based upon just one equation, while the existing works usually analyze the two elements separately, concentrating first on one and then on the other.

Finally, this paper makes a contribution to the existing literature and shows policy makers and academics that it is very important to regulate R&D accounting treatments adequately and to avoid the use of discretionary R&D capitalization as an earnings management tool. Indeed, as mentioned, we find that R&D asset is one of the main contributors to the formation of the share market value of firms listed on the Italian stock exchange.

One important limitation of this study is the Italian economic context from which the data were gathered. Therefore, special care should be taken when generalizing about these results with regard to other national contexts.

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