VOLUNTARY DISCLOSURE REDUCES AGENCY CONFLICTS: AN EMPIRICAL ANALYSIS OF ITALIAN LISTED COMPANIES WITH SUBSTANTIAL INTANGIBLE ASSETS

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Abstract

R&D assets cause information asymmetries between shareholders and managers. In order to reduce such information asymmetries, our aim is to learn what typologies of additional information managers find it opportune to disclosure voluntarily in annual reports. We consider voluntary information which can be disclosed about strategy as well as that about R&D assets.

Our analysis, which is conducted on a panel of 195 observations, shows that information about R&D is more useful to investors than information about strategy, but companies obtain greater benefits from providing information about strategy because they are more useful to other important stakeholders, such as lenders, bondholders, suppliers and others. For firms whose value is largely composed of assets such as R&D, management faces higher future uncertainty in transforming firm assets into revenues. This increases the utility for investors and other stakeholders of knowing the strategy management intends to anticipate and deal with eventual changes in the environment.

Keywords: Disclosure, Agency Conflicts, R&D, Strategy, Information Asymmetries, Growth Options

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Introduction

This paper uses the term "voluntary disclosure" to refer to information within the annual report which is voluntarily disclosed by managers and is additional to that which, by law, has to be included in the annual report itself. What is more, we choose expenditures on research and development as the focus of this work, since, for accounting literature, R&D is the main contributor to asymmetry of information between managers and third parties external to the firm.[31]

Voluntary disclosure is a mechanism which is used by managers as a means to protect investors and limit agency conflicts. According to some authors (Jensen and Meckling, 1976; Williamson, 1981), disclosure may reduce agency costs in the relationship between fund-providing shareholders and management. Williamson (1984) suggests that the transaction specificities can lead to information asymmetries. These may be attenuated by the revealing of further information, so providing a greater degree of transparency and giving investors the possibility to evaluate the firm with more precision.

One positive effect of voluntary disclosure might be a reduction in the cost of capital (Botosan, 1997; Leuz and Verrecchia, 2000) as a result of a reduction in information asymmetry. According to Eccles et al. (2001, Ch. 10) enhanced levels of disclosure will probably reduce firms' capital costs. However, the revealing of information is not without cost as it is linked to the emergence of competitive disadvantage effects. These effects relate to disclosure of information which may well be of value to the firm's competitors. The consequences for competitive advantage of such disclosure are, though, "complex and difficult to predict" (Guo et al., 2004, p. 323). The theory of proprietary costs argues that costs which relate to the revealing of information may weigh against information dissemination (Dye, 1985; Verrecchia, 2001; Prencipe, 2004), so much so that, in order to avoid competitive disadvantage, insiders might choose not to reveal further information, so protecting investors (Dye, 2001). As the intensity of competition increases, the disclosing of information becomes more costly (Darrough and Stoughton, 1990).

The decision to disclose additional information is typically made in terms of a cost-benefit framework.

This decision is taken following strategic analysis and with a view to maintaining/gaining competitive advantage. From the strategic analysis prospective (see Grant, 2010), a firm which considers carrying out some research and development (R&D)

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[31] In particular, Aboody and Lev (2000) find that insider trading leads to a higher frequency of gain for firms with greater R&D intensity. This indicates that R&D generates a great deal of information asymmetry.

activity, will analyse attentively the set of decisions to be made and the firm's resources. In the course of the analysis, it might appear that the firm has sufficient resources at its disposal to perform the R&D processes identified, possibly through retained earnings (owners' equity generated by corporate saving). In such a situation, it would not appear necessary for the firm to disclose (voluntarily) additional information. In this circumstance, therefore, the firm (ceteris paribus) is less sensitive to the potential benefits of voluntary disclosure and would, in fact, avoid proprietary costs of disclosing. The situation is different if the firm needs to make use of equity. In this case, analysis of points of strength/weakness may indicate the need to disclose (voluntarily) additional information in order to reap the benefits of a reduction in capital costs.

At this point, it might be important for practitioners and academics to learn which information managers find it convenient to communicate so as to minimise proprietary costs and maximise the above mentioned benefits. In particular, we limit the analysis to two categories of information, that regarding R&D and that about strategy, which managers could disclose in order to reduce the information asymmetries between investors and themselves when their firms make intense expenditures on intangible R&D activities. The choice between the two categories of information is not a casual one, but rather is supported by a review of academic works, some of which affirm the importance of R&D information and others the importance of strategy information. This review is performed in the first part of the theoretical framework, entitled "Which type of information do management disclosures convey to investors most frequently?" which is presented in the next part of this paper. Instead, in the second part of the theoretical framework, entitled "Which type of information do investors find more useful?", we measure the utility for investors of information voluntarily disclosed about R&D and about strategy taken singularly. Voluntarily disclosed information is useful for investors when it does not regard current values, as expressed in the firm's financial statement, but is of relevance in terms of its future earnings. This occurs when the stock price reacts as a result of the disclosure of additional information. Investors' reactions to the two different types of information that are voluntarily disclosed by managers will, however, be compared. The Ohlson (1995) model will be used with this aim.

In section 3, 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 section 4.

2. THEORETICAL BACKGROUND AND HYPOTHESES

2.1 Which type of information do management disclosures convey to investors most frequently?

Managers have great incentives to increase disclosure of information about R&D when R&D expenditure and activities are at their most intense. Inadequacy of financial information is a major incentive to managers. Baruch Lev has conducted several studies into problems which are specifically inherent to R&D assets (e.g., see: Lev *et al.*, 2005; Aboody and Lev, 1998; 2000) and argues that the reason for this inadequacy is that the firm's financial statements are not an adequate reflection of the value that such innovative activities as R&D produce. A consequence of this is that the firm (if it does not make voluntary disclosure about this activity) might be unfavourably affected by the myopia of the capital market in terms of the resource allocation process that the market itself performs. Lev (2001) argues in favour of these claims, suggesting that the current accounting model (with no further disclosure) causes investors to systematically undervalue intangibles. Lev et al. (2005) go on to verify empirically that the firms which practice relatively higher R&D spending are those which generally perform best in the stock market subsequently, indicating that market participants had previously undervalued these. The expensing rather than capitalising of R&D expenditure means that the market does not value such expenditure correctly when it is actually carried out. In other words, the fact that non-capitalised R&D expenditure could bring about positive results in the future is not understood by market participants.

Capitalisation, partial or total, is supported by certain regulators (IAS) if the project complies with predetermined success factors. However, given the uncertainty of R&D projects, Lev (2001, p. 89) suggests that the option of expanding these costs is used by many managers to avoid having to give explanations about failed projects.

A number of contributions, including those mentioned above, suggest the desirability of different specific accounting/disclosure treatments for R&D assets. Above all, as far as voluntary disclosure is concerned, the indications which emerge are presented clearly and synthetically by Lev (2001, p. 122), who encourages voluntary disclosure of information about R&D.[32] However, it is claimed by

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[32] Moreover, he suggests that the accounting system be changed. In particular, he says that the criterion of recognition should be widened. This widening would take place through the relaxing of the reliability (likely future benefits) and control (the degree of control the firm has over an asset) criteria. Finally, Lev (2003) recommends the introduction of a "comprehensive balance sheet that

other studies that firms will tend to make disclosures if they have greater information asymmetries in order to obtain benefits relating to greater liquidity and lower costs of capital (e.g. King et al., 1990; Amihud and Mendelson, 1986). Given these conditions, we form the following hypothesis:

H1: there is a positive relationship between R&D intensity and voluntary disclosures of R&D

Looking at the problem with this logic means considering the possibility that the higher the level of R&D expenditures and activities are, the more information about the scope and progress of those activities is useful to investors and the more investors will ask firms for information about those R&D expenditures and activities, which are not typically included in financial reports. According to the American Securities and Exchange Commission (SEC, 2001), investors "also need to understand the key milestones for the development of the company and its progress on achieving key operating performance measures". This includes the revealing of more information regarding the process of innovation, for example the progress of already activated R&D projects as well as those which have found financing, but are still to be activated.

The need to furnish voluntary information about R&D arises not only because of absent, or partial, recognition on the balance sheet of streams of benefits due to research and development, but also when earnings reported in the Periodic Income Statement are of less use for the assessing of firm value. If information regarding earnings is considered to be less useful, there will be more incentive for managers to reveal non-financial information (Gu F. and Li J. Q, 2003). Investors are likely to find the communicating of information about innovation to be of use given that the value produced by innovative activities like R&D is not adequately reflected in the financial information that investors might obtain from traditional accounting models (FASB, 2001). When earnings information is less useful, the communication of innovation information will probably be of greater value to investors. As argued by Chen et al. (2002), it is to be expected that, when current earnings are less informative, they will be of less use for investors in their evaluation of the firm. Therefore, we predict that more information of R&D will be disclosed by firms when information conveyed by current earnings is of less use. From an accounting measurement perspective, if earnings are not informative, this is likely to be linked to the fact that revenues and expenses diverge under the R&D expensing rule. If, over time, there is variation in the rate of investment in R&D, there will be a clear

recognises the creation of those intangible assets to which you can attribute streams of benefits" (p. 20).

difference between reported earnings which are based on immediate expensing and economic earnings which are based on R&D capitalisation. It is to be expected that a consequence of this distortion in the process of accounting measurement will be a reduction in the degree to which earnings information is useful. In this sense, it has been discovered that firms whose R&D spending rate increases most have earnings which are less informative (Lev and Zarowin, 1999). On the basis of this, we believe that the revealing of R&D information is positively influenced by variation in the R&D spending rate and, therefore, we hypothesise that:

H2: there is a positive relationship between the growth in firms' rate of spending on R&D and additional information on R&D that those firms reveal voluntarily.

Looking at the problem of useful of earnings information, we also predict that when firms report losses (i.e. negative earnings), there will be an increase in amount of information about innovation activity (of R&D) that they will reveal. Given that negative earnings are found to be of less use when investors wish to evaluate firms, some authors argue that, should losses occur, further value-relevant information will be required by investors so as to add to the information on earnings (Gu F. and Li J. Q, 2003; Collins *et al.*, 1997). Furthermore, investors will find the revealing of information about innovation to be of greater use when assessing the value of firms which are R&D-intensive given that losses in such firms often indicate a lack of earnings in the initial phases of the process of innovation as these are often linked to less certain prospects and, consequently, less certain future revenue.[33] Therefore, in both of the circumstances in hypotheses 1 and 2, managers are believed to have higher incentives to reveal information regarding their firms' innovation activities when losses are made. In more technical terms, it is therefore probable that losses will moderate (influence) the strength of the relationships between:

- intensity of R&D and disclosure of information about R&D;
- growth in the rate of spending on R&D and disclosure about R&D.
- Therefore, these are our third and fourth hypotheses:

  H3: The positive relationship between R&D intensity and voluntary disclosures of R&D is significantly greater when firms report operating losses

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[33] Mansfield and Wagner (1977) estimated that, in R&D projects, as products approached the final stages of innovation, mean probabilities of success improved by around 8-9%.

H4: The positive relationship between the growth in firms' rate of spending on R&D and additional information on R&D that those firms reveal voluntarily is significantly greater when firms report losses

The disclosure of information regarding strategy is also considered of great relevance by regulators and standard setters in their efforts to optimise flows of information within capital markets. In order to improve voluntary disclosure, the Financial Accounting Standards Board (FASB, 2001) and some authors emphasise, among other things, the usefulness of information about firm strategy and its execution (Gu and Li, 2007). In particular, the FASB specifically indicates revelations of "managements' strategies and plans for managing those critical success factors in the past and going forward" as vital for the improvement of business reporting (FASB, 2001 p. 13). Fuller and Jensen (2002), Hutton (2004) and others have indicated that the disclosure of information about strategy has a central role in rendering financial reporting transparent and effective in the post-Enron era.

Other contributions help us to learn how the role of strategy-related disclosure is highly relevant in optimising information flows in the capital markets. It is certainly useful to include the thoughts of Skinner (2008a; 2008b) amongst these contributions. Skinner criticises arguments by Lev and others who suggest that capital markets experience negative effects because of limits within the current system of financial reporting on intangibles. Skinner affirms that the higher cost of capital that firms with large amounts of intangibles face is neither unequivocally nor univocally attributable to deficiencies in current accounting model. According to Skinner, firms that possess large amounts of intangible assets, such as R&D, have a higher cost of capital because they differ economically from those firms with a value which is dominated by tangible assets. Firms with more intangible assets have more "growth options", that is more investment opportunities to choose between over time.[34] From this perspective, innovative activities such as R&D are among the main contributors to "growth options". The more growth

options grow, the more risk for those who provide funds (equity or debt) increases. In the future, these funds can easily be switched to higher risk growth opportunities by firms' managers. Firms which have a higher number of growth options available face greater challenges and risks than other firms. For example, once managers have obtained some financing, they could profit by switching investment from the projects proposed, when asking for the finance, to opportunities which present greater risk, so reducing the value of the financers' (lenders and shareholders) claims (Smith and Watts, 1992). Firms which have more "growth options" will exhibit larger asymmetries of information, reducing the liquidity of their share market and raising their capital costs (Amihud and Mendelson, 1986). However, this cannot be considered as the effect of probable shortcomings in the current accounting model, but rather a reflection of the fact that investors sustain that it is riskier to carry out expenditure on intangibles than it is in other investments.

From Skinner's explanations, we learn that efforts to optimise information flows in the capital markets have to focus upon "growth options", given that they are the cause of information asymmetries between financiers, the fund providers, and managers, the decision makers.

The "growth options" coincide with the breadth of the range of investment opportunities available to the firm's strategy (Myers, 1977). The wider the range of these investment opportunities is, the more difficult it will be for financiers to stipulate a complete contract, since it means a larger information asymmetry between financiers and management. Therefore, it is probable that financiers will seek further value-relevant information and managers might reveal information about strategy in order to meet this demand, i.e, providing information about their plans and objectives. Indeed, it is by defining/describing its strategy that a firm chooses to and declares that it will exploit certain investment opportunities while rejecting others.

Firms whose value is largely comprised of R&D assets exhibit greater future uncertainty and must support higher pressure from investors. As a consequence of this, there will probably be very strong incentives for management has to keep financial markets informed of its intentions with regards the challenges and opportunities that exist in the firm's environment (Bhojraj et al., 2004) and prevent no news from being understood as bad news by the market (Grossmann, 1981; Milgrom, 1981). Furthermore, from this prospective, it seems that the gap in communication between firms and the equity markets might be filled effectively by the voluntary disclosure of additional information about strategy. Therefore, we make the following hypothesis:

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[34] Skinner uses the definitions which Myers (1977) provided. Myers separates what he calls "assets-in-place" from "growth options". The assets-in-place are assets that the firm has already invested in whereas growth options are investment opportunities for which the firm has an option to proceed (Skinner, 2008a). Myers demonstrates that firms with many growth options exhibit much bigger information asymmetries between insiders and outsiders. For example, financers may be unwilling to lend to firms because information asymmetries render it difficult for them to be sure that managers of these firms will not take riskier investment opportunities once they have acquired the sought-for finance.

H5: there is a positive relationship between R&D intensity and voluntary disclosures of strategy

Looking at the problem with this logic means considering the possibility that the higher the level of R&D expenditures and activities are, the higher the future uncertainty will be and the greater investor pressure will be to know the plans the firm has to address changing environments and to deal with the challenges and opportunities which emerge. This prospective has its roots in the distant past, for example Skinner notes that Knight (1921, Part III) already claimed that "uncertainty engages managers and investors in a constant search for information to improve their foresight and decisions; managers have a central role in generating estimates of the future as they design and execute their firm's strategy. These estimates embody a range of expectations about investor and consumer behaviour and wider economic conditions" (Skinner, 2008a).

We define disclosure of strategy as statements about the strategic aims of investment and plans managers have for how these aims are to be achieved. This is in line with the following definition of strategy which was provided by Andrews (1980, p. 18–19):

"Corporate strategy is the pattern of decisions in a company that determines and reveals its objectives, purposes, or goals, produces the principal policies and plans for achieving those goals, and *defines the range of business the company is to pursue*, the kind of economic and human organization it is or intends to be, and the nature of the economic and non-economic contribution it intends to make to its shareholders, employees, customers, and communities." We have emphasised "defines the range of business", because this means clarifying which investment opportunities the firm intends to avail itself of.

We complete the discussion regarding information about strategy by noting that, since as younger firms tend to get less attention from analysts, they normally exhibit higher levels of information asymmetry. The younger firms are, the more investors will find voluntary disclosure of additional information to be useful, because these firms' future operations (regarding strategy planning and execution) will tend to be more unpredictable and there will be less certainty regarding their earnings prospects (Lang, 1991). Further teachings on this argument come to us from the strategic literature of the Resource Based View (RBV) (Rumelt, 1984; Hansen, Wernerfelt, 1989; Rumelt, 1991; Grant, 1996). According to the RBV, the strategic prospects of the firm are highly influenced by the material and intellectual resources that a firm has accumulated over time. In this way, time influences the firm's strategic trajectory to the extent that the firm's strategy may be seen as being "path dependent". The capabilities by which firm managers integrate, build and reconfigure the resource base to adapt it to changing market

conditions in order to achieve a competitive advantage are also path dependent (Teece *et al*, 1997, p. 516). From this prospective, investors' demand for value-relevant information about strategy might also be influenced by the age of a firm. With regard older firms, analysts have a greater knowledge of the firm's resources and skills and how these might predictably influence the firm's chosen strategy while information is more limited for younger firms. Therefore, ceteris paribus, younger firms make more disclosures with the aim of reducing information asymmetry (King et al., 1990). Consequently, our sixth hypothesis is the following:

H6: there is a negative relationship between a firm's age and voluntary disclosures of that firm's strategy.

Previous literature examined the importance that voluntarily disclosed information about strategy and R&D have. For example, empirical studies have tried to measure the impact that this voluntary disclosure has on investment recommendations formulated by financial analysts. In operating as intermediaries between managers and investors, financial analysts perform a very important role in the transmission of information; their recommendations are Buy, Hold, and Sell. García-Meca and Martinez (2007) find that financial analysts give great importance to new investments and the consistency of strategy to justify their recommendations in over 70% of their reports. Having looked at 105 sell-side analyst reports, Breton and Taffler (2001) conclude that, in formulating their recommendations, strategy is what financial analysts examine most when selecting from among alternative investment options. Orens and Lyabert (2004) reach analogous conclusions.

What is more controversial is the empirical evidence regarding the importance of voluntarily disclosed information about R&D. For example, from her analyses of 105 analyst reports regarding knowledge-intensive firms in Scandinavia, Arvidsson (2003) produces disclosure scores which indicate that financial analysts give more importance to information about R&D. In contrast, Larrán Jorge (2001) and García-Meca et al. (2005) find that analyst reports do not include of much of this kind information due to the fact that it is not frequently disclosed voluntarily in Spain, the country they examined.

2.2 Which type of information do investors find more useful?

It is not certain that the all of the information which shareholders look for is (in practice) provided voluntarily by firm managers, just as it is not given that all of the information that managers provide voluntarily is (in practice) useful to shareholders. This is because of two series of factors. First of all,

managers make a decision about what information is to be revealed and how it should be presented. One consequence of this is that the information may be manipulated (Watts and Zimmerman, 1986). Moreover, as has already been explained, sometimes the firm only voluntarily discloses information which is useful to shareholders when this disclosure brings benefits which are greater than the relative costs. However, these costs are unfortunately difficult to quantify (see also Cooke, 1989). None of this renders it less opportune for us to study whether information which managers voluntarily disclose is useful enough to shareholders to influence (or not) their investment choices. The focus of our investigation is on the degree to which voluntary disclosure becomes stock price informativeness. Stock price informativeness is measured as the stock price reaction to the disclosure of additional information. Management disclosure, which is associated with significant stock market price reaction, contains value-relevant information (Wyatt, 2008). In other words, shareholders find certain leading indicators in voluntarily disclosed additional information which the firm's balance sheet and income statement still do not show, but are of use when trying to forecast the firm's future performance.[35] For example, Lundholm and Myers (2002) discover that disclosures on the part of management provide investors with information which is indicative of what the firm will earn in the future, but is not to be found in its current earnings. On the basis of this, a positive influence of disclosure on stock price can be predicted. In particular, the hypotheses which can be made are:

> H7: There is a positive relationship between disclosures of R&D and stock price (or, in the same way: information about R&D which is voluntarily disclosed by managers is value relevant)
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> H8: There is a positive relationship between disclosures of strategy and stock price (or, in the same way: information about strategy which is voluntarily disclosed by managers is value relevant)

Much literature testing for association between stock price and financial and non-financial information has employed the regression model of Ohlson (1995) and Feltham and Ohlson (1995).[36] The model uses the accounting data of income statements and balance sheets and employs the corporation's book value, residual income, and other information to explain share price movement. In particular, in this model, the share price (P_t) is regressed on book value (BV_t), residual (excess) income (X_t^a) and other information (v_t).[37] In its most simple form, the Ohlson model can be written as:

$$P_t = BV_t + \alpha_1 * X_t^a + \alpha_2 * v_{t+} \epsilon_t$$

Where ϵ_t are the stochastic errors which are assumed to have normal distribution, a mean of zero and to be uncorrelated with other variables in the model.

The survey carried out by Wyatt (2008) as well as many other works suggest that information disclosed about intangibles forms a special category of other information (v_t) for the Ohlson (1995) model, and is, therefore, value-relevant.[38] According to these academics' works, we also treat information about R&D and strategy that is voluntarily disclosed as "other information". Therefore, the variable "v_t" can be decomposed into information about R&D and information about strategy and the regression equation can be rewritten as:

$$P_t = BV_t + b_1 * X_t^a + b_2 * InformationOnR\&D + b_3 * InformationOnStrategy_+ \epsilon_t$$

Additional information about R&D and strategy is value-relevant if we find a statistical association between this additional information and share market value. That is, the existence of a statistical association is determined by looking at the estimated regression coefficients, the "b_2" and "b_3" and testing whether

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[35] "Relevant" is different from "Reliable". Information is value-relevant if it is considered by investors in their firm valuation process (similarly, studies on value relevance are aimed at verifying the statistical association between firms' accountable value and market value). Information is reliable when is free from deliberate bias and material error and is complete. Reliability refers to expected future benefits and what the probability that these expected benefits are realisable (Wyatt, 2008). Some empirical evidence suggest that in certain circumstances, e.g. investors' overreaction to intangible information (Daniel and Titman 2001), intangible information will be value-relevant, but this has nothing to do with the reliability of that intangible information.

[36] See for example: Amir and Lev (1996); Kristandl and Bontis (2007); Wang (2008) and Liu *et al.* (2009).

[37] Residual (excess) income (X_t^a) is earnings in year *t* reduced to a value equal to that of the product between the equity book value for year *t-1* multiplied by the *rf* rate, that is the risk-free rate, for example that inherent to the treasury security yield.

[38] Ohlson (1995) did not give a definition of the "other information" in the model. However, researchers have often used the category of "other information" to examine the value relevance of non-financial information. Among these researchers, Amir and Lev (1996) examined the value relevance of financial information and non-financial information for investors in the wireless communication industry. They find that non-financial variables indicate a high degree of value correlation. Other researchers, including Wang (2008) and Liu et al. (2009), have more recently used the category "other information" to show the value relevance of non-financial information empirically.

they are significant. For example, if the test statistics for "b_2" and "b_3" are significant, we can infer that the other information, which the firm's balance sheet and income statement still do not show and is dealt with in this paper as the information about R&D and strategy that is voluntarily disclosed by managers, is associated with the value-relevance measure on the left hand side of this regression equation.

The Ohlson model is also used to compare the value-relevance of different variables. 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) capitalising of R&D expenditure influence the market.

By exploiting the possibility to make comparisons which the Ohlson model provides, we contrast the stock price informativeness of voluntary disclosures regarding R&D with that regarding Strategy. From a theoretical point of view too, we can use insights from the surveyed, preeminent literature which:

- one the one hand, supports the importance of information about R&D to predict that

  H9: information about R&D have a greater impact upon stock price than does information about strategy.

- while on the other hand, supports the importance of information about strategy to predict that

  H10: information about strategy have a greater impact upon stock price than does information about R&D.

3. Method: sample selection, variables and measurements, descriptive and univariate statistics and the regression models

A method was adopted to identify firms listed on the Italian stock exchange that might be useful in testing the formulated hypotheses. To choose firms for the sample, we used data and the "filter" functions from the AIDA and Datastream databases. Financial and insurance companies were excluded. All of the companies remaining were ordered according to the size of the rapport between average values of R&D (capitalised on balance sheet) and turnover as revealed for the years 2008, 2009, 2010, 2011 and 2012. Only companies above the median on the list were chosen for the subsequent phase. These companies constituted 50% of listed Italian, non financial and non insurance, companies with higher R&D asset values (percentualised with respect to their turnover). Not all of the companies could be included in our sample because it emerged from a manual analysis of their annual reports that some of them had presented incomplete information regarding R&D

costs for one of the five years we observed. At the end of these phases, only 39 firms could be considered useful for the following investigation. The data for each firm was gathered from the annual report for each of the five years covered by the period 2008–2012. Therefore, the sample comprised a panel of 195 observations (39 firms over five years). This opening year is not casual. As a result of modification to the rules in the Civil Code (updated article 2428), Italian listed companies increased disclosure in their annual reports from 2008 on. The newly required disclosure regards a wide range of issues, such as key financial and non-financial performance indicators, risks, environmental impact of the operations and human resources. In particular, the updated article 2428 Civil Code requires that R&D activities are discussed in the "relazione sulla gestione" (director's report), just as directors should also convey strategic information regarding the environment, investment and future behaviour of the company. However, there is no clear requirement as to what quantitative or qualitative disclosures should be provided.

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

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

3.1 The analysis to test which information is most frequently conveyed to investors

Dependent variables

To test hypotheses 1, 2, 3 and 4, we study a disclosure index relative to Research and Development (DISC.RD variable); while to test hypotheses 5 and 6, we study a disclosure index relative to Strategy (DISC.ST variable). Through these two disclosure indices, we measure *extent (breadth) and depth of information* that is voluntarily disclosed by the sampled companies. In particular, we use the method described by Adrem (1999) and, then, by García-Meca et al. (2005) to control the *extent of information about Strategy or R&D voluntarily provided. Therefore, we refer to* a set of items regarding both strategy, listed in table 1, and R&D, listed in table 2, considered as communicable (by a firm). We measure *the extent of information as a* percentage of the items of information revealed to the total of *all the items (*considered as communicable by a firm) regarding strategy, on one hand, or R&D, on the other. This particular formulation of the *extent of information revealed in annual reports* permits us to compare the *extent of the R&D information revealed with that regarding strategy.*

In order to calculate the disclosure indices relative to Strategy (DISC.ST variable) and Research and Development (DISC.RD variable), we also bear in mind the depth of the disclosed information. Therefore, we give a score to each item voluntarily disclosed by managers and quantify the scores following the method used by Cerbioni and Parbonetti (2007), who affirm that the qualitative and quantitative aspects of firms' voluntarily disclosed information should be investigated together. In particular, if information disclosed about one of the items listed in Tables 1 or 2:

- is only expressed in discursive rather than numerical terms, then a score of "1" is given to that item.
- is also expressed in numerical terms (besides discursive terms), that is both in monetary or non-monetary terms, than a score of "2" is given to that item.

We calculate (for each sampled firm and for each year) each of the two disclosure indices as the percentage of the actual score revealed to the total score that the company may communicate (the total that would be achieved by giving score 2 to the items included in the established list in Tables 1 and 2). Therefore, the qualitative and quantitative information which managers disclose is measured in this work in terms of the percentage of information provided against the maximum volume of information which is considered communicable by companies. The maximum volume has never been achieved by any of the sample companies due to the fact that none of the firms provided all of the information. Maximum volume (obtained theoretically) would be achieved if all of the items on an established list were the object of both qualitative and quantitative voluntary disclosure. It is useful to express the disclosure indices in percentages so as to be able to compare the *information revealed about Strategy and that revealed about R&D, while, at the same time, keeping both the extent and the depth of the information that is voluntarily disclosed by managers (in the two contexts) in consideration.*

Descriptive information is not necessarily followed by numerical information while, vice versa, numerical information (when provided) is expressed after descriptive/narrative information. In order to avoid counting the same information twice, from here on, when we refer to descriptive/narrative information, we just mean discursive information (with no numerical specification) with regard items (among those in the established lists in Table 1 or 2). While, when we refer to quantitative information, we mean more complete information about each item, since it includes both a descriptive and a numerical element.

Voluntary disclosures about R&D expenditure and activities, on the one hand, and strategy, on the other, may appear in any part of the annual report, for example, the notes to the financial statements or the "relazione sulla gestione" (director's report). Therefore, we calculate disclosure indices (DISC.RD and DISC.ST variables) by using annual reports from the end of the fiscal year (31st December in Italy) per each of the 5 fiscal years between 1st January, 2008 and 31st December, 2012.

Table 1. List of the items utilised to measure disclosure index relative to Strategy (DISC.ST)
We employ the items used by García-Meca (2005) to measure disclosure about firm's strategy.

New products to be marketed and new technology to be employed
Investment in new markets
Business vision; objectives and consistency of strategy
Leadership and brands
Acquisitions
Strategic alliances, agreements
Supplier and customer networks
Product quality
Information about marketing
Price policy
Organisational structure
Market share by segment/product
Shareholders structure
Relative market share to competitors
Best practice
Corporative culture
Market share
Environmental investments
Social responsibility

Note: The items refer to the choices regarding the area of business in which to compete, how to compete and with which internal or external structure (collaborative relationships with other firms) the firm wishes to face competition

The fitness of aggregation of items relative to Strategy is evaluated by using Cronbach's alpha. This assesses the capacity of a group of elements to measure an entity in common, in this case disclosed information regarding strategy. Cronbach's alpha of the scale was 0.6973. Therefore, this was able to judge the feasibility and coherence of the scales as valid (see Nunnally, 1978; Malhotra, 1997).

Table 2. List of the items used to measure disclosure index relative to R&D (DISC.RD)

Patents and licenses acquired in the course of innovative R&D activities
objective of R&D
Future projects regarding R&D
Implementing, continuing, or concluding of projects of R&D
Basic research
Development and Product design
Patents pending due to R&D
Relationships of past R&D activity to actual innovation *(e.g.* new developments, improvement in the use of existing technology)
Period of the innovation *(e.g.* how long is required to carry out the research and development of a new product)
Programmed levels of financing to meet R&D expenditure
Form of collaboration with other companies and/or government in R&D initiatives
Human capital and details on research teams

Next, we ran Cronbach's alpha to validate the aggregation of items relative to R&D. Cronbach's alpha of the scale was 0.7131. Therefore, this was able to judge the feasibility and coherence of the scales as valid.

Independent variables

On the basis of the predictions made by the framework, we choose to measure, for each firm in the sample and at the end of each year between 01/01/2008 and 31/12/2012, the variables:

- RD.INT = the intensity of R&D, the (total) expenditure in R&D divided by total sales. Our hypotheses predict positive relationships between RD.INT and the dependent variables DISC.RD (H1) and DISC.ST (H5).
- CH.RD = the change of R&D intensity, that is Δ RD.INT, calculated as the difference between the R&D intensity measured at the conclusion of a given fiscal year (*t*) and that measured at the conclusion of the second preceding year (*t-2*). Our hypotheses predict a positive relationship between CH.RD and the dependent variable DISC.RD (H2).
- AGE = age of the firm, the time period (calculated in years) since initial quotation on the stock market. Our hypotheses predict a negative relationship between AGE and the dependent variable DISC.ST (H6)
- LOSS= a dummy variable equal to 1 if net income before extraordinary items is negative, and 0 otherwise. To be more precise, within our analysis framework, LOSS is foreseen as a moderator since it affects the strength of the relationship between the single independent variables RD.INT (H3) and CH.RD (H4), on the one hand, and the dependent variable DISC.RD, on the other.

Control variables

Control variables are chosen on the basis of previous studies into voluntary disclosure. Therefore, we measure, for each firm in the sample and at the end of each year between 01/01/2008 and 31/12/2012, the variables:

- SIZE, as more information is normally made available by large firms than it is by small firms, the size of a firm will probably reflect the level of asymmetry of information that exists between managers and investors. Size is calculated as the natural logarithm of the firm's total assets at fiscal year-end.
- LEV, it is expected that firms which are heavily in debt will suffer higher costs of monitoring. Ahmed and Courtis (1999) argue that, as a result of this, managers of such firms might reveal additional information in their annual reports in an attempt to lower these costs. Therefore, we calculate leverage as the total amount of debt over the total book value of equity.
- PROF, Raffournier (1995) suggests that there might be significant incentives for firms which make high profits in some years to reveal more corporate information during these years because this would render their good performance more visible to investors. We use the "net profit / book value of equity" rapport as a measurement of profitability, as was also done by Malone *et al.* (1993).
- M/B is market-to-book ratio. This is equal to the market value divided by the book value of equity. Barth and Kasznik (1999) indicate that market-to-book ratio might also reflect the information asymmetry of a firm. Indeed, in firms with high growth rates and significant quantities of intangibles, managers will probably benefit from more information with regard the firm's future growth and the value of those intangible assets. Firms with high market-to-book ratios reveal information voluntarily in order to deal with a potential gap in information brought about by

elevated asymmetry between insiders and outsiders.

Descriptive and univariate Analysis

Table 3 presents the descriptive statistics *for the extent of information revealed in annual reports. The extent of information revealed is one of the elements which contribute to the measuring of the disclosure indices (DISC.ST and DISC.RD). In particular, table 3 does not distinguish between descriptive or quantitative information, but rather reports the mean and median percentage value for the sampled firms of the information* revealed compared to the total of all the *items* considered as communicable by a generic firm regarding strategy (see Table 1 for the items) and

regarding R&D (see Table 2 for the items). In reading table 3, *we note that, on average, firms voluntarily disclosed information about 50,45% of the items* relative to strategy *in 2012, the last revealed year.* Instead, there is little voluntary disclosure of information about R&D. Indeed, only 21,10% of the items relative to RD were disclosed by the listed companies included in the sample. What is more, as is shown in table 3, there was also a great difference between the *extent of information provided about strategy and that provided about R&D* in the other revealed years*. These initial descriptive statistics support the idea that (on average) firms prefer to provide information about strategy rather than information about R&D.*

Table 3. The descriptive statistics for extent of information revealed in annual reports *about R&D and Strategy*

Year 2012	*Mean*	*Median*	*S. D.*
extent of information revealed in annual reports about STRATEGY	*50.45%*	*47,37%*	*15.31*
extent of information revealed in annual reports about R&D	*21.10%*	*33.33%*	*13.72*
Year 2011	*Mean*	*Median*	*S. D.*
extent of information revealed in annual reports about STRATEGY	*53.39%*	*52.63%*	*17.11*
extent of information revealed in annual reports about R&D	*22.46%*	*33,33%*	*15.32*
Year 2010	*Mean*	*Median*	*S. D.*
extent of information revealed in annual reports about STRATEGY	*49.97%*	*42.1%*	*16.57*
extent of information revealed in annual reports about R&D	*21.16%*	*16.66%*	*14.39*
Year 2009	*Mean*	*Median*	*S. D.*
extent of information revealed in annual reports about STRATEGY	*50.33%*	*47,37%*	*16.95*
extent of information revealed in annual reports about R&D	*17.66%*	*16,66%*	*15.11*
Year 2008	*Mean*	*Median*	*S. D.*
extent of information revealed in annual reports about STRATEGY	*54.13%*	*57,89%*	*17.33*
extent of information revealed in annual reports about R&D	*23.34%*	*33.33%*	*15.97*

In tables 4 and 5, it is possible to distinguish between descriptive information and quantitative information with regards the 5 year period focussed upon and these can be further disaggregated into monetary and non-monetary information. Table 4 is focused upon disclosures about strategy. Table 5

focuses upon disclosures about R&D. Both of the tables present the average percentage values calculated for all of the sample firms over the 5 years of the 2008-2012 period.

Table 4. Mean number of disclosures about STRATEGY by type

Type of disclosure		Mean number
Information only expressed in Narrative/descriptive terms		40,5 %
Information also expressed in numerical terms	monetary quantified	3,7%
	non-monetary quantified	7,4%
Total mean disclosures per company	51,6%	

Table 5. Mean number of disclosures about R&D by type

Type of disclosure		Mean number
Information only expressed in Narrative/descriptive terms		13,8 %
Information also expressed in numerical terms	monetary quantified	2,8%
	non-monetary quantified	4,4%
Total mean disclosures per company	21,0%	

In looking at table 4, *we note that sampled firms (during the revealed years) did not voluntarily disclose information about strategy for all of the items* considered as communicable by a firm (included in Table 1), but only for 51,6% of them. *In particular, on average, companies only disclosed descriptive/narrative type information for* 40,5% *of the items* (considered as communicable). Only for 11,1% of the items did sampled companies voluntarily provide quantitative as well as descriptive information and this could be divided up as follows: 7,4% of these items were in the form of voluntary disclosure of quantitative, non-monetary information while only the residual 3,7% was in the form of voluntary disclosure of monetary information.

With regard the information about R&D which is voluntarily disclosed by sample companies, table 5 *shows that, on average, companies only disclosed information about a minority (21%) of the items* considered as communicable by a firm (included in Table 2). For the majority of these items only descriptive/narrative information is provided *(this occurred for 13.8% of the items in Table 2).* Only 4.4% of these items are the object of voluntary disclosure of non-monetary quantitative information,

while the residual 2.8% of items are the object of voluntary disclosure of monetary information.

After having revealed all of the necessary data, we calculated and formed a panel of 195 different combinations of variable values (*DISC.RD, DISC.ST, RD.INT, CH.RD, AGE, LOSS, LEV, PROF, SIZE, M/B*), one for each firm-year observation within our sample.

Table 6 presents descriptive statistics for these variables whereas their correlation statistics are presented in Table 7.

The firms are in general profitable, with *PROF* at 7.9%. The firms are leveraged at 63.19%, indicating that debt financing is an important source of funds. With regard to their size, the firms are relatively large firms with about 492 million euros in assets on average; the smallest firms have, on average, assets of circa 179 million euros and the largest firms have, on average, assets of about 1,431 million. The disclosure index relative to information on strategy is 31.5%, much higher than that the 14.2% for R&D, and this further confirms the idea that (on average) managers prefer to *provide more information about strategy than about R&D.*

Table 6. Descriptive Statistics on all variables (dependent, independent and control)

Observations 195

Variable	Mean	Median	SD	25%	75%
DISC.RD	14.2%	16.66%	9.52	0	47.35%
DISC.ST	31.5%	31.6%	18.033	15.8%	63.91%
RD.INT	0.09	0.07	0.05	0.02	0.15
CH.RD	0.02	0.00	0.03	-0.03	0.08
AGE	21.7	18.9	9.22	13.4	37.3
LOSS	0.164	0.00	0.46	0.00	1
LEV	0.6319	0.611	0.07	0.501	0.791
PROF	0.079	0.071	0.11	-0.093	0.190
SIZE	20.014	20.073	0.73	19.002	21.082
M/B	1.547	1.445	1.03	0.633	2.995

Table 7 shows certain significant correlations. DISC.RD with M/B, DISC.ST with AGE, DISC.RD with PROF, DISC.ST with SIZE, DISC.ST with LEV and, finally, RD.INT with M/B are significantly correlated (p<0.05). DISC.ST with M/B, RD.INT with DISC.RD, RD.INT with DISC.ST, CH.RD with DISC.RD and CH.RD with DISC.ST are strongly correlated (p<0.01). DISC.RD with SIZE and DISC.ST with PROF are weakly correlated (p<0.1).

Table 7. Correlation matrix

variables	1	2	3	4	5	6	7	8	9	10
1 DISC.RD	1									
2 DISC.ST	0.059	1								
3 RD.INT	0.179 **	0.183 **	1							
4 CH.RD	0.189**	0.175**	0.067	1						
5 AGE	-0.023	- 0.140 *	0.081	0.056	1					
6 LOSS	0.079	0.059	0.039	0.041	0.019	1				
7 SIZE	0.098 †	0.127 *	0.022	0.038	0.021	0.061	1			
8 LEV	0.012	0.137*	0.081	0.078	0.059	0.014	0.008	1		
9 PROF	0.129 *	0.108 †	0.089	0.071	0.011	-0.061	0.072	0.053	1	
10 M/B	0.141*	0.193 **	0.128 *	0.083	0.081	-0.036	0.018	0.031	0.069	1

Notes: Pearson's product-moment correlation coefficients.
N = 195; 1-tailed: † p < 0.10; * p < 0.05; ** p < 0.01

The regression models

In addition to the univariate tests that provide preliminary evidence about some hypothesised relationships, we employ two multiple ordinary least squares regression analyses to examine the dynamic interaction among the variables and their relationship to R&D and Strategy disclosure indices.

The first is a hierarchical regression analysis, reported in Table 8, that uses *DISC.RD* as a dependent variable to test hypotheses *1, 2, 3* and 4, which focus upon voluntary disclosure about R&D. Our hypotheses predict a positive coefficient on independent variables RD.INT (H1) and CH.RD (H2). Taken singularly, these independent variables interact with the *LOSS* variable, which is a moderator. Our hypotheses predict a positive coefficient on interaction $RD.INT \times LOSS$ (H3) and $CH.RD \times LOSS$ (H4).

Next, we carry out a second linear regression analysis which uses *DISC.ST*, as a dependent variable to test hypotheses 5 and 6, which focus upon voluntary disclosure about strategy. The results from this regression analysis are presented in table 10. Our hypotheses predict a positive coefficient on independent variables RD.INT (H5) and a negative coefficient on independent variables AGE (H6)

Regression analysis of disclosure indices "DISC.RD"

The results of this analysis are brought together in table 8. In Table 8, the first thing we did was to simply place the control variables in *Model I*. The results are reported in the first column of table 8. This model explains about 6.2% of the variance. The model is fit since *Fsign* is 3.130, significant at the 0.05 level. Within *Model I*, when the regression coefficients are examined, the findings suggest that firms of larger dimensions (*SIZE* is significant at p<0.05) or a larger amount of intangible assets (M/B is significant at p<0.05) make larger voluntary disclosures with regards their R&D activity. On the other hand, statistically less significant effects are noted for profitability (*PROF* is significant at p<0.1). Therefore, we placed the independent variables in the second phase and formulated Model II, which we called the 'main effects model'. The results are reported in column two of table 8. The main effects model makes a more significant contribution than the base model (ΔR^2 = 5,5%, *Fchange*=4.938 with p<0.01). New variables which are to be added are, in general, capable of producing statistically significant effects on the disclosure index of R&D. In particular, findings suggest that there is strong association between the *RD.INT* (the standardised regression coefficient is equal to *b*= 0.125 significant at *p*< 0.01) and *DISC.RD* variables. Therefore, hypothesis *1* is supported by this analysis. On the other hand, the *CH.RD* variable (significant at p<0.01) also affect the disclosure index of R&D. Therefore, hypothesis *2* is supported by this analysis. Next, we tested hypotheses 3 and 4 by entering the interaction effects. An interaction effect is statistical significant if, and only if, the interaction term produces a significant contribution over and above the main effects only model. With this goal, we write column 3 of table 8, which we called the 'full model'. This presents the results which are arrived at when interaction terms

corresponding to hypotheses 3 and 4 are added to the equation.

The adding of the interaction terms does not give a statistically significant improvement in model fit (ΔR^2 = 1.5%, *Fchange*=2.311 with *p* > 0.10). Therefore, hypotheses 3 and 4 are not supported by our analysis. The full model (Model III) is fit and explains about 13.2% of the variance with *Fsign*= 3.115, significance at the 0.01 level.

The results found in the three steps (base model, main effects and full model) are significant and robust. As is evident from the table 8, all models are significant (at p< 0.05 or p<0.01), with R^2 ranging from 0.062 for the base model to 0.132 for the full model.

In order to test our model, we apply other statistical tests. In particular, with regards the problem of multicollinearity, we measured the variance

inflation factor (VIF) of each one of the independent variables. VIF values were found to be low (range 1.1–1.8) enough to confirm the absence of multicollinearity.

Finally, we test the results of the multiple OLS regression analysis by using the Breusch-Pagan test (Breusch and Pagan, 1979). The Breusch–Pagan test is used to test for heteroscedasticity in the linear regression models. We carry out this test for each of the three models in table 9. The residuals are estimated for each regression model in table 8. After this, an auxiliary regression analysis of the squared residuals is carried out on the independent variables. The results of these auxiliary regression analyses are reported in table 9 and show that the null hypothesis of homoskedasticity can be accepted in models I, II and III of table 8, both on the basis of the F-Statistic and on the basis of the test statistic $N{\times}R^2$.

Table 8. Results of hierarchical regression analysis of DISC.RD variable

	Model I	Model II	Model III
control variables			
SIZE	0.197*	0.157*	0.095*
LEV	0.295	0.217	0.124
PROF	0.189†	0.111†	0.083†
M/B	0.251*	0.159*	0.097*
independent variables			
RD.INT		0.125**	0.118**
CH.RD		0.173**	0.048**
LOSS		0.134	0.124
Interaction			
RD.INT$\times$ LOSS			0.124
CH.RD$\times$LOSS			0.173
ANOVA			
F sign	3.130*	3.521**	3.115**
R^2	0.062	0.1165	0.132
Adj R^2	0.042	0.083	0.089
ΔR^2	0.062	0.055	0.015
F change	3.130*	4.938**	2.311

Note: Standardised regression coefficients are displayed in the table.
N = 195; 1-tailed: † p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

Table 9. Heteroscedasticity Test: Breusch-Pagan

	Model I	Model II	Model III
F-statistic	1.632	1.391	1.104
Prob. *F*	0.168	0.211	0.362
N*R-squared	6.479	9.653	9.942
Prob. *Chi-Square*	0.166	0.209	0.355

Note: N= 195.

Regression analysis of disclosure indexes "DISC.ST"

Table 10 presents the regression results of the disclosure index of firm's strategies (*DISC.ST*) on R&D-intensity and age variables, as well as on control variables. The regression produces an R2 of 19.4%, which is higher than that found in the full model of regression analysis of the disclosure index of R&D (whose R2 was 13.2%). In this case too, the *SIZE* variable is among the control variables which have a significant impact (the standardised regression coefficient is equal to 0.193 with $p<0.05$) on the disclosure index of firm's strategies. The same applies for the LEV variable (the standardised regression coefficient is equal to $b= 0.332$ with $p <0.05$). Therefore, companies which are larger and more in debt disclose more strategy information. Finally, more significant effects are noted for M/B variable (the standardised regression coefficient is equal to $b= 0.181$ with $p <0.01$). Therefore, high growth firms make more voluntary disclosures of information about their strategies. At the same time, *PROF* has weak effects of low significance (the standardised regression coefficient is equal to $b= 0.086$ with $p<0.1$) on disclosure of information about firm's strategies. With regard the independent variables, our findings demonstrate that the regression coefficient on RD.INT is positive and significant (the standardised regression coefficient is equal to 0.241 with $p<0.001$). Therefore, our analysis supports hypothesis 5. Finally, the standardised regression coefficient on AGE is negative and significant (equal to -0.213 with $p<0.05$). So, our analysis supports hypothesis 6.

In order to test our model, we measured the variance inflation factor (VIF) of each one of the independent variables. VIF values were found to be equal to 2.4, therefore is confirmed the absence of multicollinearity.

Finally, we test the results of the multiple OLS regression analysis by using the Breusch-Pagan test. The results of this test show that the null hypothesis of homoskedasticity can be accepted in the model both on the basis of the F-Statistic and on the basis of the test statistic $N \times R2$.

Table 10. Results of regression analysis of DISC.ST variable.
The regression equation is: DISC.ST = b_0 + b_1 RD.INT + b_2 AGE + b_3 SIZE + b_4 LEV + b_5 PROF + b_6 M/B + ϵt.

CONTROL VARIABLES		ANOVA	
SIZE	0.193*	F sign	7.521 ***
LEV	0.332*	R^2	0.194
PROF	0.086†	Adj R^2	0.168
M/B	0.181 **		

INDEPENDENT VARIABLES		BREUSCH-PAGAN TEST	
RD.INT	0.241***	F-statistic	1.032
AGE	-0.213*	Prob. F	0.406
		N*R-squared	7.220
		Prob. Chi-Square	0.457

Note: Standardised regression coefficients are displayed in the table.
N = 195; 1-tailed: † p < 0.10; * p < 0.05; ** p < 0.01; *** p < 0.001

3.2 The analysis to test which type of information is most useful to investors

Within this work's theoretical framework, the model of Ohlson (1995) and Feltham and Ohlson (1995) was selected to test for association between stock price and information that is voluntarily disclosed by managers. We have already indicated that the Ohlson model uses the accounting data of income statements and balance sheets together with "other information" and we have also presented the basic form of the Ohlson model. With respect to the basic form, the studies into the value relevance of activities/expenditure on R&D have underlined the importance of applying distinctions between accounting data which refer to the different aspects of R&D (Abody and Lev, 1998; Han and Manry, 2004). In particular, Han and Manry (2004) re-elaborate Ohlson's equity-valuation model, making some transformations within the equations written by Ohlson. These transformations were aimed at grasping the different effects of the different components of R&D expenditure. We pick up, partially, on these transformations and adapt them to our cognitive requirements.

First of all, we begin with Han and Manry (2004), who assume the equity-valuation model of Ohlson which is written as follows:

$$p_t = k(\varphi x_t - d_t) + (1 - k)bv_t + \alpha v_t \quad \textbf{[equation 1]}$$

where:

p_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 $\alpha > 0$. [39]

Now, we:

- show, in equation 1, the R&D expenditures that are capitalised (indicated by $rdcap_t$) and those that are expensed ($rdexp_t$).
- separate the capitalised element of R&D expenditure (i.e. $rdcap_t$) from the book value of net assets. In this way, we avoid mixing capitalised R&D with the other assets within the equations so as to control what effects capitalised R&D has on share price. Thus, we write: bv^*_t as $bv_t - rdcap_t$, in other words bv^*_t is book value minus capitalised R&D.

Therefore, we rewrite equation 1 as follows:

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[39] 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).

$$p_t = k\varphi x_t - k\, d_t + (1-k)\, bv^*_t + (1-k)\, rdcap_t + \alpha\, v_t \quad \textbf{[equation 2]}$$

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 ($oexp_t$).

So we rewrite equation 2 as follows:

$$p_t = k\,\varphi sale_t - k\,\varphi oexp_t - k\,\varphi rdexp_t - k\, d_t + (1-k)\, bv^*_t + (1-k)\, rdcap_t + \alpha\, v_t \quad \textbf{[equation 3]}$$

We study the different components of R&D expenditure, because they might influence share price differently. Firstly, as $rdexp_t$ is a expense item, the influence it has on market price takes a negative sign in equation 3. 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, there will be additional positive consequences of this expenditure in the future. Similarly, even though Eq. (3) shows that capitalised R&D expenditure ($rdcap_t$) affects price positively to the same degree as other assets (bv^*_t), the market might give $rdcap_t$ a higher value than other assets as a result of its capacity for generating greater future economic benefits.

In order to evaluate the value-relevance of information about R&D and strategy that is voluntarily disclosed by managers, 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 aim, we add the firm subscript i, we consider the φ value to be stable over the 2008-2012 period and, finally, we adopt insights from the literature which we reviewed in the theoretical framework. According to these insights, information disclosed about intangibles makes up a special category of "other information" for the Ohlson (1995) model, and, therefore, could be value-relevant. We consider as "other information" that which is voluntarily disclosed about R&D and strategy by managers within annual reports. Naturally, given the statistical nature of the model, we include ϵ_t, to represent the stochastic errors, which are assumed to have normal distribution, a mean of zero and to be uncorrelated with other variables in the model.

Therefore, we can write the multiple linear regression equation as:

$$P_{it} = b_0 + b_1\, SALE_{it} + b_2\, OEXP_{it} + b_3\, RDEXP_{it} + b_4\, D_{it} + b_5\, BV^*_{it} + b_6\, RDCAP_{it} + b_7\, RD.GOOD\_NEWS_{it} + b_8\, RD.BAD\_NEWS_{it} + b_9\, ST.GOOD\_NEWS_{it} + b_{10}\, ST.BAD\_NEWS_{it} + \epsilon_t \quad \textbf{[equation 4]}$$

Where:

- P_{it} = market value of common stock as measured five months after the end of year t. This 5-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 June in the year (*t+1*).

- $RDCAP_{it}$= R&D expenditures capitalised 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*

When studying the impact of disclosure on stock market value, it is necessary to bear in mind the opposing effects that good and bad news generate on that stock market value. Since good news is expected to increase shareholder value and bad news should reduce it, we introduce the variables $RD.GOOD\_NEWS_{it}$, $RD.BAD\_NEWS_{it}$, $ST.GOOD\_NEWS_{it}$ and $ST.BAD\_NEWS_{it}$ constituting the "other information" ditto which the Ohlson (1995) refers. These are independent variables with respect to which hypotheses 7, 8, 9 and 10 will be tested. In particular:

- $RD.GOOD\_NEWS_{it}$ and $RD.BAD\_NEWS_{it}$, are two disclosure indices for R&D innovative activities. $RD.GOOD\_NEWS_{it}$ measures the disclosure which gives investors "good news" regarding initiatives which attempt to increase shareholder value; $RD.BAD\_NEWS_{it}$ measures disclosure of "bad news" which might reduce shareholder value. We calculate these two variables through the set of items, already presented in table 2, which are considered to be communicable with regards innovative activities of R&D. When information disclosed about one of the items listed in Table 2 is good, a score of "1" is given to that item within $RD.GOOD\_NEWS_{it}$. When information disclosed about one of the items listed in Table 2 is bad, then a score of "1" is given to that item within $RD.BAD\_NEWS_{it}$. Therefore, $RD.GOOD\_NEWS_{it}$ and $RD.BAD\_NEWS_{it}$ respectively measure disclosure *of good or bad news about R&D activities as a* percentage of items disclosed, through good and bad news respectively, against the total of *all of the items* which are considered as communicable regarding R&D (the total of the items in *table 2 is 12).*
- $ST.GOOD\_NEWS_{it}$ and $ST.BAD\_NEWS_{it}$, are the two disclosure indices of firm strategy which measure voluntary disclosure of "good news" and "bad news" about strategy respectively. When information disclosed about one of the items listed in Table 1 is good, a score of "1" is given

to that item within $ST.GOOD\_NEWS_{it}$. When information disclosed about one of the items listed in Table 1 is bad, the score of "1" is given to that item within $ST.BAD\_NEWS_{it}$. Therefore we calculate these two variables through a set of items, presented in table 1, and we calculate $ST.GOOD\_NEWS_{it}$ and $ST.BAD\_NEWS_{it}$ as a percentage of items disclosed, through good and bad news with respect to the total of all of the *items* considered communicable regarding a firm's strategy (the total of the items in *table 1 is 19).*

It emerges from the set of variables listed above that the sum of $RDCAP_t$ and $RDEXP_t$ is equal to the value of R&D (total) expenditures in year *t*. This latter measurement, deflated by sales, was used in previous sections to calculate the "*RD.INT*" variable. However, as already said, we keep expenditure elements separate in this section, since the market might attribute additional future economic benefits to them besides those indicated by financial statements. For example, expensed R&D ($RDEXP_t$) might have a positive correlation with price (as opposed to $OEXP_t$) and capitalised R&D expenditures ($RDCAP_t$) may also have a positive impact which is greater than that of the other assets (BV^*_{it}).

All monetary variables, in other words: P_{it}, RDCAP*it*, D_{it}, BV^*_{it}, $SALE$*it*, $OEXP$*it* and $RDEXP_{it}$ are deflated by the number of outstanding shares.

Firstly, we control whether the regression coefficients on disclosure indices of good or bad news about R&D and strategy, in other words coefficients on $RD.GOOD\_NEWS_{it}$, $RD.BAD\_NEWS_{it}$, $ST.GOOD\_NEWS_{it}$ and $ST.BAD\_NEWS_{it}$, are consistent with the reasoning presented in the theoretical framework. Voluntary disclosures about R&D (hypothesis 7) and strategy (hypothesis 8) are expected to provide investors with additional information which the firm's balance sheet and income statement still do not show, but are of use when trying to forecast the firm's future performance and the market price of its shares. For this to happen, the coefficients b_7, b_8, b_9 and b_{10} should be significant and different from 0. In particular, to test hypotheses H7 e H8, we control that:

$b_7>0$ and $b_8<0$ (H7), $p<0.05$ (at least) for both coefficients.
$b_9>0$ and $b_{10}<0$ (H8) con $p<0.05$ (at least) for both coefficients.

The next step is to compare the coefficients relative to disclosure of good or bad news about R&D with coefficients relative to disclosure of good or bad news about strategy respectively. The aim of this is to test whether there is support for:
- hypothesis H9, according to which the impact of disclosure of news about RD is greater than value-relevance of disclosure about strategy,
- hypothesis H10, which opposes H9 above,

In particular, to test hypotheses H9 and H10, we control whether:

$b_7 > b_9$ and $b_8 < b_{10}$, or in equivalent terms $b_7 - b_9 > 0$ and $b_8 - b_{10} < 0$, indicating that H9 is supported; $b_7 < b_9$ and $b_8 > b_{10}$, and therefore $b_7 - b_9 < 0$ and $b_8 - b_{10} > 0$, meaning that H10 is supported.

Table 11. Descriptive Statistics

Observations 195

Variable	Mean	Median	SD	25%	75%
P	13.12	11.91	12.150	0.9327	29.1331
RDCAP	0.0349	0.0313	0.022	0.0035	0.0603
D	0.4395	0.42	0.869	0.0051	1.6169
SALE	1.3567	1.4193	1.312	0.0668	3.1226
OEXP	1.3358	1.3981	1.540	0.065	3.375
RDEXP	0.0209	0.0215	0.024	0.0018	0.0476
RD.GOOD_NEWS	9.64 %	8.33 %	14.611	0	25.35
RD.BAD_NEWS	11.38 %	8.33%	16.667	0	28.91
ST.GOOD_NEWS	23.77%	21,053%	10.927	8.834	33.91
ST.BAD_NEWS	27.80%	26.316%	21.675	10.186	41,341

All monetary variables are deflated by the number of shares outstanding.

Table 11 shows the descriptive statistics. We find that, on average, sample companies have a greater propensity to provide bad news (11.38% and 27.84%) rather than good news (9.64% and 23.77%), albeit not by much. Unfortunately, our model cannot give an explanation for this phenomenon, since variables of good and bad news are independent variables within our regression model: they are used to explain a phenomenon (in this case, the market price of shares) and not to be explained. However, future research might investigate this aspect in Italy.

Table 12 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} (this too is divided by the number of outstanding shares). The lack of correlations between the *SALE - RDCAP* and *RDCAP - OEXP* pairs of variables can be understood as an absence of significant (from a statistical point of view) earnings management action, which normally takes place through the capitalisation of R&D expenditure. Indeed, managers might choose to capitalise R&D expenditure so as to improve the earnings reported in financial statements, if *SALE* diminish or *OEXP* increase. However, we do not find significant correlations between these variables.

Regression analysis of the stock market value (variable P)

Table 13 presents regression results and test results. The significance of each regression coefficient is

evaluated using the *t*-statistic. As predicted by hypothesis 7, the values of the regression coefficients on *RD.GOOD_NEWS$_{it}$* and *RD.BAD_NEWS* are significantly different from 0 *(p<0.001)*; according to hypothesis H7 the first of the two coefficients (b_7) is positive, while the second (b_8) is negative. Therefore, the market sees voluntary disclosures about R&D as important sources of information (both positive and negative) which is not found in the sampled firms' actual earnings, but is of relevance for their future earnings and, therefore, for the current market value of their shares.

The theoretical values of the regression coefficients on *ST.GOOD_NEWS$_{it}$* and *ST.BAD_NEWS* are also significantly different from 0 *(p<0.001)* and, in line with the H8 predictions, the first of the two coefficients (b_9) is positive, while the second (b_{10}) is negative. This supports H8 according to which the market sees voluntary disclosure about strategy as an important source of information (either positive or negative) which the firm's balance sheet and income statement do not but that is relevant for their future earnings and, therefore, for the current market value of their shares.

Our regression analysis shows that capitalised and expensed expenditures on R&D can provide future economic benefits such as assets. Indeed, the coefficients on *RDCAP$_{it}$* and *RDEXP$_{it}$* are positive and significantly greater than 0 (the coefficients are $b_6 = 1.708$ at *p<0.001* and $b_3 = 0.893$ at *p<0.01* respectively). The finding of a positive coefficient on *RDEXP* is contrary to predictions of equation 3,

which considered *RDEXP* as just another expense item and, consequently, associated it with a negative impact on market price. If $RDEXP_t$ is positively related to price, it is because the market believes that this R&D expenditure has future economic benefits which contrast with what is expressed in the firm's income statement. The final two lines of Table 13 show the differences between the coefficients of the indices regarding disclosures of information about R&D and strategy, referring to both good and bad news. These coefficient differences are significantly different from 0 ($p<0.05$). In particular, the b_7 coefficient is larger than b_9 and the negative value of b_8 is larger than that of b_{10}, hence H10 is not supported by our analysis, while H9 is supported. This means that information about R&D is more price informativeness than information about strategy.

Although the independent variables often correlate in pairs significantly, diagnostics indicate that the VIF of each independent variable in the regression model is less than 3.7, so there is normally no problem of multicollinearity in this model. [40]

4. Discussion and conclusion

We begin this paper by looking at the fact that voluntary disclosures about R&D expenditures and activities are made by managers as a consequence of the fact that financial information which is based on traditional models of accounting is not an adequate reflection of the value R&D creates. These voluntary disclosures are probably of use to outsiders within the resource allocation process that the market performs. From a valuation (or investor) perspective of accounting, we explored limits to financial accounting and we predicted that managers provide additional information on intangibles such as R&D in annual reports in order to obtain financing from the equity markets and to reduce the cost of equity capital that is raised, when:

(a) R&D expenditures and activities are most intense, since the value created by R&D which is not reflected in balance sheet measurements increases. This reasoning is the basis of H1.

And also when earnings reported in the periodic income statement are of less use when assessing firm value because:

(b) the rate of investment in R&D varies. This reasoning is the basis of H2.

(c) there is a lack of information on earnings (in the case losses are made), so investors look for other, further information in each of the circumstances a) e b) described. H3 and H4 are based on this reasoning.

In wanting to simplify the concepts, it can be said that, from the valuation (or investor) perspective, commentators are essentially arguing that book values

would be the same as the firm's market value in an ideal world. Therefore, the current accounting model creates a difference between market and book values which is the sole consequence of the value of unrecognised intangible assets (and their streams of benefits), such as the R&D assets. Therefore, commentators encourage managers to make voluntary disclosures of information about intangibles such as R&D, since, in this way, they provide information which is useful for investors in order to understand what the "correct" difference between book and market values should be.

Next, we explored the prospective that defends the current accounting model and precludes the recognition on the balance sheet of items that are not caused by external transactions and events and/or for which it is expensive to verify measurement. This is a stewardship perspective of accounting, according to which the most important role of annual reports is to furnish the firm and the various third parties with information which is useful for contracting. The shareholders are not the only people for whom this information is meant, but there are also lenders, bondholders, suppliers, customers etc. For all these parties, the reliability of financial statements measurements is of paramount importance. On the other hand, it is, by its very nature, a difficult, uncertain task for auditors from outside the firm to evaluate the positive future effects of such intangible assets as R&D. For example, many intangibles, such as R&D, are characterised by the difficult issues of building/enforcing of the rights of property. Others may easily make use of and profit from the positive effects of intangible assets; for instance, the intellectual capital which employees represent might be lost to the company should they decide to leave. Investors find information about the historic cost of assets useful, since the gap between market and book value is a useful indicator of what difficulties the firm's managers will meet in the future in trying to maintain and/or extend the market value and, above all, what difficult tasks await the management in their transforming that (high) market value into (greater) streams of revenue. Therefore, it is not certain that investors would require the share value of the firm to be mirrored in its book value. Penman (2007) indicated that investors want a lot of important information regarding the historical costs of a company's assets and the ability of managers to turn such assets into earnings. [41] The problem is that for firms whose value is largely composed of intangibles assets such as R&D, management faces higher future uncertainty in transforming firm assets into revenues. The higher future uncertainty increases firms' capital

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

[41] Penman (2007) demonstrates that the approaches which make use of income statement information, adopting it to predict future revenues, earnings, and cash flows, are effective in their evaluation of companies, even those where large amounts of value can be attributed to intangibles.

costs and pressures from investors for information about the plans the firm has to address changing environments and deal with the challenges and opportunities they create. Consequently, the central importance is underlined of the role which the revealing of information on strategy has with regard rendering financial reporting more transparent and effective. As Trueman (1986) points out, the difference between a firm's book and share market values reflects the way investors imagine

management will anticipate and deal with eventual changes to the environment in which that company operates. Therefore, the more information investors have regarding managerial strategies for dealing with change, the higher their level of confidence in the managers and the share market value of the firm will be.

Table 12. Correlation matrix

	variables	2	3	4	5	6	7	8	9	10	11
1	P_{it}	0.279***	0.231***	-0.131*	0.224**	0.249***	-0.124*	-0.179**	-0.171**	0.239***	0.241***
2	BV^*_{it}	1	0.087	-0.177**	0.148*	0.288***	-0.129*	0.073	0.044	0.077	0.058
3	$RDCAP_{it}$		1	0.062	-0.045	-0.088	-0.012	-0.029	-0.013	0.201**	0.211**
4	$OEXP_{it}$			1	-0.34	0.228***	-0.009	0.009	0.011	0.044	0.072
5	$RDEXP_{it}$				1	0.188**	-0.004	-0.088	-0.099	0.205**	0.213**
6	$SALE_{it}$					1	+0.005	-0.004	-0.009	0.066	0.076
7	D_{it}						1	-0.109†	-0.125*	0.021	0.127*
8	$RD.BAD\_NEWS_{it}$							1	0.005	0.019	0.21
9	$ST.BAD\_NEWS_{it}$								1	0.024	0.041
10	$RD.GOOD\_NEWS_{it}$									1	0.059
11	$ST.GOOD\_NEWS_{it}$										1

Notes: Pearson's product-moment correlation coefficients.
N = 195; 1-tailed: † $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; ***$p < 0.001$

Table 13. Coefficient estimates from regression (of price) based on the following equation:
$P_{it} = b_0 + b_1 SALE_{it} + b_2 OEXP_{it} + b_3 RDEXP_{it} + b_4 D_{it} + b_5 BV^*_{it} + b_6 RDCAP_{it} + b_7 RD.GOOD\_NEWS_{it} + b_8 RD.BAD\_NEWS_{it} + b_9 ST.GOOD\_NEWS_{it} + b_{10} ST.BAD\_NEWS_{it} + \epsilon_t$. The coefficient difference estimates are also reported. Finally, the results of the *t*-statistics test are reported for all of the coefficients, including the differences highlighted above.

Coefficient and test statistics		
Variable	Coefficient	*t*-statistics
$SALE_{it}$	0.379 (b_1)	5.937***
$OEXP_{it}$	-0.431 (b_2)	1.829*
$RDEXP_{it}$	0.893 (b_3)	2.739**
D_{it}	-0.245 (b_4)	2.033*
BV^*_{it}	0.339 (b_5)	8.768***
$RDCAP_{it}$	1.708 (b_6)	7.953***
$RD.GOOD\_NEWS_{it}$	0.981 (b_7)	3.678***
$RD.BAD\_NEWS_{it}$	-2.311 (b_8)	3.891***
$ST.GOOD\_NEWS_{it}$	0.679 (b_9)	3.592***
$ST.BAD\_NEWS_{it}$	-1.837 (b_{10})	3.312***
R^2		0.381
Fsign		14.299***
$RD.GOOD\_NEWS_{it} - ST.GOOD\_NEWS_{it}$	0.302	2.039*
$RD.BAD\_NEWS_{it} - ST.BAD\_NEWS_{it}$	-0.474	1.989*

N=195;
t statistics test: * significant at 0.05 (one-tailed); ** significant at 0.01 (one-tailed); *** Significant at .001 (one-tailed)

From this prospective, firms whose assets are largely made up of intangibles are riskier and have larger information asymmetries. To obtain more financing from the equity markets and reduce the cost of the equity that is raised, their managers provide additional information on strategy in the annual report when:

- R&D expenditure and activities are more intense. This reasoning forms the basis of H5.
- The firm is younger, since information about strategic behaviour by young firms is more limited than for older firms. This reasoning forms the basis of H6.

Moving on from managers who voluntarily convey additional information to the investors who use that information, we hypothesise that:

- management disclosure about R&D contains value-relevant information and is, therefore, associated with significant stock market price reaction (H7)
- management disclosure about strategy contains value-relevant information and is, therefore, associated with significant stock market price reaction (H8)

Finally, we compare stock price informativeness of voluntary disclosures about R&D with that for strategy and, in this way, we hypothesise that:

- there is a more important role for information disclosed about strategy (H9)
- there is a more important role for information disclosed about R&D (H10)

To test all our hypotheses, we analyse data on those Italian listed companies quoted on the Milan stock exchange which perform the most intensive R&D (Research & Development) activity. In particular, we analyse a panel of 195 (39 firms over the five years from 2008 to 2012). The data for each firm was gathered from annual reports of sampled firms.

Our analysis shows that firms find it convenient to make voluntarily disclosures of additional information about both R&D and strategy. However, the comparisons made in table 3 between the descriptive statistics of the extent of information revealed for R&D and strategy in annual reports show that Italian listed companies make little voluntary disclosure of information about R&D, while they more frequently find it convenient and opportune to make disclosures about strategy. Descriptive *statistics in tables 4 and 5, which distinguish between narrative, monetary quantified and non-monetary quantified information, show that voluntary disclosure about both R&D and strategy is* predominantly discursive in nature, with relatively few disclosures containing information that is quantified in either monetary or non-monetary terms. *These results are consistent with certain older works which, within the voluntary disclosure context, show a prevalence of discursive information with respect to* *quantified information (for example* Guthrie et al. 2007 as well as Beattie et al., 2004).

Our regression analyses do not totally support the predictions made within the valuation (or investor) perspective of accounting. In particular, there is no support for hypotheses H3 and H4, while there is support for hypotheses H1 and H2. Consequently, we can arrive at a conclusion with regard investor behaviour, within the terms outlined in point *a*), and manager behaviour, within the terms outlined in point b) as follow:

(a) as R&D expenditure increases so the current value increases of future benefits which the balance sheets can not measure due to the actual accounting regulations. This would lead investors, who wish to obtain a correct evaluation of the firm's equity value, to seek additional information with respect to that provided in the company's financial statements. Investors' demand for additional information would grow markedly when there is an increase in R&D expenditure;

(b) managers make voluntary disclosure of information about R&D in an attempt to satisfy investors' demand for additional information when R&D expenditure increases. It seems that managers do not increase the voluntarily disclosed information still further if there is a (total) lack of earnings (at the same time as the increase in R&D expenditure).

Our regression analyses totally support the predictions made within the stewardship perspective on accounting, that is H5 and H6: the intensity of R&D positively influences the management disclosure of additional information about strategy, which is also influenced by the age of the firm.

Generally speaking, then, findings show that sample firms find it convenient to make voluntary disclosure of additional information about both R&D and strategy when making expenditures in intangible activities of R&D. As already indicated our descriptive statistics, also our regression analyses of disclosure indices of R&D and strategy show that managers prefer to provide additional information about strategy more frequently and that about R&D less frequently. Indeed, a comparison of table 8 and table 10 shows that regression of the *DISC.ST* variable produces an adjusted R^2 of 0.168, which is greater than that of the analogous regression of the *DISC.RD* variable (R^2=0.091 in model III of table 8). Moreover, although the intensity of R&D (*RD.INT*) influences both the voluntary disclosure of R&D and of strategy, it should be said that the levels of statistical significance are different. Indeed, in table 10, *RD.INT* is statistically associated with DISC.ST at a level of statistical significance, $p < 0.001$, which is higher than the level of statistical significance, $p < 0.01$, with which RD.INT is statistically associated with DISC.RD (in Mod. III of table 8). Finally, the index of disclosure of information about strategy

(DISC.ST) is more sensitive to the intensity of R&D (*RD.INT*) than the index of disclosure of information about R&D (DISC.RD) is. Indeed, the regression coefficient of *RD.INT* (in table 10) is 0.241 and this is higher than the regression coefficient of *RD.INT*, in table 8 (mod. III), which is 0.118. It is impossible to attribute these empirical results to the superiority of one prospective over another (stewardship versus investors perspective on accounting). It is evident that much explicit R&D information might not be voluntarily disclosed by companies, not because it is of little use to investors, but because of the competitive disadvantage effects (higher proprietary and litigation costs) it could produce. By comparing the descriptive statistics and the regression coefficients of the *RD.INT* variable, in tables 8 and 10, we can only reasonably think that from the point of view of the managers, who make the operating decisions, it can be assumed that to increase the intensity of R&D expenditures, the net benefits (net of proprietary and litigation costs) of voluntary disclosure of strategy are perceived (by the managers) as exceeding those of disclosing information about R&D.[42]

By analysing shareholder choices, we find that hypotheses H7 and H8 are supported. This means that management disclosure about both R&D and strategy contain value-relevant information and that, in practice, shareholders use the information that is voluntarily disclosed by managers when making decisions about providing funds. Given that hypothesis H9 is supported to the detriment of H10, we also conclude that information about R&D that is voluntarily disclosed by managers is more useful to investors than information provided by those managers about strategy.

These final results, together with those found previously show, therefore, greater investor reactivity to information about R&D, but greater propensity to provide information about strategy on the part of firms. Although this might seem to be a contradiction, there may be two fundamental reasons for all this. The first is that proprietary and litigation costs of information about R&D could be so high as to cancel out the many benefits that this information can bring to companies, unfortunately it is not possible to quantify the entity of such costs through statistical models. The second possible explanation, which has to be left for future research, is that it is reasonable to think that information about strategy is provided more frequently than that about R&D for the benefit of stakeholders other than shareholders. In particular,

sample companies are leveraged at about 73% (see Tab.6), indicating that debt financing is an important source of funds. Given such high leverage levels, it is probable that, with an increase in investment in R&D assets, the dependency of companies on their stakeholders, such as banks and other lenders, increases as the need to provide voluntarily information about strategy increases. Bankers and other lenders ask for more information about strategic aims of investment and how managers intend to achieve these aims. This is because innovative activities such as R&D are among the main contributors to "growth options", meaning that, once they have obtained some debt financing, managers could easily move their investments to options which entail greater risk than those agreed to by lenders, so reducing the value of lenders' claims. Moreover, explicit information about R&D assets is less sought after by bankers, given that, should bankruptcy or liquidation occur, these assets will lose most of their value. For historical reasons, Italy has poor financial infrastructures (Pagano, Panetta and Zingales, 1998). In particular, a high level of ownership concentration is characteristic of all firms quoted on the Milan stock exchange. Three different classes of major block holders are commonly identified: families with active family members, the state or other public bodies, and coalitions of shareholders with entrepreneurial backgrounds (Cascino *et al.*, 2010). A dominant shareholder relies more on external funds from lenders (debt) and less on external funds from other shareholders (equity), since the latter could threaten his continued control of the firm. One important limitation of this study is, therefore, that of the Italian economic context from which these data were gathered. Therefore, special attention should be given when generalising about these discoveries with regard to other national contexts. Another important limitation of this study is that it has ignored other types of corporate reports which, in addition to annual reports, can be used to communicate information about R&D or strategy. These other corporate reports include analyst presentations, CSR reports, interim reports, preliminary reports and web pages. With regard this last point, some scholars indicate that examining annual reports allows more reliable voluntary disclosure to take place. For example, Majella (2000) affirms that financial statements, notes to the financial statements or the Director's Report constitute the most credible disclosures since they are audited.

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[42] Since the effects of disclosure on competitive disadvantage "are complex and difficult to predict" (Guo et al., 2004, p. 323), and it is particularly complicated to quantify competitive disadvantage in terms of models, we follow the line of reasoning made by Cooke (1989) according to which, when a firm chooses to make voluntary disclosures, it is because the benefits are perceived to exceed the costs.

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