Which most influences the non-financial reporting of R&D assets, strategies or shortcomings in financial accounting?

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Abstract

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 this way, we find that firms which carry out most R&D activity find it convenient to make voluntary disclosures of additional information regarding strategy, while they only make limited voluntary disclosures of information regarding their R&D expenditures and activities. We relate the needs to provide more information about R&D expenditures or strategies to different theories which are explained in the theoretical framework of this paper.

Introduction

Voluntary disclosure is a mechanism which is used to protect investors and help them reduce agency conflicts. Agency theory asserts that disclosure can reduce agency costs in the relationship between shareholders, who provide funds, and management, who make the operating decisions (Jensen and Meckling, 1976; Williamson, 1981). As Williamson (1984) argued, the specificity of transactions can create information asymmetries that can be mitigated by the disclosure of further information. This would which provide greater transparency and enable investors to anticipate better future transactions for evaluation purposes.

Disclosure benefits are related to liquidity, costs of capital and analyst evaluation (Botosan, 1997; Healy and Palepu, 2001; Verrecchia, 2001). At the same time, disclosure is not costless because it is associated with the emergence of proprietary and litigation costs (Darrough and Stoughton, 1990). According to the proprietary costs theory, costs relating to disclosure could discourage the dissemination of information (Dye, 1985; Verrecchia, 2001; Prencipe, 2004).
Managers could decide to disclose less information to avoid competitive disadvantage and protect investors better (Dye, 2001). Darrough and Stoughton (1990) asserted that if the number and the size of rivals increases, disclosure becomes more costly. Although the effects of disclosure on competitive disadvantage “are complex and difficult to predict” (Guo et al., 2004, p. 323), some authors suggest that firms seek to satisfy financial analysts’ and investors’ high demand for intellectual capital information by disclosing value-relevant information (Cerbioni and Parbonetti, 2008; García-Meca and Martínez, 2007; García-Meca et al., 2005). Investors would surely interpret nondisclosure of this critical aspect of a firm’s activities and future performance as “bad news” (Milgrom, 1981), implying, for example, the absence of significant products under development (a thin pipeline), a failure of clinical tests or limited markets for the anticipated result, and will consequently reduce the company’s value. In a world of complete information, the internal mechanisms of accountability might be useless because investors could directly protect themselves; under conditions of an incomplete contract and bounded rationality, however, voluntary disclosures are mechanisms of accountability.

The decision to disclose additional information is typically made in terms of a cost-benefit framework. Proprietary costs are those associated with disclosing potentially valuable information to the firm’s competitors. Instead, a positive effect of voluntary disclosure might be a reduction in the cost of capital (Botosan, 1997; Leuz and Verrecchia, 2000) as the result of a reduction in information asymmetry. Eccles et al. (2001, Ch. 10) argue that enhanced disclosure levels will probably lower firms’ cost of capital, increase analyst attention and so forth.1

This work begins with the following research question. Since the firm can disclose various types of information, which is it preferable to disclose (according to prevailing theory) and which is then provided significantly (from a statistical point of view)?

Many studies refer to Voluntary Disclosure on Intangibles in Capital Markets, although, unfortunately, as far as we know, none of these proposes at the base of its framework the fact that the decision to disclose some information regarding intellectual capital is one that a firm makes after carrying out strategic analysis and with a view to maintaining/gaining competitive advantage. From the strategic analysis prospective (see Grant, 2001), a firm which considers, for example, carrying out some research and development (R&D) activity, with its high costs and risks, will analyse attentively the set of decisions to be made, particularly the analysis of the firm’s resources. In the course of the analysis, it might appear that the firm has sufficient resources at its disposal to

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1 The theoretical argument that disclosures reduce the cost of capital is based on Glosten and Milgrom (1985), Amihud and Mendelson (1986), Merton (1987), King, Pownall, and Waymire (1990), and Diamond and Verrecchia (1991). For empirical evidence regarding the negative association between disclosure level and cost of capital, see Botosan (1997), Sengupta (1998), Healy, Hutton, and Palepu (1999), and Botosan and Plunket (2002).
perform the R&D processes identified, possibly through self-financing. 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 by not 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 on capital costs. At this point though, it is necessary to identify which information is best provided so as to minimise proprietary costs and maximise the above mentioned benefits.

As the focus of this work, we choose the practice of R&D, since, for accounting literature, R&D is the main contributor to information asymmetries between managers and those outside the firm (Aboody and Lev, 2000). Therefore, we analyse 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 them. Therefore, in the following section, we will present theories on the (negative and positive) consequences that disclosure of information about R&D, first, and strategy, after, generate regarding agency costs and competitive disadvantage. We elaborate a theoretical framework and various hypotheses for the two categories of information which we have outlined.

The first framework is based on a certain dissatisfaction with regard information on intangibles in corporate financial reports (see Holland, 2002). Information on a firm’s innovation or technology cannot be included in financial statements because of identification, recognition, and measurement problems. Since financial information is not sufficient as the basis for a reliable evaluation of a company, additional disclosures of information about R&D by management are important to optimise information flows in the capital markets.

The second framework is based on the presumption, in contrast with that above, that there are no shortcomings in the current accounting model (Skinner 2008a, 2008b). Consequently, investors are unlikely to demand additional value-relevant information about R&D. Literature on voluntary disclosure of intellectual capital totally overlooks the contribution made by this factor, which, furthermore, has generated a great deal of interesting work (see the survey made by Gowthorpe, 2009). These contributions might help us understand better which information firms would find it most opportune to disclose voluntarily in annual reports. Given that the existence of asymmetric

\[ \text{However, Wagenhofer (1990, p. 342) stated: "If the firm does not disclose, it still can incur proprietary costs, because the opponent might take an adverse action based on the information conveyed by non disclosure. Conversely, disclosure can result in no proprietary costs if the information disclosed deter the opponent from taking an adverse action."} \]
information regarding R&D activity is accepted unanimously,\(^3\) we have looked for a theoretical framework that juxtaposes R&D activity with differing disclosure requirements (from those normally connected with R&D), which are, nonetheless, effective in reducing the above mentioned information asymmetries. With this aim, contributions which emphasise the role of information about strategy are important. Therefore, we hypothesise that additional disclosures of information about strategy by management are important so as to optimise information flows in the capital markets.

In sections 3, we present the empirical research, together with description of the data, variables and methodology. The research will use statistic and econometric models which, while distinguishing between information about R&D and that on strategy, are able to quantify: a) the intensity of the disclosure of information provided by Italian listed companies; b) whether information provided by Italian listed companies is influenced significantly by the carrying out of R&D activity. Finally, the results will be discussed in section 4.

2. THEORETICAL BACKGROUND AND HYPOTHESES

The importance of providing information on R&D

Some commentators argue that firms with large amounts of intangibles relative to fixed, tangible assets are handicapped in their ability to obtain financing. Lev and Zarowin (1999, p. 383) suggest that reporting inadequacies may adversely affect investors’ and firms’ welfare. Cañibano et al. (2000, p. 112) add that if financial statements provide investors with biased (conservative) estimates of the firm’s value (book value of equity), inefficiencies (myopia) may appear in the resource allocation process. Andriessen (2004) make the following comments. When a company evaluates and reports its intangible assets, its capacity for raising capital increases. If those companies that provide finance only have the information provided through traditional accounting practices, they might not risk lending funds to firms with low levels of tangible assets. On the other hand, if they have access to a further information set incorporating intellectual capital, they might now view any perceived risk as acceptable. Ignorance of intellectual capital causes investors to have doubts about what may happen in the future and to undervalue of shares. Furthermore, a company with low levels of tangible assets has a lower capacity to guarantee debts (Sotomayor González and Larrán Jorge, 2005). This may cause investors to conclude that the company has a high level of risk and, thus, not wish to invest in it, making it difficult for the firm to access this kind of financing. Hofmann (2005)

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\(^3\) This was demonstrated empirically by Aboody and Lev (2000) who that find the frequency and gains of insider trading are greater for firms with higher R&D intensity.
says that the cost of capital is too high for knowledge intensive companies. Therefore, by displaying their invisible assets, firms might demonstrate that they represent less of a risk than is at first apparent and, in turn, reduce the rate of return required by stakeholders (Sveiby, 1997).

Lev (2001) makes a number of arguments to support the claim that the current lack of disclosure about intangibles has adverse effects on capital markets. Lev argues that current accounting practice leads to the “systematic undervaluation of intangibles” by investors. He points to two papers, one by Chan et al. (2001) and the other by Lev et al. (2005). Both of these show that shares of firms with relatively higher R&D spending tend to outperform other firms in the years following that spending. The implication is that these firms where previously undervalued by market participants.

The market fails to correctly value R&D expenditures at the time they are made because those expenditures are expensed rather than capitalised at that time. Thus, it is assumed that market participants naively respond to the accounting treatment of expenditures and fail to understand that R&D expenditures which are not capitalised may well result in future benefits. Capitalisation, partial or total, is supported by certain regulators (IAS) if the project complies with predetermined success factors. However, Lev (2001) suggests that, given the uncertainty of R&D projects, the option of expensing these costs is used by many managers to avoid having to give explanations about failed projects: “Thus, companies get the best of all worlds from in-process R&D expensing: no price hit at the time of expensing and a significant boost to future reported profitability” (p. 89).

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.4

R&D intensity may proxy for information asymmetry between managers and investors. Aboody and Lev (2000) find that the frequency and gain of insider trading are greater for firms with higher R&D intensity, suggesting that R&D is a major contributor to information asymmetry. In addition, prior studies suggest that firms with greater information asymmetries are more likely to make disclosures (e.g. King et al., 1990). Thus, the information asymmetry hypothesis also predicts a positive association between disclosure and R&D intensity. Given these conditions, we make the following hypothesis:

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4 Moreover, he advocates changing the accounting system. His principal recommendation here is to broaden the recognition criterion so that expenditures on intangibles can be recognised as assets to a greater extent. This would be accomplished by relaxing the criteria on reliability (probable future benefits) and control (that the entity has control over the asset). Lev (2003) advocates the introduction of a “comprehensive balance sheet that recognises the creation of those intangible assets to which you can attribute streams of benefits” (p. 20). He proposes the capitalisation of research and development, patents, brands and “sometimes organisational capital”.
**H1: Firms with higher R&D intensity make more disclosures of R&D.**

To see the problem with this logic, it is worth considering the possibility that the more R&D processes are understood, the more information about the scope and progress of these processes is useful to investors and the more investors ask firms for such processes because they include opportune information which is not typically included in financial reports. According to the American Securities and Exchange Commission (SEC), investors “also need to understand the key milestones for the development of the company and its progress on achieving key operating performance measures” (SEC, 2001). This includes disclosure of general information about the innovation process, including the status of R&D projects, availability of future financing, and whether project development is on schedule. Eventual completion and commercialisation also signify the success of innovation and information about the delivery of marketable products or services helps investors assess the value created by the activity.

The need to provide 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 less useful in assessing firm value. Managers have greater incentives to disclose non-financial information when financial information, such as earnings, is less useful (Gu F. and Li J. Q, 2003). Disclosures of innovation are likely to be useful to investors because financial information based on traditional accounting models does not adequately reflect the value created by innovative activities such as R&D (FASB, 2001; SEC, 2001). When earnings are less useful, it is likely that disclosures of innovation, particularly those concerning the firm’s long-term strategies or non-financial leading indicators, can provide investors with more value-relevant information. In line with Chen et al. (2002), we expect earnings to be less useful in valuing firms when current earnings are less informative. Thus, our overall prediction is that firms make more disclosures of R&D when current earnings are less informative. From an accounting measurement perspective, the lack of informativeness in earnings is probably related to a mismatch between revenues and expenses under the expensing rule of R&D. When the investment rate in R&D changes over time, reported earnings based on immediate expensing will differ materially from economic earnings based on capitalisation of R&D. This distortion in the accounting measurement process is expected to adversely affect the usefulness of earnings information. With regard this, Lev and Zarowin (1999) have found that firms with greater increases in their rate of R&D spending have less informative earnings, as indicated by lower earnings response coefficients and smaller $R^2$s in the return-earnings regression. Thus, we predict a positive association between disclosure of R&D and change in the R&D spending rate. This is our second hypothesis:
**H2: Firms with higher increases in their R&D spending rate make more disclosures of R&D.**

We also expect firms to increase disclosure of innovation when they report losses. Since negative earnings are less useful for evaluating firms (Collins et al., 1997; Hayn, 1995), investors are likely to have greater demand for additional value-relevant information to supplement the information on earnings in the event of losses. Moreover, for R&D-intensive firms, losses are often indicative of the absence of revenue during early stages of the innovation process. Given that early-stage innovations tend to be associated with more uncertain prospects and, hence, more uncertain future earnings, disclosures of innovation are likely to be more useful to investors for assessing the value of such firms.\(^6\)

Thus, we expect firms to have greater incentives to make disclosures about their innovation activities when they experience losses. This is our third hypothesis:

**H3: Firms reporting operating losses make more disclosures of R&D**

**The need to provide more information about strategy**

Managers have strong incentives to increase disclosure of information about R&D. With regard to this, in the previous section, we formulated hypotheses according to which the inadequacy of financial information is a major incentive to managers. The reason for this is that the firm’s financial statements do not adequately reflect the value created by innovative activities such as R&D and, therefore, the firm (if it did not make voluntary disclosure about this activity) might be unfavourably affected by the myopia of the capital market within the resource allocation process that the market itself performs. Perhaps the most fully explicated version of this line of reasoning is made by Lev (2001), who has conducted several studies specifically into problems inherent in R&D assets (e.g., see: Lev et al., 2005; Aboody and Lev, 2001).

Instead, this section starts with the position of one of the main critics of Lev's line of reasoning, Skinner (2008a; 2008b). In particular, Skinner does not find convincing the arguments by those who support the claim that the current lack of disclosure about intangibles has adverse effects on capital markets. We believe that the arguments that Skinner provides are interesting in order to formulate further hypotheses and, so, that a brief synthesis is necessary. First of all, Skinner begins with the consideration made by Lev (2001) that firms with large amounts of intangibles have a

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\(^5\) Most approaches to equity evaluation rely on information from the income statement and use that information to forecast future revenues, earnings, and cash flows. As Penman (2007) demonstrates, this approach works well to evaluate companies, even those for which relatively large amounts of value are attributable to intangibles.

\(^6\) Mansfield and Wagner (1977) estimated that, in R&D projects, the improvement in the mean probabilities of success was about 8-9% as products moved toward later stages of innovation.
higher cost of capital. Skinner suggests that this is not attributable to deficiencies in these firms’ accounting, but to the fact that these firms are economically different from firms whose value is mainly comprised of tangible assets. Firms with more intangible assets have more “growth options”, that is more investment opportunities to choose between over time. Firms which have more growth options available are inherently riskier than other firms, given that, for example, their managers could easily switch to higher risk investment opportunities than those discussed with lenders once they have obtained some debt financing, so reducing the value of lenders’ claims.\(^\text{7}\) Firms which have more “growth options” naturally have larger information asymmetries, a situation which leads to a less liquid market for their shares and to a higher cost of capital (Amihud and Mendelson, 1986). In other words, these results simply reflect the fact that investors believe that expenditures on intangibles are riskier than other investments. These results have nothing to do with eventual shortcomings in the current accounting model. So much so that Skinner (2008a, p. 196) suggests that it is not at all clear that a different accounting regime would change these results and, above all, that there is no evidence that the current accounting treatment of intangibles leads to systematic lower evaluations for firms with large amounts of intangibles. On the contrary, the fact that many technology firms (e.g. Microsoft, Cisco and Intel) trade at a large premium to their book values would seem to contradict the notion that investors mechanically rely on accounting asset recognition rules in assessing equity values.

Problems regarding a “growth option” have to be studied in greater depth since they may be relevant for the firm’s voluntary disclosure.

It is well-known in corporate finance that the nature of firms’ investment opportunities affects their financing. Myers (1977) distinguishes what he labels as “assets-in-place” (assets in which the firm has already invested) from “growth options” (investment opportunities over which the firm has an option to proceed). He shows that information asymmetries between managers and those outside the firm are significantly larger for firms whose value is largely comprised of growth options. For example, these information asymmetries make it difficult for firms to borrow against their assets because lenders cannot be sure that managers of these firms will not opportunistically alter their investment strategies once lending is in place. According to Skinner, the Myers’ distinction between assets-in-place and growth options corresponds quite well to the distinction between those assets conventionally recognised on the balance sheet and off-balance sheet intangibles. From this perspective, innovative activities such as R&D are among the main contributors to “growth options”.

\(^{7}\) For evidence, see Smith and Watts (1992).
The information asymmetries are associated with the breadth of the range of investment opportunities available to the firm’s strategy. The wider the range of these investment opportunities is, the more difficult it will be for financiers to stipulate a complete contract. Therefore, financiers are likely to have greater demand for additional value-relevant information and managers could seek to satisfy this demand by disclosing information about strategy, 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 are associated with higher future uncertainty and face greater investor pressure; thus, they are likely to have particularly strong incentives to inform financial markets of their plans to deal with the challenges and opportunities of a deregulated environment (Bhojraj et al., 2004, p. 922) and prevent the market from interpreting the absence of information as bad news (Grossmann, 1981; Milgrom, 1981). Furthermore, from this prospective, it seems that the communication gap between companies and the stock market might be effectively filled by the disclosure of information about strategy since firms with greater information asymmetries are more likely to make disclosures (e.g., King et al., 1990) in order to obtain benefits relating to greater liquidity and lower costs of capital (Arnihud and Mendelson, 1986). We make the following hypothesis:

**H4: Firms with higher R&D intensity make more disclosures of their strategy**

We define disclosure of strategy as statements about the strategic goals of investment and management plans relating to the achievement of these goals. This is consistent with the following definition of strategy given 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 economies and non-economic contribution it intends to make to its shareholders, employees, customers, and communities.” We have emphasised “defines range of business”, because this means clarifying which investment opportunities the firm intends to avail itself of.

For example, if managers of companies engaged in the development of new drugs believe they are undervalued because their financial statements do not provide external investors with sufficient information about the value of the market opportunities (or threats) for new drugs which it intends to exploit (or avoid), managers of these firms could make additional voluntary disclosures. These firms would increase disclosure until the additional (marginal) costs of disclosure equalled the
associated marginal benefits. It may well be that greater disclosure by these firms results in a lower cost of capital.

Regulators and standard setters also consider strategy-related disclosure to be highly relevant in their efforts to optimise information flows in the capital markets. The Financial Accounting Standards Board (FASB), for improving voluntary disclosure, emphasises, among other things, the usefulness of information about firm strategy and its execution (FASB, 2001). In particular, the FASB specifically identifies disclosures of “managements’ strategies and plans for managing those critical success factors in the past and going forward” as a crucial step for improving business reporting (FASB, 2001 p. 13). Academics and practitioners have advocated the important role of strategy disclosure in enhancing the transparency and effectiveness of financial reporting in the post-Enron era (e.g., Fuller and Jensen, 2002; Hutton, 2004).

From a RBV prospective (Rumelt, 1984; Hansen, Wernerfelt, 1989; Rumelt, 1991; Grant, 1996), strategy is 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, firm age may also affect investors’ demand for value-relevant information about strategy. 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. Lang (1991) suggests that investors are inclined to find disclosure by younger firms more useful, because future operations of younger firms are likely to be less predictable and there is more uncertainty about the earnings prospects for such firms. Younger firms tend to have greater information asymmetry, as they are typically followed by fewer analysts. Therefore, the information asymmetry hypothesis (e.g. King et al., 1990) also predicts that younger firms make more disclosures. This is our fifth hypothesis:

**H5: Younger firms make more disclosures about their strategy.**

Previous literature has examined the importance that voluntarily disclosed information about strategy has. For example, empirical studies have tried to measure the impact that this voluntary disclosure has on investment recommendations formulated by financial analysts. Financial analysts as intermediaries between managers and investors perform a very important role in the transmission of information; their recommendations are Buy, Hold, and Sell. Garcia and Martinez (2007) find that to justify their recommendations, in over 70% of their reports, financial analysts cite
information about new investments and consistency of strategy, as well as strategic alliances and agreements.

Breton and Taffler (2001) explore 105 sell-side analyst reports. They conclude that financial analysts examine firm management, strategy, and trading environment when making an investment recommendation. In 50 analyst reports, Orens and Lyabert (2004) find that the items most often mentioned are strategy of the company and products. What is more controversial is the empirical evidence regarding the importance of voluntarily disclosed information about R&D. For example, Arvidsson (2003) analyses 105 analyst reports on knowledge-intensive companies in Nordic countries. Her disclosure scores show that financial analysts focus primarily on information regarding R&D. In contrast, Larrán Jorge, 2001; Garcia-Meca et al., 2005 do not find much information in this category in analyst reports, because there is little voluntary disclosure of this information in the country they examined, i.e. Spain.

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

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 and 2011. 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 given that 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 four 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 four years covered by the period 2008–2011. Therefore, the sample comprised a panel of 156 observations (39 firms over four years).

The financial and non-financial data needed for the statistical tests was collected manually from the annual reports of the sample firms. These were available both on the Italian stock exchange internet site and in the “investor relations” section of certain corporations’ websites. Datastream was the source for data relative to Italian stock market values.
**Dependent variables**

To test hypotheses 1, 2 and 3, we study a disclosure index relative to Research and Development (DISC.RD variable); while to test hypotheses 4 and 5, we study a disclosure index relative to Strategy (DISC.ST variable).

We calculate each of the two disclosure indices as Garcia-Meca et al. (2005) did, in other words, we give a score of one to each item disclosed over the set of items considered as communicable by the firm from an established list (Tables 1 and 2). Therefore, each index is the percentage of the actual score revealed to the total score that the company may communicate. This method has often been applied to measure the release of voluntary information in annual reports, for instance by Adrem, 1999.

<table>
<thead>
<tr>
<th>Table 1. List of the items utilised to measure disclosure index relative to Strategy (DISC.ST)</th>
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<tbody>
<tr>
<td>New products and technology</td>
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<tr>
<td>Investment in new business</td>
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<tr>
<td>Business vision; objectives and consistency of strategy</td>
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<tr>
<td>Leadership and brands</td>
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<tr>
<td>Acquisitions</td>
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<tr>
<td>Strategic alliances, agreements</td>
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<tr>
<td>Network of suppliers and distributors</td>
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<tr>
<td>Quality of products</td>
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<tr>
<td>Information about marketing</td>
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<tr>
<td>Price policy</td>
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<tr>
<td>Organisational structure</td>
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<tr>
<td>Market share by segment/product</td>
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<tr>
<td>Shareholders structure</td>
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<tr>
<td>Relative market share to competitors</td>
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<tr>
<td>Best practice</td>
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<td>Corporative culture</td>
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<td>Market share</td>
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<tr>
<td>Environmental investments</td>
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<td>Social responsibility</td>
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**Independent variables**

We also use:
RD.INT = R&D intensity, the ratio of R&D expenditure to sales;
CH.RD = the change of R&D intensity, Δ R&D.INT from 2008 to 2011;
AGE = firm age, the number of the years calculated since initial quotation on the stock market;
LOSS = a dummy variable equal to 1 if net income before extraordinary items is negative, and 0 otherwise.

Our hypotheses predict a positive coefficient on RD.INT (H1 e H4), CH.RD (H2) and LOSS (H3), and a negative coefficient on AGE (H5).

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

<table>
<thead>
<tr>
<th>Patents and licenses</th>
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<tr>
<td>Goal, objective of R&amp;D</td>
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<tr>
<td>Future projects regarding R&amp;D</td>
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<tr>
<td>Implementation, continuation, or termination of R&amp;D projects</td>
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<tr>
<td>Basic research</td>
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<tr>
<td>Product design/development</td>
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<tr>
<td>Patents pending</td>
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<tr>
<td>Relation with current innovation (e.g. strategic new initiative, enhancement of existing technology)</td>
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<tr>
<td>Time frame of the innovation (e.g. years to complete)</td>
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<tr>
<td>Amount of financing or spending planned</td>
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<tr>
<td>Form of R&amp;D venture (e.g. alliance with other firms, contracting with government or other firms)</td>
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<tr>
<td>Human capital and details on research teams</td>
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</tbody>
</table>

**Control variables**

We selected control variables on the basis of prior studies into voluntary disclosure. Therefore, we use:

- **SIZE**, large firms are likely to provide more information because of investors’ demand for information, lower average costs of collecting and disseminating information and increased demand for outside capital (Hossain et al., 1995). We calculate SIZE as the natural logarithm of the total amount of assets at the end of fiscal year
- LEV, firms with high debt levels are expected to incur higher monitoring costs. As a consequence, managers of high debt companies might try to reduce these costs by disclosing more information in the annual reports (Ahmed and Courtis, 1999). Therefore, we calculate leverage as the total amount of debt over the total book value of equity.

- ROE, companies with high profitability could have incentives to make more corporate disclosures (Raffournier, 1995) because doing so would underscore their good performance to investors. Following Malone et al. (1993), Raffournier (1995), Gul and Leung (2004), and Garcia-Meca and Martinez (2005), we use return on equity as a measurement of performance.

- M/B, it is market-to-book ratio (growth) measured by the ratio of market value to book value of equity. High growth firms use voluntary disclosures as a viable method for bridging a potential information gap due to higher asymmetry between managers and investors.

**Table 3. The descriptive statistics for disclosure indices relative to R&D and Strategy**

| Year 2011 | Disc.ST | 53.39% | Median | 52.63% | S. D. | 17.11 |
| Year 2010 | Disc.ST | 49.97% | Median | 42.1%  | S. D. | 16.57 |
| Disc.RD  | 22.46% | 33.33% | Median | 16.66% | S. D. | 14.39 |

| Year 2009 | Disc.ST | 50.33% | Median | 47.37% | S. D. | 16.95 |
| Disc.RD  | 17.66% | 16.66% | Median | 15.11  | S. D. |    |

| Year 2008 | Disc.ST | 54.13% | Median | 57.89% | S. D. | 17.33 |
| Disc.RD  | 23.34% | 33.33% | Median | 15.97  | S. D. |    |
Descriptive and univariate Analysis

In table 3, we report the descriptive statistics of the extent of information revealed in annual reports. For example, we note that, in 2011, firms voluntarily disclosed, on average, information about 53.39% of the items relative to strategy. Instead, there is little voluntary disclosure of information about R&D. Indeed, only 22.46% of the items relative to RD were disclosed by the listed companies included in the sample.

Table 4 shows certain significant correlations. LEV with DISC.ST, DISC.RD with ROE, DISC.RD with M/B, DISC.ST with AGE, RD.INT with M/B and DISC.ST with SIZE are significantly correlated (p < 0.05). DISC.ST with M/B, RD.INT with DISC.RD and RD.INT with DISC.ST are strongly correlated (p < 0.01). DISC.RD with SIZE and DISC.ST with ROE are weakly correlated (p < 0.1).

Table 4. Correlation matrix:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 DISC.RD</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 DISC.ST</td>
<td>0.043</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 RD.INT</td>
<td>0.179**</td>
<td>0.228**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 CH.RD</td>
<td>0.058</td>
<td>0.051</td>
<td>0.067</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 AGE</td>
<td>-0.023</td>
<td>-0.141*</td>
<td>0.081</td>
<td>0.026</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 LOSS</td>
<td>0.078</td>
<td>0.059</td>
<td>0.039</td>
<td>0.021</td>
<td>0.019</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 SIZE</td>
<td>0.098†</td>
<td>0.137*</td>
<td>0.022</td>
<td>0.028</td>
<td>0.021</td>
<td>0.061</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 LEV</td>
<td>0.012</td>
<td>0.129*</td>
<td>0.081</td>
<td>0.091</td>
<td>0.059</td>
<td>0.014</td>
<td>0.008</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 ROE</td>
<td>0.131*</td>
<td>0.108†</td>
<td>0.079</td>
<td>0.071</td>
<td>0.011</td>
<td>0.061</td>
<td>0.072</td>
<td>0.053</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>10 M/B</td>
<td>0.133*</td>
<td>0.192**</td>
<td>0.122*</td>
<td>0.083</td>
<td>0.081</td>
<td>-0.036</td>
<td>0.018</td>
<td>0.031</td>
<td>0.069</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: Pearson's product-moment correlation coefficients.
N = 156; 1-tailed: † p < 0.10; * p < 0.05; ** p < 0.01
**The regression models**

We estimate two linear regressions by ordinary least squares. The first linear regression is on the disclosure index of information about R&D (DISC.RD variable) and will test H1, H2 and H3. The second linear regression is on the disclosure index of information about strategy (DISC.ST variable) and will test H4 e H5.

**Table 5. Model 1: results of regression analysis of DISC.RD**

<table>
<thead>
<tr>
<th>Standardised regression coefficients</th>
<th>Model 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>are displayed in the table. N = 156</td>
<td></td>
</tr>
<tr>
<td><strong>Control Variable</strong></td>
<td></td>
</tr>
<tr>
<td>SIZE 0.871 *</td>
<td></td>
</tr>
<tr>
<td>LEV 0.354</td>
<td></td>
</tr>
<tr>
<td>ROE 0.412</td>
<td></td>
</tr>
<tr>
<td>M/B 0.975*</td>
<td></td>
</tr>
<tr>
<td><strong>Independent Variable</strong></td>
<td></td>
</tr>
<tr>
<td>RD.INT 0.749 **</td>
<td></td>
</tr>
<tr>
<td>CH.RD 0.548</td>
<td></td>
</tr>
<tr>
<td>LOSS 0.386</td>
<td></td>
</tr>
<tr>
<td>Adj R² 0.098</td>
<td></td>
</tr>
<tr>
<td>White test 0.791</td>
<td></td>
</tr>
<tr>
<td>Durbin-Watson 1.493</td>
<td></td>
</tr>
<tr>
<td>Fsign 3.411 **</td>
<td></td>
</tr>
</tbody>
</table>

Note: ***, **, indicate significance at 0.01 or 0.05 level, respectively.

**Regression analysis of disclosure indexes**

In “model 1”, we carry out the analysis on the basis of the following multiple-regression:

[Model 1] \[ \text{DISC.RD} = \alpha_0 + \alpha_2 \text{RD.INT} + \alpha_3 \text{CH.RD} + \alpha_4 \text{LOSS} + \alpha_5 \text{SIZE} + \alpha_6 \text{LEV} + \alpha_7 \text{ROE} + \alpha_8 \text{M/B} + \varepsilon \]
Table 5 presents the full regression results (model 1) and shows the adjusted coefficient of determination, F-significance, the heteroskedasticity test, and the Durbin-Watson test. The regression produces an adjusted R² of 0.098, which shows that a moderate percentage of the variation in the disclosure can be explained by linear variations of the variables within this model. From among the control variables, the SIZE variable is significant at the 5% level. The positive coefficient indicates that larger companies disclose more R&D information. This result is consistent with empirical evidence on voluntary disclosure according to which larger companies disclose more voluntary information about R&D than smaller companies (Arvidsson, 2003). According to the univariate findings, the market-to-book ratio (M/B) variable is found to be significant in the multivariate regression results. Leverage (LEV) has not a significant impact on the extent of the disclosures about R&D. This result is consistent with other findings suggesting that the relationship is not significant (e.g. Giner, 1997; Ho and Wong, 2001; Ferguson et al., 2002; Arvidsson, 2003).

With regard the independent variables, our hypotheses predict a positive coefficient on RD.INT (H1), CH.RD (H2) and LOSS (H3). However, only RD.INT has a significant impact (at the 1% level) on the extent of the disclosure of R&D, therefore H1 is supported.

On the other hand, no significant impact (of at least 5%) is registered for:
- CH.RD, so H2 is not supported
- LOSS, therefore H3 is not supported

In “model 2”, we carry out the analysis on the basis of the following multiple-regression:

\[
\text{DISC.ST} = \alpha_0 + \alpha_1 \text{RD.INT} + \alpha_2 \text{AGE} + \alpha_3 \text{SIZE} + \alpha_4 \text{LEV} + \alpha_5 \text{ROE} + \alpha_6 \text{M/B} + \varepsilon
\]

Table 6 presents the full regression results (model 2) and shows the adjusted coefficient of determination, F-significance, the heteroskedasticity test, and the Durbin-Watson test. The regression produces an adjusted R² of 0.20, which is almost twice the analogous one found in model 1. It shows that a higher percentage of the variation in the disclosure of strategic information can be explained by linear variations of the variables within this model. The SIZE and LEV variables are significant at the 5% level. Finally, more significant effects are noted for M/B variable \((p < 0.01)\).

With regard the independent variables, our hypotheses predict a positive coefficient on RD.INT (H4) and a negative coefficient on AGE (H5). Both of the variables are found to have a significant impact on the extent of the disclosure on strategy:
- RD.INT (significant at the 0.1% level), therefore H4 is supported
• AGE (significant at the 1% level), therefore H5 is supported

Table 6. Model 2: results of regression analysis of DISC. ST

<table>
<thead>
<tr>
<th>Standardised regression coefficients</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>are displayed in the table. N = 156</td>
<td></td>
</tr>
<tr>
<td>Control Variable</td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>0.921 *</td>
</tr>
<tr>
<td>LEV</td>
<td>0.419 *</td>
</tr>
<tr>
<td>ROE</td>
<td>0.397</td>
</tr>
<tr>
<td>M/B</td>
<td>0.892**</td>
</tr>
<tr>
<td>Independent Variable</td>
<td></td>
</tr>
<tr>
<td>RD.INT</td>
<td>0.923 ***</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.514 **</td>
</tr>
<tr>
<td>Adj R²</td>
<td>0.20</td>
</tr>
<tr>
<td>White test</td>
<td>0.851</td>
</tr>
<tr>
<td>Durbin-Watson</td>
<td>1.712</td>
</tr>
<tr>
<td>Fsign</td>
<td>7.461 ***</td>
</tr>
</tbody>
</table>

Note: ***, **, *, indicate significance at 0.001, 0.01 or 0.05 level, respectively.

4. Discussion and conclusion

This work arose from a strategic problem. As revealed in the literature, voluntary disclosures can have some disadvantages for the company, especially in terms of the costs of preparing and disseminating additional information.

Voluntary disclosure, especially if it is material, can also put a firm at a competitive disadvantage due to increased competition or added government regulation. On the other hand, more voluntary disclosures are also seen to improve stock performance (Healey et al., 1999) and produce a higher stock price correlation with future earnings (Gelb and Zarowin, 2000).
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 can reasonably be assumed that the benefits are perceived to exceed the costs.

The research questions described in the introduction have been addressed following this line of reasoning. These questions can be rephrased thus:

**Point of Arrival 1.** Which category of information do firms find it most convenient to disclose (i.e. which information do they choose most frequently for voluntary disclosures)?

**Point of Arrival 2.** Which category of information is most significant and most influenced by innovative activities of R&D? The equivalent of identifying the category of information which is most significantly and quantitatively, influenced by commitment to R&D.

The decision to consider R&D was not casual, but suggested by the fact that R&D is the main contributor to information asymmetries between shareholders, who provide funds, and managers, who make the operating decisions.

In this way, we looked for theories identifying possible information which it is opportune to disclose in order to reduce informative asymmetries. We found that opposing areas of literature made contributions which were suited to our aims:

- some of the literature referred to dissatisfaction with regard the limited information (about R&D) included in financial statements and, therefore, encourages further voluntary disclosure of information about R&D
- another part of the literature denies shortcomings in the current accounting model and talks of greater investor pressure aimed at obtaining more information from firms about their strategy.

From a prospective of dissatisfaction regarding information (about R&D) included in financial statements, we elaborate hypotheses (H1), that firms with higher R&D intensity make more disclosures of R&D, (H2), that the lack of informativeness in earnings under the expensing rule of R&D drives managers to make more disclosures of R&D when the R&D spending rate increases and (H3), that firms increase disclosure of R&D information when they report losses because negative earnings are less useful for evaluating intangible assets such as R&D of the firms.

From the prospective of investors who are likely to have a greater demand for additional information about strategy, we elaborate hypotheses (H4), that firms with higher R&D intensity
make more disclosures about their strategy, and (H3), that the need of investors for information about the strategy of firms who ask for their finance is higher for newer firms.

To test our hypotheses, we analyse a panel of 156 observations (39 firms over the four years from 2008 to 2011). The data for each firm was gathered from annual reports of sampled firms which were also listed on the Italian stock exchange in Milan. The findings support all of the formulated hypotheses, except H2 and H3.

In conclusion, with regard research question “point of arrival 1”, our analysis shows that firms find it convenient to make voluntarily disclosures of additional information about both R&D and strategy. However, the comparison, made in table 3, between the descriptive statistics of the DISC.RD variable and the DISC.ST variable 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. The comparison between the regression model of the DISC.RD variable and that of the DISC.ST variable suggests the answers to research question “point of arrival 2”. Indeed, a comparison of table 5 and table 6 shows that regression of the DISC.ST variable (model 2) produces an adjusted R2 of 0.20, which is almost twice that of the analogous regression of the DISC.RD variable (model 1). Moreover, although the intensity of R&D (RD.INT) influences both the voluntary disclosure of R&D (model 1) and of strategy (model 2), it should be said that the levels of statistical significance are different. Indeed, in model 2, 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 model 1). 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 R&D.INT in table 6 is 0.923 and this is higher than the regression coefficient of R&D.INT in table 5 (which is 0.749).

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